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Icthyofaunistic study of river Kabul at Michini, Khyber Pakhtunkhwa, Pakistan

Muhammad Rauf[1], Naeem-ud-Din[2], Zaigham Hasan[3], Abdul Haseeb[2], Hussain Shah[2], Sana Ullah[1*]

[1]*Fisheries and Aquaculture Lab, Department of Animal Sciences, Quaid-i-Azam University, Islamabad, Pakistan*

[2]*Department of Zoology, Islamia College University, Peshawar, Khyber Pakhtunkhwa, Pakistan*

[3]*Fisheries Lab, Department of Zoology, University of Peshawar, Khyber Pakhtunkhwa, Pakistan*

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Abstract

The present study was conducted to determine the diversity of fish communities in River Kabul at Michini, Khyber Pakhtunkhwa Pakistan from June to November, 2011. During the study period, a total of 23 freshwater fish species were recorded belonging to 6 orders, 9 families and 19 genera. Cyprinidae was the most dominant family represented by 11 species including *Barilius vagra, Rasbora daniconius, Cirrhinus mrigala, Labeo diplostomus, Puntius ticto, Puntius sophore, Tor macrolepis, Crossocheilus diplocheilus, Garra gotyla, Carassius auratus* and *Cyprinus carpio*. Family Sisoridae was represented by 4 species consisting of *Bagarius bagarius, Glyptothorax naziri, Glyptothorax punjabensis*, and *Glyptothorax stocki*. Family Channidae was embodied to two species: *Channa punctata* and *Channa gachua*. The other 6 families were represented by a single specie each i.e. family Cobitidae by *Botia birdi*, family Siluridae by *Wallago attu*, family Schilbeidae by *Clupisoma naziri*, family Heteropneustidae by *Heteropneusteus fossilis*, family Mastacembelidae by *Mastacembelus armatus* and family Cichlidae by *Oreochromis niloticus*. Based on the findings from the present study it was concluded that River Kabul has got high ichthyic diversity, which can serve as the back bone of the economy for the study area if proper management is carried out.

***Corresponding Author:** Sana Ullah ✉ sunyuop@gmail.com

Introduction

Fish engendered a number of ecological benefits across the globe amongst different humans' societies (Ullah *et al.*, 2014a). Most noticeable among these are their role in food chain, biological processes' regulation, cycling of nutrients and ornamentation (Ullah *et al.*, 2014b; Ullah and Ahmad, 2014). On account of fish ability to migrate in different patterns such as annually or seasonally across different temporal and spatial borders, they effectively serve as important dispensers and carriers of genetic reserves, energy and nutrients (Sthanadar *et al.*, 2015).

Fish is also significant due to having genetic library which is consistently advantageous in the domains of aquaculture itself as well as medicines (Hammer and Holmlund, 1999).

Of the total earth, only 1% is constituted by freshwater (Helfrich *et al.*, 2009). Although this is too tiny fraction of the entire expanse still it is home to at least one lac species out of the total identified eighteen lacs species (Dudgeon *et al.*, 2006). According to Butler (2006), 28,900 fish species have been identified. Of the total identified fish species 58% belongs to marine water, 41% exists in freshwater while 1% fish species are diadromous (Helfrich *et al.*, 2009).

Freshwater environments are categorized as one of the richest habitats in term of biological diversity (Ward and Tockner, 2001). Freshwater fish species are classified into 2 groups based on their ancestors' postulated habitats. The 1st group is known as primary freshwater species on account of emergence for the first time in freshwater and accounts for eight thousands species. The 2nd group comprised of fifteen hundreds species supposed to be originated from marine ones and is termed as secondary freshwater species (Aleen, 1982).

During last century riverine ecologies suffered due to high anthropogenic intervention that resulted in degradation and habitat loss which ultimately led to many consequences such as a huge number of fish species became endangered or highly endangered (Qadir and Malik, 2009). This was even more pronounced in rivers where substantial plea is retained by freshwater (Rahman *et al.*, 2012). Although some fish species in Pakistan have been declared threatened by IUCN but there is a huge number of wild populations that declined in different aquatic bodies including streams and rivers on account of over exploitation accompanied by degradation of wild habitats and different changes in ecologies in vicinity (Hossain *et al.*, 2012).

All the findings so far regarding biodiversity clearly indicated and recommended regular studies on biodiversity to evaluate the present status and justifiable management of water bodies in future as well (Imteazzaman and Galib, 2013). In the tropics specifically in Asian countries rivers support a very rich but hardly identified biota (Allen, 1991). Despite being a significant role for human population, rivers of tropical Asia remains poorly studied and understood (Kottelat and Whitten, 1996). In Pakistan, studies have been conducted by many research institutions and universities to know about the biodiversity and can analyse many riverine systems of the country such as Swat (Hasan *et al.*, 2013), Panjkora (Hasan and Ullah, 2013; Muhammad *et al.*, 2014), Konhaye (Ullah *et al.*, 2014c), Rhound (Ullah *et al.*, 2014a), Bajaur (Hasan *et al.*, 2015), Barandu (Syed, 2013) and Indus (Rafiq, 2000) etc. Therefore the present preliminary study was carried out on River Kabul at Michini, Khyber Pakhtunkhwa in order to evaluate its fish fauna.

Materials and methods

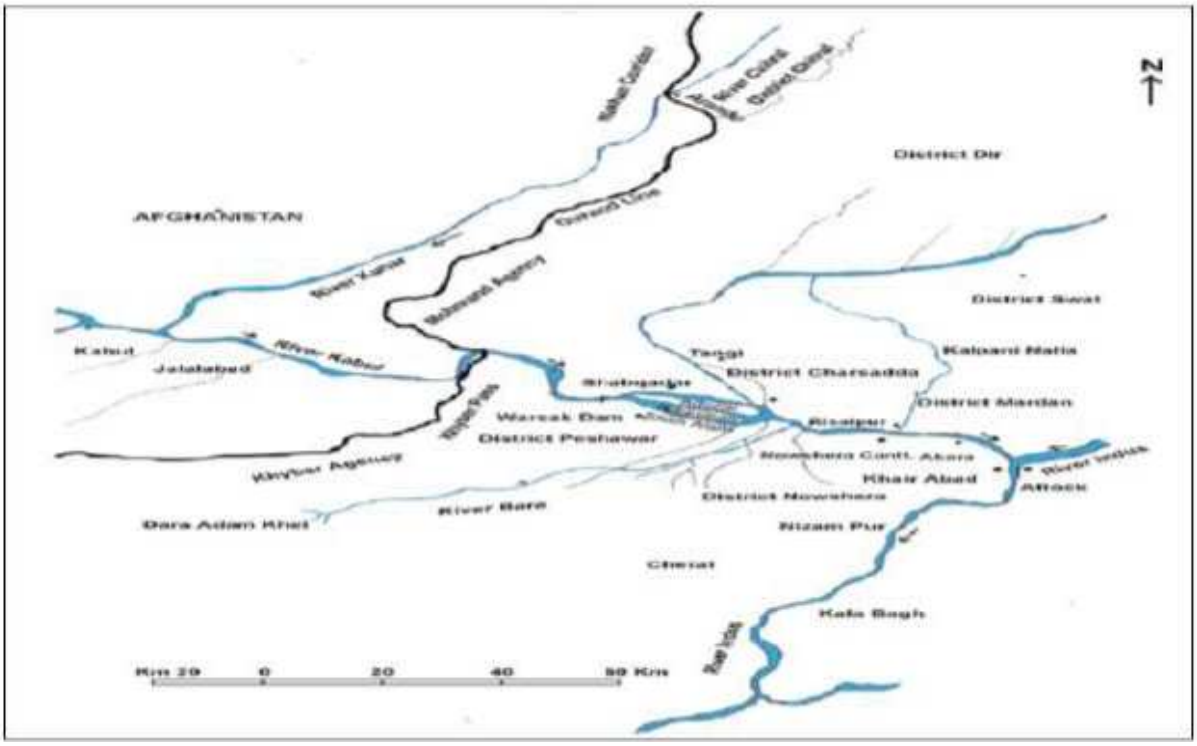
Study Area and Duration

The study was carried out at Michini from June to November 2011. Figure 1 is showing the study area.

Fish Identification

The collected specimens were identified with the help of studying its meristic counts and morphometric measurements. Several standard keys and literature

was consulted for fish identification including: Fresh water fishes in Pakistan by Mirza (1990), Inland fishes of India and adjacent countries (Vol-I and Vol-II) by Talwar and Jhingran (1991), The fresh water fishes of Indian region by Jayram (1999) and Fishes of the Punjab by Mirza and Sandhu (2007)



ig. 1. Map showing study area as well as full water drainage pattern (Adopted from Yousafzai *et al.*, 2008).

Results and discussion

Fish Fauna and Morphometric Measurements

A survey of the fish fauna of River Kabul at Michini Bridge near Mohmand Agency was carried out from June to November 2011. During the present study 23 freshwater fish species were recorded, belonging to 6 orders, 9 families and 19 genera. Family Cyprinidae was the dominant with 11 species viz *B. vagra, R. daniconius, C. mrigala, L. diplostomus, P. ticto, P. sophore, T. macrolepis, C. diplocheilus, G. gotyla, C. auratus* and *C. carpio*. Family Sisoridoe was represented by 4 species viz *B. bagarius, G. naziri, G. punjabensis*, and *G. stocki*. Family Channidae was represented by two species viz *C. punctata* and *C. gachua*.

Table 1. Fish Fauna of River Kabul at Michini, Khyber Pakhtunkhwa Pakistan.

S. No	Order	Family	Genus	Species
1	Cypriniformes	Cyprinidae	*Barilius*	*B. vagra*
2			*Rasbora*	*R. daniconius*
3			*Cirrhinus*	*C. mrigala*
4			*Labeo*	*L. diplostomus*
5			*Puntius*	*P. ticto*
6				*P. sophore*
7			*Tor*	*T. macrolepis*
8			*Crossocheilus*	*C. diplocheilus*
9			*Gara*	*G. gotyla*
10			*Carassius*	*C. auratus*
11			*Cyprinus*	*C. carpio*
12		Cobitidae	*Botia*	*B. birdi*
13		Siluridae	*Wallago*	*W. attu*
14			*Bagarius*	*B. bagarius*
15		Sisoridae	*Glyptothorax*	*G. naziri*
16	Siluriformes			*G. punjabensis*
17				*G. stocki*
18		Schilbeidae	*Clupisoma*	*C. naziri*
19		Heteropneustidae	*Heteropneusteus*	*H. fossilis*
20	Channiformes	Channidae	*Channa*	*C. gachua*
21				*C. punctata*
22	Mastacembeliformes	Mastacembelidae	*Mastacembelus*	*M. armatus*
23	Perciformes	Cichlidae	*Oreochromis*	*O. niloticus*

The other 6 families were represented by a single specie each i.e. family Cobitidae by *B. birdi*, family Siluridae by *W. attu*, family Schilbeidae by *C. naziri*, family Heteropneustidae by *H. fossilis*, family Mastacembelidae by *M. armatus* and family Cichlidae by *O. niloticus*. Table 1 is showing the fauna while Table 2 is showing morphometric measurements of the specimens collected during study period.

Table 2. Morphometric measurements of fish collected from River Kabul at Michini, Khyber Pakhtunkhwa Pakistan.

Name	TL	SL	FL	HL	ED	LS	Pre DL	Post DL	Pre PL	Post PL	LCP	HCP	BD	GP	BB (Pair)	TS
B. vagra	11.3	9.3	10.3	2.2	0.5	0.6	5.4	4	4.5	4.9	1.8	1.0	1.9	0.6	1	12
R. daniconius	10.2	8.2	9.1	1.7	0.4	0.5	4.8	3.8	4.4	4	1.7	0.8	1.8	0.5	Nil	62
C. mrigala	16.4	13	14.3	3.1	0.6	1.1	6.1	7.4	6.4	6.4	2.2	1.5	3.7	1.1	2	05
L. diplostomus	17.7	13.8	15.2	3.2	0.6	1.7	6.1	8	7.2	7.4	2.6	1.8	4	1.8	1	02
T. macrolepis	23.0	18.0	20.0	5.5	0.9	2	10.0	9.4	10.0	9.4	4.0	2.3	4.3	2.3	2	02
P. ticto	11.2	9.0	10.1	2.4	0.5	0.6	4.2	4.9	4.4	5	1.9	1.3	3.2	0.7	1	02
P. sophore	6.7	5.1	5.8	1.4	0.5	0.3	2.7	2.8	2.8	2.9	1.1	0.7	1.8	0.4	Nil	02
C. diplocheilus	11.4	9.5	10.5	2	0.4	0.9	4.2	5.5	4.7	4.7	1.8	0.6	2.2	0.8	2	82
G. gotyla	9.3	7.6	8.5	2.9	0.2	0.9	3.5	4.1	3.7	3.8	1.3	1	1.7	0.9	2	06
C. auratus	13.2	10.2	12.0	3.1	0.7	0.8	5.4	5.2	4.9	5.5	1.5	1.7	4.2	1.2	Nil	24
C. carpio	11.9	9.3	10.5	3.0	0.7	1.1	4.8	4.4	4.5	4.4	1.4	1.3	3.5	1.3	2	18
B. birdi	12.9	10.4	11.5	2.4	0.3	1.2	5.6	5.2	5.3	5.2	1.9	1.7	2.6	0.6	4	12
C. naziri	20.4	17.2	17.7	3.5	1.4	0.6	4.9	12.5	6.5	10.6	3.2	1.5	3.6	1.3	4	20
G. stocki	9	7.3	8	1.9	0.1	0.8	2.4	5	3.5	3.8	1.2	0.6	1.4	0.8	4	10
G. punjabensis	9.8	8.1	8.7	2.3	0.1	1.1	2.9	5.2	4.1	4.1	1.7	0.8	1.9	1	4	16
G. naziri	20.4	17.2	17.7	3.5	1.4	0.6	4.9	12.5	6.5	10.6	3.2	1.5	3.6	1.3	4	08
H. fossilis	22.5	20.5	21.2	3.2	0.4	0.6	6.7	15.2	7.2	14.1	-----	----	3.5	1.3	4	02
C. punctata	16.5	13.7	15.2	4.7	0.6	0.8	5.2	8.9	4.8	8.6	1.1	1.6	3.1	1.6	Nil	08
C. gachua	16.4	13.4	15	4.7	0.5	01.1	5.3	8.2	5	8.2	1.2	1.6	2.8	1.8	Nil	04
O. niloticus	13.3	10.3	13.1	3.4	0.9	1.4	4.2	7.0	4.3	6.6	1.4	1.7	4.7	2	Nil	18

TL = Total Length, SL = Standard Length, FL = Fork Length, HL = Head Length, ED = Eye Diameter, LS = Length of Snout, DL = Dorsal Length, PL = Pelvic Length, LCP = Length of Caudal Peduncle, HCP = Height of Caudal Peduncle, BD = Body depth, GP = Gap of mouth, BB = Barbels, TS = Total collected specimens of each species.

Numerical Findings

The cypriniformes, numbering around five thousand species (or about one fourth of the total number of fishes known), include the hordes of fishes that predominate on all the continents except Australia. Only the Perch-like fishes (Perciformes) with about eight thousand species outnumber them. Order cypriniformes has approximately thirty-five families and only two, the ariid and plotosid catfishes are marine (Lagler, 2003).

Butt and Mirza (1981) studied the fish diversity of major rivers of Vale of Peshawar NWFP (Now KPK) Pakistan. A total of 54 species were reported during this study. The sampling point on River Kabul was at Michini fort, where the following 11 species were collected. *Barilius vagra pakistanicus*, *Osteobrama catio*, *G. gotyla*, *Aspidoparia morar*, *Schizothorax plagiostomus*, *Noemacheilus corica, W. attu*, *Clupisoma marius naziri*, *Gagata cenia*, *H. fossilis*, and *Channa striata*. In comparison to the work done by Butt and Mirza (1981), our present study identified 18 more fish species for the first time from Michini.

Coad (1981) studied ichthyofauna of major rivers of Afghanistan including River Kabul and reported 44 fish species from River Kabul. Family Cyprinidae was the most dominant family with 26 species viz *Amblypharyngodon mola, Aspidoporia jaya, Barilius vagra, Cirrhinus burnesiana, Cirrhinus*

reba, Danio devario, Esomus danricus, Labeo angara, Labeo dero, Labeo diplostomus, Labeo dyocheilus, Labeo gonius, Labeo pangusia, Puntius conchonius, Puntius sarana, Puntius sophore, Salmostoma bacaila, Schizocypris ladigesi, Schizothorax barbatus, Schizothorax chrysochlora, Schizothorax edeniana, Schizothorax esocinus, Schizothorax intermedius, Schizothorax labiatus, Schizothorax plagiostomus and *Tor putitora*. Family Cobitidae was represented by 8 species viz *Noemacheilus alepidotus, Noemacheilus brahui, Noemacheilus choprai, Noemacheilus griffithi griffithi, Noemacheilus kessleri kessleri, Noemacheilus sargadensis plaudani, Noemacheilus stenurus choprai, Noemacheilus stoliczkai uranoscopus*. Family Bagridae and Siluridae was represented 3 species each viz *Mystus seenghala*, *Mystus tengara*, *Rita rita* and *Ompok bimaculatus*, *Ompok canio*, *Ompok pabda respectively*. Whereas family Schilbeidae was represented by *Glyptosternum reticulatum*, *Glyptothorax jalaensis* and family Channidae by *Ophiocephalus* (=*Channa*) *punctatus* and *Ophiocephalus* (=*Channa*) *gachua*.

Table 3. Occurrence of the fishes collected at Michini in the River Indus and its four tributaries viz River Kabul, Kohat Toi, Haro and Saon between Kalabagh and Mangla.

S.no	Fish Names	Indus	Kabul	Kohat Toi	Haro	Saon	CO*
1	*B. vagra*	+	+	+	+	+	05
2	*R. danonicus*	-	+	-	-	-	01
3	*C. mrigala*	+	-	-	-	+	02
4	*L. diplostomus*	+	+	+	+	+	05
5	*P. sophore*	+	+	+	+	+	05
6	*P. ticto*	+	+	+	+	+	05
7	*T. macrolepis*	+	+	+	+	+	05
8	*C. diplocheilus*	+	+	+	+	+	05
9	*G. gotyla*	+	+	-	+	+	04
10	*C. auratus*	+	+	-	-	+	03
11	*C. carpio*	+	+	+	+	+	05
12	*B. birdi*	+	+	-	-	+	03
13	*B. bagarius*	+	-	-	-	-	01
14	*G. naziri*	+	+	+	+	-	04
15	*G. punjabensis*	+	+	-	-	-	02
16	*G. stocki*	+	-	-	+	-	02
17	*W. attu*	+	+	+	-	+	03
18	*H. fossilis*	+	+	-	+	+	04
19	*C. naziri*	+	+	-	+	+	04
20	*C. gachua*	+	+	+	+	+	05
21	*C. punctata*	+	+	-	+	+	04
22	*M. armatus*	+	+	+	+	+	05
23	*O. niloticus*	-	-	-	-	+	01

"+" sign indicates the presence and "-" sign indicates the absence of a fish species from the respective tributary.
*CO = Total number of tributaries shared.

Present Study in Comparison to Previous Studies

The species reported in present study, which are common with Coad (1981), are *B. vagra, L. diplostomus, P. sophore, T. macrolepis*, *C. gachua* and *C. punctata*.

Mirza 1997 studied the biodiversity of fishes in the River Indus and its tributaries between Kalabagh and Tarbela. River Kabul joins River Indus in that area. A total of sixty seven species were reported from River Kabul. Family Cyprinidae was the most specious family with thirty species namely *Chela cachius, Salmostoma bacaila, Salmostoma punjabensis, Amblypharyngodon mola, Aspidoparia morar, Barilius modestus, Barilius pakistanicus, Barilius vagra, Brachydanio rerio, Danio devario, Esomus*

danricus, Rasbora daniconius, Barbodes sarana, C. reba, Cyprinion watsoni, Labeo dero, Naziritor zhobensis, Osteobrama cotio, P. ticto, T. putitora, C. diplocheilus, G. gotyla, Racoma labiata, S. plagiostomus, C. auratus, C. carpio. Family Noemacheilidae was represented by six species viz *Acanthocobitis botia, Noemacheilus corica, Schistura alepidota, Schistura microlabra, Schistura prashari* and *Triplophysa naziri*. Family Bagridae was represented by five species viz *Aorichthys aor sarwari, Mystus bleekeri, Mystus Cavassius, Mystus vittatus* and *Rita rita*. Family Sisoridae and Channidae were represented by 4 species each viz *Gagata cenia, Glyptothorax cavia, G. naziri, G. punjabensis* and *C. gachua, Channa marulius, C. punctatus, C. striatus* respectively. Family Schilbeidae was represented by three species viz *C. naziri, Eutropiicthys vacha*. Family Cobiotidae was represented by three species viz *Botia birdi, Botia javedi* and *Lepidocephalus guntea*. Family Siluridae and Belontidae were represented by 2 species each viz *O. pabda*, *Wallago attu* and *Colisa fasicata*, *Colisa lalia* respectively. The rest of the eight families were represented by one specie each i.e. family Clupeidae by *Gadusia chapra*, family Notopteridae by *Notopterus notopterus*, family Heteropneustidae by *Heteropneusteus fossilis*, family Belonidae by *Xenetodon cancila*, family Chandidae by *Chanda nama*,family Gobiidae by *Classogobius giuris* and family Cichlidae by *O. aureus*. The fish species including *B. vagra, L. diplostomus, P. sophore, P. ticto, T. macrolepis, C. diplocheilus* and *C. gachua* are the species which were in common amongst all the tributaries and River Kabul at Michini.

Table 4. Occurrence of the Species recorded at Michini in the other tributaries of River Indus throughout Pakistan.

S. No	Fish Names	NA	HZ	KASH	CHIT	SW	DIR	VPES	WBN	IND.B	PUNJ	SIND H	CO
1	*B. vagra*	-	-	+	-	-	+	-	-	+	+	+	04
2	*R. danonicus*	-	-	-	-	-	-	+	-	+	+	+	04
3	*C. mrigala*	-	-	+	-	-	-	+	+	+	+	+	06
4	*L. diplostomus*	-	+	+	-	+	+	+	+	+	+	+	09
5	*P. sophore*	-	+	+	-	-	+	+	+	+	+	+	08
6	*P. ticto*	-	+	+	-	+	+	+	+	+	+	+	09
7	*T. macrolepis*	-	+	+	-	+	+	+	+	+	+	+	09
8	*C. diplocheilus*	-	+	+	-	+	+	+	+	+	+	+	09
9	*G. gotyla*	-	+	+	-	+	+	+	+	+	+	+	09
10	*C. auratus*	-	+	-	-	-	-	-	-	+	+	+	04
11	*C. carpio*	-	+	+	-	-	+	-	-	+	+	+	05
12	*B. birdi*	-	+	+	-	-	-	+	-	+	+	-	05
13	*B. bagarius*	-	-	+	-	-	-	-	-	-	+	+	03
14	*G. naziri*	-	-	-	-	-	+	+	+	+	+	-	04
15	*G. punjabensis*	-	+	+	-	-	+	+	+	+	+	+	08
16	*G. stocki*	-	+	+	-	+	+	+	-	-	-	-	05
17	*W. attu*	-	+	+	-	-	-	+	+	+	+	+	07
18	*H. fossilis*	-	-	-	-	-	-	+	+	+	+	+	05
19	*C. naziri*	-	+	+	-	-	+	+	-	+	-	-	04
20	*C. gachua*	-	+	-	-	-	+	+	+	+	+	+	08
21	*C. punctata*	-	-	+	-	-	+	+	+	+	+	+	06
22	*M. armatus*	-	+	+	-	+	+	+	+	+	+	+	09
23	*O. niloticus*	-	-	-	-	-	-	-	-	+	+	+	03

"+" sign indicates the presence and "-" sign indicates the absence of a fish species from the respective tributary.
NA (Northern areas). HA (Hazara Division) KASH (Kashmir),CHIT(Chitral),SW (Swat),DIR (Dir,), VPES (Valley of Peshawar),WBN (West Bank of Indus comprising Southern tribal areas and northern Baluchistan drained by the Rivers Kurram, Gomal and Zhob) IND.B (Indus Baluchistan including central and southern Baluchistan draining into Indus), PUNJ (Punjab), SIND (Sindh), CO (Total number of drainages shared by each species).

Fish species such as *B. bagarius*, *C. mrigala*, *L. diplostomus*, *O. niloticus*, *G. stocki* were not reported by Mirza (1997) but they were collected in our present study.

Rafique (2000) reported 65 endemic fish species in the Indus drainage. According to him fish species like *G. naziri, G. punjabensis, G. stocki,* and *C. naziri* were not reported from River Kabul, a tributary of River Indus but in the present study those species were reported and found abundant at Michini, River Kabul. None of the 23 species collected in present work was reported by Rafique (2001) in Chitral and Northern areas. This signifies the fact that all species collected in present work are semi cold or warm water fish species and therefore they cannot withstand the freezing waters of Northern areas and Chitral.

Table 5. Detail about some of the exotic species reported in the present study and their possible impact on native species.

Fish Species	Year of Introduction	Reference	Reason for Introduction	Possible Impact on Native fish fauna
Common carp *C. carpio* (Linnaeus)	1964 from Thailand and UK.	FAO (1997); FISHBASE (2003)	Aquaculture, Sport fishing	Reduction of water quality and destroys aquatic vegetation by uprooting it, feed on eggs of native fishes, Potent breeder, compete for food and space with native fauna of Pakistan both in captivity and wild. Their habit of digging around in the bottom and muddying the water can seriously alter the environment to the detriment of other species
Tilapia *O. niloticus* (Linnaeus)	1985 from Egypt	De Silva *et al.*, (2004)	Aquaculture in brackish/saline water bodies	It eats detritus and can feed on small fish and fish larvae. The species is a maternal mouth brooder that constructs nests in shallow water for breeding and fertilization. For this reason it is vulnerable to rapid changes in water level and depends on suitable substrates for nest building
Gold Fish *C. auratus* (Linnaeus)	1961	Mirza, (2003)	Aquaculture, Ornamental	Competition for food and space with native fauna of Pakistan in the wild.

Species like *B. vagra, C. auratus, B. bagarius* and *O. niloticus*, which were not reported by Rafique (2001) from valley of Peshawar, are reported in present study. *B. birdi*, and *G. naziri* were not reported from tributaries of Indus River in Sindh whereas *G. stocki* and *C. naziri* were not reported from Sindh and Punjab.

River Indus at Machini and Other Places

Table 3 is showing occurrence of the fishes collected at Michini in the River Indus and its four tributaries viz River Kabul, Kohat Toi, River Haro and River Saon between Kalabagh and Mangla. Table 4 is showing occurrence of the Species recorded at Michini and other tributaries of River Indus throughout Pakistan. Table 5 is showing the possible impact of the exotic species recorded in this study on native species.

Conclusion

A total of 23 fish species were reported during the present study. Moreover Exotic species like *C. carpio, O. niloticus, C. auratus* along with voracious and highly carnivores species like *B. bagarius* was reported in the present study. Fish collection became much easier and fruitful towards low flow (winter), however during low flow, illegal fishing methods were seen in operation hence it is recommended that Fisheries Ordinance and Fisheries Rules (1976) should be implemented to prevent illegal fishing and

to control mesh size of nets, poisoning use, use of explosives, use of electric current for fishing etc. because these indiscriminate fishing methods drastically reduce the population of young spawn thereby reducing its provenance and abundance. A closed season for fishing should be enforced to allow protection of brood stock, undisturbed migration and spawning. Farm fish protection committees should be established for public awareness.

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