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## Studies on ichthyofaunal diversity of Head Qadirabad, River Chenab, Punjab, Pakistan

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#### Abstract

Present study was aimed to access the ichthyofaunal diversity at Head Qadirabad, Chenab, Pakistan. 1391 fish specimens were collected during September 2015 to June 2016 on monthly basis. 43 species of fishes belonging to seven orders, 14 families and 34 genera were recorded. Overall fish catches were dominated by native fishes along with some exotic fishes like *Cyprinus carpio*, *Ctenopharyngodon idella*, *Hypophthalmichthys molitrix*, *Oreochromis niloticus* and *Oreochromis mossambicus*. On the basis of percentage contribution of families to their orders; Siluriformes (35.71%) was found dominant followed by Perciformes (28.57%). Cyprinidae was dominant on the basis of number and percentage contribution of genus and species represented with 14 genera (41.18%) and 19 species (44.19%) followed by Bagridae represented with three genera (8.82%) and four species (9.3%). The values for diversity, richness and evenness indices were 3.36, 13.36 and 0.89 respectively. Effective conservation measures are suggested to sustain the population of commercially important fishes.

**Keywords:** Chenab, diversity, fish fauna, headwork, freshwater

#### 1. Introduction

Punjab province of Pakistan is the land of five rivers. These rivers support diverse fauna and flora. Among these rivers, Chenab river is the life line for Punjab. Many researchers have studied the Ichthyofaunal diversity from the rivers of Punjab, Pakistan [1-15]. In a freshwater ecosystem fishes play an important role in maintaining stable ecosystem [16]. Fishes belonging to family Cyprinidae constituted the major population of riverine fish species in Pakistan. Many fish species included in Cyprinidae are regarded as commercially and economically high valued species in Pakistan. The population of these commercially important freshwater fishes is declining in the rivers of Pakistan [17, 18]. About 20% of freshwater fishes are declared as either endangered or extinct in the world [19]. In an aquatic ecosystem fishes are an effective biological indicator being sensitive to the environmental changes and having wide range of tolerance at community level [20, 21]. Worldwide anthropogenic stresses are responsible for the fish and fisheries decline from freshwater and marine resources. The present study was conducted to investigate fish species diversity, abundance and richness at head Qadirabad by using various diversity indices (Shannon-Weaver diversity, Margelf richness and Hill, s evenness).

#### 2. Materials and Methods

Fish sampling was done on monthly basis from September 2015 to June 2016. The sampling was mainly done from upstream and downstream of Head Qadirabad (32°19'04 N, 073°41'36 E and elevation 210 M). Various fishing techniques were employed for catching as many as fish species as possible. Fishing nets having different mesh sizes such as hand net (Hath jal), Cast net (Sotawa jal), Drag net (Wahera), Gill net (Laung) were used for the fish collection. The smaller fish specimens were preserved in 10% formalin while larger specimens were injected 10% formalin through vent. Preserved specimens were brought to the Fish Museum for their identification up to the species level. Morphometric and meristics study of collected specimens was done by using regional fish identification keys [22, 23]. The representative specimens of each fish species were shifted into 70% alcohol and displayed in glass jars at Fish Museum, Fisheries Research & Training Institute, Manawan, Lahore.

### 2.1 Study Area

River Chenab originates in Kulu and Kangra districts of Himachal Pardesh, India. This river enters into the territory of Pakistan near Diawara village, district Sialkot, Punjab. Chenab river is having 13469 sq. mile catchment area. The river Chenab has twelve major tributaries out of which Nallah Palkhu and Nallah Aik are in Pakistan. In Pakistan, river Chenab has four headworks (Marala, Qadirabad, Khanki and Trimmu headworks) and six link canals (Upper Chenab canal, Marala Ravi link canal, Lower Chenab canal, Rasul Qadirabad link, Qadirabad Balloki link, Trimmu Sidhni link). Head Qadirabad is 45 Km away from Gujranwala city. It is situated upstream right at 32°19'04 N, 073°41'36 E, 210 M upstream left at 32°20'06 N, 073°41'36 E, 206 M, downstream right at 32°19'33 N, 073°40'57 E, 200 M and downstream left at 32°18'56 N, 073°41'16 E, 200 M (Fig 1).



Fig 1: Map of river Chenab including the study area

### 2.2 Statistical Analysis

For estimating fish species diversity, richness and evenness from the study area different diversity indices were used [24-26].

### 3. Results and Discussion

The present collection comprised of total 1391 fish specimens. These fishes were categorized into seven orders, 14 families, 34 genera and 43 species. The detail of recorded fish species is given in Table 1. On the basis of number and percentage contribution of families, genus and species to their orders, order Siluriformes was found dominant represented with five families (Bagridae, Siluridae, Schilbeidae, Sisoridae and Heteropneustidae) contributing 35.71%, 11 genera (32.35%) and 12 species (27.9%), followed by Perciformes with four families (Chandidae, Gobiidae, Belontiidae and Cichlidae) contributing 28.57% to their order, five genera (14.7%) and seven species (16.27%). The percentage contribution of families to their orders (Osteoglossiformes, Cypriniformes, Beloniformes, Channiformes and Mastacembeliformes) was 7.14%. Cypriniformes contributed 14 genera (41.17%) and 19 species (44.18%). The percentage contribution of genus and species to the orders Osteoglossiformes, Beloniformes and Mastacembeliformes was recorded as 2.94% and 2.32% respectively. Channiformes was represented with two species (*Channa marulius* and *Channa punctate*) contributing 4.65% to the whole collection. The number and percentage contribution of families, genus and species to their orders is shown in Table 2 and Fig 2.

Table 1: List of fishes and their relative abundance recorded from head Qadirabad, Chenab, Pakistan.

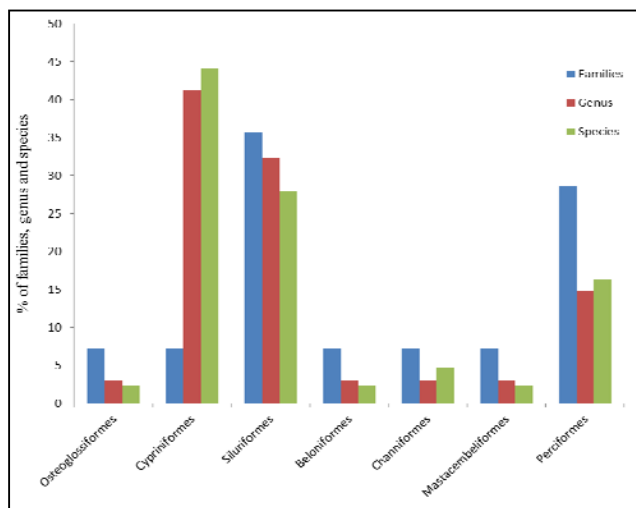
S. No	Order/Family	Scientific Name	Common Name	R.A	P <sub>1</sub> lnP <sub>1</sub>
<b>I</b>	<b>Osteoglossiformes</b>				
<b>I-1</b>	Notopteridae	<i>Notopterus notopterus</i>	But Pari	0.0057	-0.1721
<b>II</b>	<b>Cypriniformes</b>				
<b>II-2</b>	Cyprinidae	<i>Labeo rohita</i>	Rohu	0.0122	-0.0537
3		<i>Labeo boga</i>	Bhangan	0.0589	-0.1667
4		<i>Labeo calbasu</i>	Kalbans	0.0079	-0.0382
5		<i>Labeo dero</i>	Dero Machali	0.0035	-0.0197
6		<i>Cirrhinus mrigala</i>	Mori	0.015	-0.0629
7		<i>Cirrhinus reba</i>	Reba Machali	0.0115	-0.0513
8		<i>Gibelion catla</i>	Thaila	0.0079	-0.0382
9		<i>Puntius sophore</i>	Sophore Popra	0.1969	-0.3199
10		<i>Puntius punjabensis</i>	Punjabi popra	0.0596	-0.168
11		<i>Tor putitora</i>	Mahseer	0.0028	-0.0164
12		<i>Salmophasia punjabensis</i>	Punjabi Chal	0.0352	-0.1178
13		<i>Securicula gora</i>	Bari Chal	0.0632	-0.1745
14		<i>Esomus danricus</i>	Somara Machali	0.005	-0.0264
15		<i>Osteobrama cotio</i>	Pali-ro Machali	0.0165	-0.0677
16		<i>Chela cachius</i>	Cachius Budha	0.0265	-0.0962
17		<i>Garra gotyla</i>	Pathar Chat	0.033	-0.1125
18		<i>Cyprinus carpio*</i>	Gulfam	0.0136	-0.0584
19		<i>Ctenopharyngodon idella*</i>	Grass Carp	0.0086	-0.0409
20		<i>Hypophthalmichthys molitrix*</i>	Silver Carp	0.0064	-0.0323
<b>III</b>		<b>Siluriformes</b>			
<b>III-21</b>	Bagridae	<i>Sperata sarwari</i>	Singhari	0.0129	-0.0561
22		<i>Rita rita</i>	Desi Khaga	0.0064	-0.0323
23		<i>Mystus cavasius</i>	Kanghar	0.0474	-0.1445
24		<i>Mystus bleekeri</i>	Kanghar	0.0294	-0.1036
<b>IV-25</b>	Siluridae	<i>Wallago attu</i>	Malli	0.0086	-0.0409
26		<i>Ompok pabda</i>	Pafta Machali	0.0057	-0.0294
<b>V-27</b>	Schilbeidae	<i>Eutropiichtys vacha</i>	Jhalli Machali	0.0136	-0.0584
28		<i>Clupisoma garua</i>	Bachwa	0.01	-0.0461
<b>VI-29</b>	Sisoridae	<i>Bagarius bagarius</i>	Fauji Khaga	0.0079	-0.0382
30		<i>Gagata cenia</i>	Gagata cenia	0.0064	-0.0323
31		<i>Sisor rابدophorus</i>	Kirla Machali	0.0021	-0.0129

VII-32	Heteropneustidae	<i>Heteropneustes fossilis</i>	Sanghi Machali	0.0158	-0.0655
IV	<b>Beloniformes</b>				
VIII-33	Belonidae	<i>Xenentodon cancila</i>	Kaan Machali	0.0035	-0.0198
V	<b>Channiformes</b>				
IX-34	Channidae	<i>Channa marulius</i>	Saul	0.0093	-0.0435
35		<i>Channa punctata</i>	Daula	0.0244	-0.0906
VI	<b>Mastacembeliformes</b>				
X-36	Mastacembelidae	<i>Mastacembelus armatus</i>	Baam	0.0172	0.0699
VII	<b>Perciformes</b>				
XI-37	Chandidae	<i>Chanda nama</i>	Sheesha Machali	0.0632	-0.1745
38		<i>Parambassis ranga</i>	Ranga Sheesha	0.0186	-0.0741
XII-39	Gobiidae	<i>Glossogobius giuris</i>	Golu Machali	0.0165	-0.0677
XIII-40	Belontidae	<i>Colisa fasciata</i>	Bari Kanghi	0.028	-0.1001
41		<i>Colisa lalia</i>	Choti Kanghi	0.0086	-0.0409
XIV-42	Cichlidae	<i>Oreochromis niloticus*</i>	Chirra Machali	0.0352	-0.1178
43		<i>Oreochromis mossambicus*</i>	Chirra Machali	0.0172	-0.0698

\*indicates exotic fish species

**Table 2:** Number and percentage contribution of families, genus and species under different orders.

S. No	Orders	Families	Genus	Species	% of families in an order	% of genus in an order	% of species in an order
1	Osteoglossiformes	1	1	1	7.14	2.94	2.32
2	Cypriniformes	1	14	19	7.14	41.17	44.18
3	Siluriformes	5	11	12	35.71	32.35	27.9
4	Beloniformes	1	1	1	7.14	2.94	2.32
5	Channiformes	1	1	2	7.14	2.94	4.65
6	Mastacembeliformes	1	1	1	7.14	2.94	2.32
7	Perciformes	4	5	7	28.57	14.7	16.27
Total:		14	34	43			

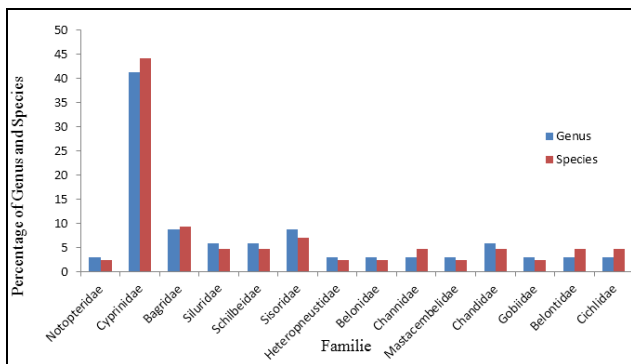


**Fig 2:** Number and percentage contribution of families, genus and species under various orders.

Fishes belonging to the family Cyprinidae were found dominant in the present collection contributing 14 genera (41.18%) and 19 species (44.19%). Family Bagridae was represented with three genera (8.82%) and four species (*Sperata sarwari*, *Rita rita*, *Mystus cavasius* and *Mystus bleekeri*). The percentage contribution of three genera and species to family Sisoridae was 8.82% and 6.98% respectively. Percentage contribution of genus and species to the families Siluridae, Schilbeidae and Chandidae was 5.88% and 4.65% respectively. Fishes belonging to the families Notopteridae, Heteropneustidae, Belonidae, Channidae, Mastacembelidae and Gobiidae were placed under a single genera and species. The percentage contribution of genus and species to their families was 2.94% and 2.32% respectively. Fishes under families Belontidae and Cichlidae each contributed single genera (2.94%) and two species (4.65%). The number and percentage contribution of genus and species to their families is shown in Table 3 and Fig 3.

**Table 3:** Number and percentage contribution of genus and species under different families.

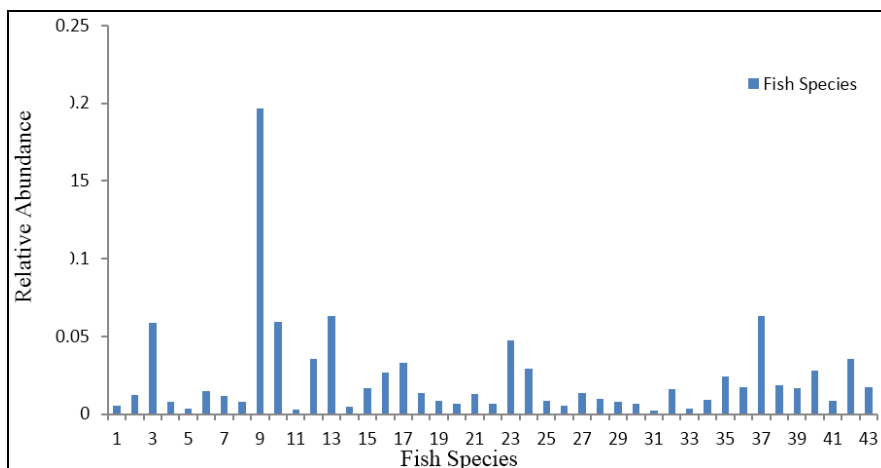
S. No	Families	Genera	% of genera in a family	Species	% of species in a family
1	Notopteridae	1	2.94	1	2.32
2	Cyprinidae	14	41.18	19	44.19
3	Bagridae	3	8.82	4	9.3
4	Siluridae	2	5.88	2	4.65
5	Schilbeidae	2	5.88	2	4.65
6	Sisoridae	3	8.82	3	6.98
7	Heteropneustidae	1	2.94	1	2.32
8	Belonidae	1	2.94	1	2.32
9	Channidae	1	2.94	2	4.65
10	Mastacembelidae	1	2.94	1	2.32
11	Chandidae	2	5.88	2	4.65
12	Gobiidae	1	2.94	1	2.32
13	Belontidae	1	2.94	2	4.65
14	Cichlidae	1	2.94	2	4.65
Total:		34		43	



**Fig 3:** Number and percentage contribution of genus and species under various families.

Present collection comprised of endemic, indigenous and exotic fish species. *Puntius punjabensis* and *Salmophasia punjabensis* are endemic fish species in Pakistan [18]. Five species *Cyprinus carpio*, *Ctenopharyngodon idella*, *Hypophthalmichthys molitrix*, *Oreochromis niloticus* and *Oreochromis mossambicus* are exotic fish species in this river [4, 15, 18]. These exotic fish species are commercially important also being cultured in Pakistan and their presence was also reported from other rivers of Pakistan [14, 15, 27]. *Labeo rohita*, *Labeo calbasu*, *Cirrhinus mrigala*, *Gibelion catla*, *Tor putitora*, *Sperata sarwari*, *Rita rita*, *Wallago attu*, *Eutropiichthys vacha*, *Channa marulius*, *Channa punctata* and *Mastacembelus armatus* are commercially and economically important fishes in Pakistan were also found in the present

collection. The relative abundance of these commercially important fishes was found very low in this collection. This shows overfishing or may be illegal fishing of these commercially important fishes. The major portion of present collection has comprised of small sized fishes which have low commercial value. *Puntius sophore* has shown highest value of relative abundance (0.1969) followed by *Securicula gora* and *Chanda nama* (0.0632). This was due to their smaller size, rendering them inedible to the humans and wide distribution throughout the river Chenab [4, 7, 15]. The present study revealed that population of one of the most important and popular fish *Tor putitora* (0.00028) was declining in this river. The present specimens of this species were collected only from the upstream of this headwork; no specimen was found from the downstream. Different reasons such as overfishing, aquatic pollution, habitat destruction and introduction of alien species into the river were responsible for their population decline. Similar study on population dynamics of *Tor macrolepis* was conducted in Attock region, Pakistan [13]. Their findings revealed that population of commercially important fishes were declining in the river. Specimens of *Sisor raddophorus* (0.0021) were collected from the downstream of this headwork [18]. IUCN status of *Sisor raddophorus* has been declared as very rare from different rivers of Pakistan. The relative abundance of recorded fish species is shown in Fig 4. The value of Shannon-Wiener diversity and Margalef, f richness indices at head Qadirabad was 3.36 and 13.4 respectively (Table 4).



**Fig 4:** Fish species diversity and relative abundance at head Qadirabad, Chenab, Pakistan.

**Table 4:** Statistical analysis of the fish diversity, richness and evenness at head Qadirabad, Chenab.

Number of fish species	43
Shannon (H')	3.36
Margalef (R)	13.36
Evenness	0.89

[28] Various threats and decline in the population of Indian and Chinese carps of river Chenab were reported. These findings support our results. [11] 33 fish species were reported from Head Qadirabad. The value of Shannon diversity index was 3.106. 12 fish species (*Labeo boga*, *Puntius punjabensis*, *Securicula gora*, *Esomus danricus*, *Chela cachius*, *Mystus bleekeri*, *Ompok pabda*, *Chanda nama*, *Glossogobius giurus*,

*Colisa fasciata*, *Colisa lalia* and *Oreochromis mossambicus*) which were found in our collection were not reported in their studies. [29] The value of diversity index was found very low for carps found in river Chenab between Qadirabad and Khanki Headworks [15]. 34 fish species were reported from the river Chenab at its three headworks (Marala, Qadirabad and Khanki headworks). The highest value of diversity index was found at head Qadirabad followed by Khanki and Marala Headworks. [30] Freshwater fish fauna was studied at Balloki and Trimmu headworks. In their study various threats were reported to the population of commercially important freshwater fish species due to invasion of exotic fish species. In our study *Oreochromis niloticus*, an exotic fish species has also shown high relative abundance (0.0352). The exotic fish species are becoming established in the rivers of Pakistan

competing with the native species for feeding and breeding leading to the decline in the population of commercially important native fish species.

#### 4. Conclusion

River Chenab being an important wetland in Pakistan supports diverse fish fauna. The commercially and economically important fish fauna is declining in the river due to overfishing and establishment of exotic fish species. Authorities should take effective conservation measures to protect ichthyofauna of this river.

#### 5. Acknowledgment

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