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Statistical analysis of freshwater fishes of head Khanki, Punjab, Pakistan

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ABSTRACT

Pakistan has more than 225 wetlands (0.78 Million hectares) area. Out of total 74% consist of freshwater and remaining consists of marine water. Pakistan has 19 Ramsar sites. Ichthyologist noted that 27,977fish species are present in whole world; more than 786 species of marine and 171 freshwater ichthyofauna reported in Pakistan. Head Khanki it is an essential wetland and situated at River Chenab. The main objective of study was to know the diversity of fish of head Khanki, Punjab, Pakistan. The present study was carried out at Head Khanki, Punjab from January 2018 to December 2018, while data were collected at early morning. During the survey, 26 species and threat to fish fauna were analyzed from the study area. Shannon-Weiner Index, Richness and Evenness of freshwater fishes were 2.834, 9.803 and 0.8699 respectively observed from Head Khanki. During the study observed the fallowing threats to fish i.e. increase pesticides, waste material, fertilizers, excess fishing for export and domestic use, bad construction of fish-ladder and low or no stocking of fish fauna in river. It is concluded that study area have high fish diversity and also has unique fish fauna, fish species are declined but due to overfishing and anthropogenic impacts.

Keywords: Diversity, Richness, Evenness, Freshwater, Fishes, Threats

INTRODUCTION

Pakistan has more than 225 wetlands (0.78 Million hectares) area. Out of total 74% consist of freshwater and remaining consists of marine water. Pakistan has 19 Ramsar sites (Altaf *et al.*, 2014). Water is very necessary and vital for the fauna life activities e.g. drink, agriculture, industry, and human daily use (Bartram and Ballance, 1996). Water and life has deep connection, life was not possible without water (Gleick *et al.*, 2002). Water has a vital role in human societies. Almost all the societies of human were established near the water i.e. river, canal and ocean (Gupta and Gupta, 2006). Water quality is decreasing day by day due to anthropogenic impact i.e. deforestation, agriculture intensification, urbanization, industrialization and ecotourism (Singh *et al.*, 2007; Majagi *et al.*, 2008).

The different diversity indices were used to evaluate the diversity i.e. Shannon-Weiner, Simpson, Evenness, Richness and Dominance (Altaf, 2016). Ichthyologist noted that 27,977fish species are present in whole world (Nelson, 2006), more than 786 species of marine (Mirza and Alam, 2000) and 171 freshwater fishes are recorded from Pakistan (Mirza, 2004). The main objective of study was to explore the diversity of fish of head Khanki, Punjab, Pakistan.

MATERIALS AND METHODS

Methodology: Data was collected in each month from January 2018 to December 2018 from head Khanki. Drift nets and hooks were utilized to capture fish fauna in study area. Drift nets and hooks were attached by bamboos and wooden poles. There were present vary mesh size, used in both lotic and lentic water. Group questionnaires were also used to observe the fish diversity.

Study area: Head Khanki (32^{o}24'07 N, 073^{o}58'39 E, and elevation at 219 M) is located at river Chenab near adjacent to Gujranwala and Gujarat (Figure 1). Water pH was recorded as 7.1-8.1. Study area has four seasons, while almost 45^{o}C temperature is measured in summer and almost 5^{o}C in winter (Umair *et al.*, 2013; Umair *et al.*, 2017).

Aquatic vegetation: In River Chenab at head Qadirabad, the aquatic vegetation includes *Carex fedia, Hydrilla verticillata, Nelumbo nucifera, Nymphaea lotus, Phragmites karka, Potamogeton crispus, P. pectinatus, Typha angustata, Vallisneria spiralis, Zannichellia palustris* and *Chara spp.* (Umair *et al.*, 2013; Umair *et al.*, 2017).

Terrestrial vegetation: The natural vegetation of the surrounding plains in tropical thorn forest with species such as *Acacia nilotica, Capparis decidua, Prosopis cineraria, Tamarix aphylla, Zizyphus mauritiana, Z. nummularia, Calotropis procera, Eleusine compressa, Erianthus spp., Panicum antidotale and Saccharum spontaneurn. Dalbergia sissoo* and *Acacia nilotica* have been extensively planted along nearby roadsides and around agricultural land (Umair *et al.*, 2013; Umair *et al.*, 2017).

Weed diversity: In River Chenab at Head Qadirabad, the most common weed species includes *Tribulus terrestris L., Solanum nigrum L., Xanthium strumarium, Amaranthus viridis, Cynodon dactylon, Achyranthes aspera, Parthenium hysterophorus, Calotropis procera, Conyza ambigua DC., Oxalis*

cornicula, Chenopodium album, Euphorbia pilulifera L., Euphorbia prostrata L. and *Cannabis sativa* (Umair *et al.*, 2013; Umair *et al.*, 2017).

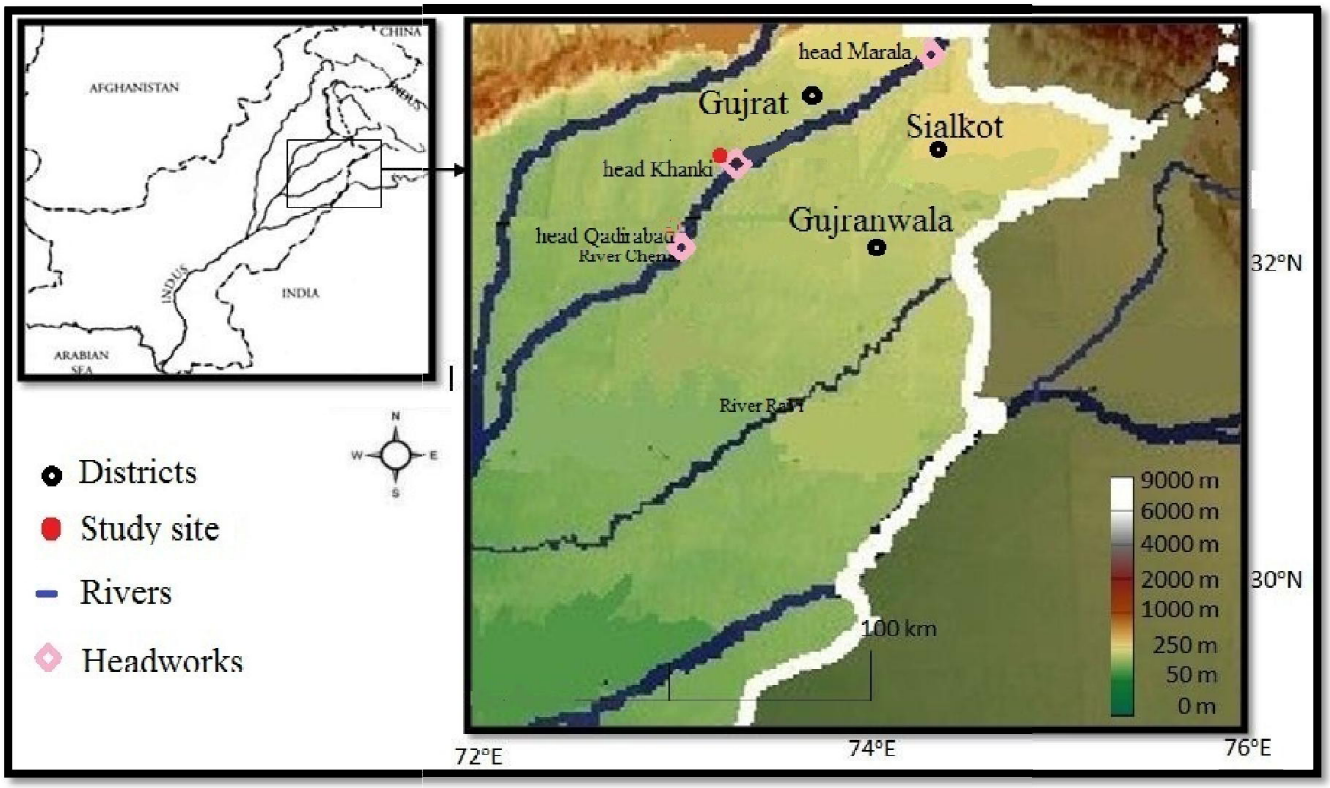

Figure 1. The Map of head Khanki.

Statistical Analysis: Different statistical indices were used to analysis the fish diversity i.e. Shannon-wiener Index, Richness Index and Evenness Index. While Shannon-wiener Index (H') was analyzed by given formula (Shannon and Weaver, 1949);

$$H' = - [\Sigma PI \ In \ PI]$$

Where, H' = Shannon-wiener Index

Richness Index (R), the number of fish species was calculated by formula is written as (Margalef, 1958);

$$R = (S - 1)/lognN$$

Where S= total number of species

N = total number/ population of ichthyofauna

Evenness Index (E), was calculated by the formula written as (Pielou, 1966);

$$E = H'/ Logn \ S$$

RESULTS AND DISCUSSIONS

During the survey 33 species and 355 individual of fishes were observed. Shannon-Weiner Index (H') was recorded as 2.834. Shannon-Weiner Index indicated the heterogeneity among species of the study area, while Evenness Index was noted as; 0.8699 and Richness was as; 9.803 (Table 1) in the study area. Altaf *et al.* (2011b) identified the 33 species from the head Qadirabad. Khan

et al. (2011) recorded the 50 species from the Ravi while 30 species recorded from the river Jhelum.

Top abundant fishes of the study area were as; *Oreochromis* spp. (R.A= 0.214085), *Labeo rohita* (0.084507), *Cirrhinus mrigala* (0.061972), *Bagarius bagarius* (0.061972), *Sperata sarwari* (0.061972), *Channa punctata* (0.059155), *Tor microlopsis* (0.059155), *Rita rita* (0.047887), *Heteropneustes fossilis* (0.047887) and *Clupisoma garua* (0.033803) (Table 2). Comparison of the present fish species distribution with previous reported fish species in Pakistan was analyzed (Table 3).

During the study observed the fallowing threats to fish i.e. increase fertilizers, pesticides, waste material, excess fishing for marketing and export, bad construction of fish-ladder and no or low stocking of fish species in river.

Conclusion: It is concluded that study area have high fish diversity and also has unique fish fauna, but fish population and species are declined due to overfishing and pollution.

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Authors' contributions: Project designed by Muhammad, Umair and Yaqoob, data collected by Muhammad and Umair, statistical analysis by Rasheed, supervised by Khan; while critically analysis by Ashraf, Haider, Chattha, Ansari, Yaqoob and Iqbal.

Table 1: Fish of the head Khanki, River Chenab

Common Name	Scientific Name	R.A	PilnPi
Common Carp	*Cyprinus carpio*	0.002817	-0.01654
Mori	*Cirrhinus mrigala*	0.061972	-0.17235
Raho	*Labeo rohita*	0.084507	-0.20881
Kalbans	*Labeo calbasu*	0.011268	-0.05054
Thaila	*Catla catla*	0.019718	-0.07742
Dola	*Channa punctata*	0.059155	-0.16727
Sole	*Channa marulius*	0.025352	-0.09317
Tilapia	*Oreochromis* spp.	0.214085	-0.32999
Khaga	*Rita rita*	0.047887	-0.14553
Foji Khaga	*Bagarius bagarius*	0.061972	-0.17235
Baam Machhali	*Mastacembelus armatus*	0.014085	-0.06004
Sangari	*Sperata sarwari*	0.061972	-0.17235
Mali	*Wallago attu*	0.030986	-0.10765
Jhali	*Eutropiichthys vacha*	0.019718	-0.07742
Masheer	*Tor microlopsis*	0.059155	-0.16727
Bachhwa	*Clupisoma garua*	0.033803	-0.1145
But Pari	*Notopterus Notopterus*	0.011268	-0.05054
Patha Chalwa	*Barilius Bendelisis*	0.005634	-0.02918
Sophore Popra	*Puntius sophore*	0.008451	-0.04034
Ticto Popra	*Puntius ticto*	0.005634	-0.02918

Ranga Sheesha Machhali	*Parambassis ranga*	0.002817	-0.01654
Kirla Machhali	*Sisor rabdophorus*	0.030986	-0.10765
Kaan Machhali	*Xenentodon cancila*	0.033803	-0.1145
Pali Roo Machhali	*Osteobrama cotio*	0.014085	-0.06004
Choti Chal Machhali	*Salmostoma bacaila*	0.030986	-0.10765
Sangehi Machhali	*Heteropneustes fossilis*	0.047887	-0.14553
Shannon-wiener diversity Index			**-2.834**
Richness Index			**9.803**
Evenness Index			**0.8699**

Table 2: Top abundant fishes of Head Khanki.

Scientific Name	**Relative abundance (R.A.)**
Oreochromis spp.	0.214085
Cirrhinus mrigala	0.061972
Labeo rohita	0.084507
Bagarius bagarius	0.061972
Channa punctata	0.059155
Sperata sarwari	0.061972
Rita rita	0.047887
Tor microlopsis	0.059155
Heteropneustes fossilis	0.047887
Clupisoma garua	0.033803

Table 3: Fish species recorded from study area and comparison with previous record in Pakistan.

Common Name ***Scientific Name***	**Previous record in Pakistan**
Common Carp *Cyprinus carpio*	Indus (Khan *et al.*, 2008; Hussain *et al.*, 2016; Muhammad *et al.*, 2017a), Sutlej (Iqbal *et al.*, 2017), Jhelum (Khan *et al.*, 2008; Mirza *et al.*, 2011), Ravi (Hussain *et al.*, 2015) and River Chenab (Altaf *et al.*, 2011a; Altaf *et al.*, 2011b; Altaf *et al.*, 2015; Latif *et al.*, 2016; Muhammad *et al.*, 2017c; Muhammad *et al.*, 2018),
Mori *Cirrhinus mrigala*	Indus (Khan *et al.*, 2008; Hussain *et al.*, 2016), River Chenab (Altaf *et al.*, 2011a; Altaf *et al.*, 2011b; Altaf *et al.*, 2015; Muhammad *et al.*, 2017c), Sutlej, Jhelum (Iqbal *et al.*, 2017) and Ravi (Hussain *et al.*, 2015; Hussain *et al.*, 2017)
Raho *Labeo rohita*	Indus (Khan *et al.*, 2008; Mirza and Mirza, 2014; Hussain *et al.*, 2016; Muhammad *et al.*, 2017a; Sheikh *et al.*, 2017), River Chenab (Khan *et al.*, 2008; Mirza *et al.*, 2011; Altaf *et al.*, 2015; Latif *et al.*, 2016; Muhammad *et al.*, 2017c), Sutlej (Iqbal *et al.*, 2017), Jhelum (Mirza *et al.*, 2011; Mirza and Mirza, 2014) and Ravi (Hussain *et al.*, 2015; Hussain *et al.*, 2017)

Kalbans *Labeo calbasu*	Indus (Khan *et al.*, 2008; Muhammad *et al.*, 2017c), River Chenab (Altaf *et al.*, 2011b), Sutlej (Iqbal *et al.*, 2017), Jhelum (Khan *et al.*, 2008; Mirza *et al.*, 2011) and Ravi (Hussain *et al.*, 2015)
Thaila *Catla catla*	Indus (Khan *et al.*, 2008; Hussain *et al.*, 2016; Muhammad *et al.*, 2017a; Sheikh *et al.*, 2017), River Chenab (Altaf *et al.*, 2011a; Altaf *et al.*, 2011b; Altaf *et al.*, 2015; Muhammad *et al.*, 2017c), Sutlej (Iqbal *et al.*, 2017; Muhammad *et al.*, 2017c), Jhelum (Khan *et al.*, 2008; Muhammad *et al.*, 2017c) and Ravi (Hussain *et al.*, 2015; Hussain *et al.*, 2017; Muhammad *et al.*, 2017c)
Dola *Channa punctata*	Indus (Khan *et al.*, 2008; Hussain *et al.*, 2016; Muhammad *et al.*, 2017a), River Chenab (Altaf *et al.*, 2011b; Altaf *et al.*, 2015), Sutlej (Iqbal *et al.*, 2017), Jhelum (Khan *et al.*, 2008; Mirza *et al.*, 2011) and Ravi (Hussain *et al.*, 2015)
Soul *Channa marulius*	Jhelum (Khan *et al.*, 2008; Mirza *et al.*, 2011; Muhammad *et al.*, 2017b), River Chenab (Altaf *et al.*, 2011b; Altaf *et al.*, 2015; Muhammad *et al.*, 2017b), Indus (Khan *et al.*, 2008; Hussain *et al.*, 2016; Muhammad *et al.*, 2017a; Muhammad *et al.*, 2017b), Ravi (Hussain *et al.*, 2015; Muhammad *et al.*, 2017b) and Sutlej (Iqbal *et al.*, 2017; Muhammad *et al.*, 2017b)
Tilapia *Oreochromis* spp.	River Chenab (Altaf *et al.*, 2015), Indus (Khan *et al.*, 2008; Muhammad *et al.*, 2017a), Jhelum (Khan *et al.*, 2008; Mirza *et al.*, 2011), Sutlej (Iqbal *et al.*, 2017) and Ravi (Hussain *et al.*, 2015)
Khaga *Rita rita*	Indus (Khan *et al.*, 2008; Hussain *et al.*, 2016), River Chenab (Altaf *et al.*, 2011b; Altaf *et al.*, 2015), Sutlej (Iqbal *et al.*, 2017), Jhelum (Mirza *et al.*, 2011) and Ravi (Hussain *et al.*, 2015)
Foji Khaga *Bagarius bagarius*	River Chenab (Altaf *et al.*, 2011b; Altaf *et al.*, 2015)
Baam Machhali *Mastacembelus armatus*	Indus (Khan *et al.*, 2008; Hussain *et al.*, 2016; Muhammad *et al.*, 2017a), River Chenab (Altaf *et al.*, 2011b; Altaf *et al.*, 2015), Sutlej (Iqbal *et al.*, 2017) and Jhelum (Khan *et al.*, 2008)
Sangari *Sperata sarwari*	Indus (Khan *et al.*, 2008), River Chenab (Altaf *et al.*, 2011b; Altaf *et al.*, 2015), Sutlej (Iqbal *et al.*, 2017), Jhelum (Mirza *et al.*, 2011) and Ravi (Hussain *et al.*, 2015)
Mali *Wallago attu*	Indus (Khan *et al.*, 2008; Hussain *et al.*, 2016; Muhammad *et al.*, 2017a), River Chenab (Altaf *et al.*, 2011b; Altaf *et al.*, 2015), Sutlej (Iqbal *et al.*, 2017), Jhelum (Khan *et al.*, 2008; Mirza *et al.*, 2011) and Ravi (Hussain *et al.*, 2015)
Jhali *Eutropiichthys vacha*	Indus (Khan *et al.*, 2008), River Chenab (Altaf *et al.*, 2011b; Altaf *et al.*, 2015), Jhelum (Khan *et al.*, 2008) and Sutlej (Iqbal *et al.*, 2017)
Masheer *Tor microlopsis*	River Chenab (Altaf *et al.*, 2011b; Altaf *et al.*, 2015)
Bachhwa *Clupisoma garua*	Jhelum (Khan *et al.*, 2008; Mirza *et al.*, 2011), River Chenab (Altaf *et al.*, 2011b; Altaf *et al.*, 2015), Indus

	(Khan *et al.*, 2008; Hussain *et al.*, 2016; Muhammad *et al.*, 2017a), Ravi (Hussain *et al.*, 2015) and Sutlej (Iqbal *et al.*, 2017).
But Pari *Notopterus Notopterus*	Indus (Khan *et al.*, 2008; Hussain *et al.*, 2016; Muhammad *et al.*, 2017a), River Chenab (Altaf *et al.*, 2011b; Altaf *et al.*, 2015), Sutlej (Iqbal *et al.*, 2017), Jhelum (Khan *et al.*, 2008) and Sutlej (Iqbal *et al.*, 2017)
Patha Chalwa *Barilius Bendelisis*	River Chenab (Altaf *et al.*, 2011b; Altaf *et al.*, 2015)
Sophore Popra *Puntius sophore*	River Chenab (Altaf *et al.*, 2011b; Altaf *et al.*, 2015)
Ticto Popra *Puntius ticto*	River Chenab (Altaf *et al.*, 2011b; Altaf *et al.*, 2015)
Ranga Sheesha Machhali *Parambassis ranga*	River Chenab (Altaf *et al.*, 2011b; Altaf *et al.*, 2015)
Kirla Machhali *Sisor rabdophorus*	River Chenab (Altaf *et al.*, 2011b; Altaf *et al.*, 2015)
Kaan Machhali *Xenentodon cancila*	River Chenab (Altaf *et al.*, 2011b; Altaf *et al.*, 2015)
Pali Roo Machhali *Osteobrama cotio*	River Chenab (Altaf *et al.*, 2011b; Altaf *et al.*, 2015)
Choti Chal Machhali *Salmostoma bacaila*	River Chenab (Altaf *et al.*, 2011b; Altaf *et al.*, 2015)
Sangehi Machhali *Heteropneustes fossilis*	River Chenab (Altaf *et al.*, 2011b; Altaf *et al.*, 2015)

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