Research Article

Morphometric measurement, relative abundance and effect of physico-chemical parameters of water on ichthyofaunistic diversity of River Tochi District North Waziristan (Newly Merged District), Khyber Pakhtunkhwa

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Abstract

An ichthyofaunistic survey of River Tochi at District North Waziristan (NW) was conducted from July 2018 to December 2018 to know about morphometric measurement and relative abundance of fish fauna and impact of physico-chemical parameters on fish biodiversity and survival. A total 604 specimens were collected containing 21 species. The total reported species of fishes belong to five different orders (Cypriniformes, Channiformes, Siluriformes, Perciformes and Mastacembeliformes), seven families (Cyprinidae, Nemacheilidae, Channidae, Siluridae, Sisoridae, Cichilidae and Mastacembelidae) and nine genera (*Barilius*, *Gara*, *Aspidoparia*, *Crossochiellus*, *Cyprinion*, *Cyprinus*, *Puntius*, *Cirrihinus*, *Labeo*, *Schistura*, *Channa*, *Ompok*, *Glypthorax*, *Oreochromis* and *Mastacembelis*). Family Cyprinidae was the dominant family of the all reported families. Species *Schistura affaciata* is the first time report of this species from Khyber Pakhtunkhwa. Analytical results of Water quality parameters like Temperature, pH, Conductivity, Alkalinity, Salinity, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Total Hardness, Magnesium (Mg) Hardness, Calcium (Ca) Hardness and free CO₂ reveal that all the values fall in standard range for fish life.

Keywords: Cyprinidae; Fish fauna; Physico-chemical; River Tochi; Water quality

Introduction

Fishes makes about half of the total recognised species of vertebrates [1, 2]. Every year, few hundred species are added to the list of fish

diversity [3]. In Pakistan, there found about 200 fish species in all freshwater bodies of the country [4-6]. Ichthyodiversity usually depends on different living and non living components

of ecosystem i.e depth of water body, changeability in water level and morphometric topographies. Fisheries output also influenced by hydro biological structures of catch point [7]. The limnological properties and physical conditions of water body affect the species composition of water body [8]. The sustainability of fish diversity and its abundance is based on the hydrological parameters as well as plankton diversity [9]. This study was aimed to determine ichthyofaunal diversity, analysis of physico-chemical parameter of water of river tochi and their effect on fish fauna. All the proposed aims were achieved successfully. This study was carried out District North Waziristan which is second largest district in newly merged districts of Khyber Pakhtunkhwa. The North Waziristan Agency (NWA) was set up in 1895. It was in the year, 1910 when N.W. A. was constituted as a full-fledged agency with its Headquarter “Miran Shah” [10]. This N. W. A. become a district of Khyber pakhtunkhwa in May, 2018. The River Tochi also called as Gambila River, is located in Khyber Pakhtunkhwa province. It is an important River of district North Waziristan and it is formed by the conjunction of “Margha” and “Masthoni” streams. Both streams come from the northern side of Vargin, Paktia (Afghanistan) and meet at “Dwathoi” district North Waziristan, Pakistan. In the hills and within the limits of district North Waziristan and Bannu district, the River is called as “Tochi” but once it enters Marwat region, it is called “Gambilla” [11]. The total length of River Tochi from origin to end is approximately 373 km [12].

Materials and methods

Different sites were chosen for water sampling and fish collection. Water sampling and fish collection was done from July, 2018 to December, 2018.

During whole study period, different types of fish gears were used for collection of fish. A month wise visit was arranged for the collection of the fish in the river. For preservation, 10 % formalin solution was used. The large sized

specimens of the fish were injected with pure formalin to avoid rotting. The list of the keys used in the identification of the fish is as under;

1. Fauna of Lahore [13]
 2. Fishes of Punjab, Pakistan [14]
 3. Cat fishes of India [15]
 4. Freshwater fishes of the Indian region [16].
- For studying different physical and chemical characteristics of the water of the river Tochi, water samples were also collected from each collection point during collection trip using standard protocol. All collected water samples were studied for different physical and chemical properties of water like pH, conductivity, salinity, total dissolved substance, total alkalinity, Total hardness, Ca hardness, Mg hardness, total suspended solid, Free CO₂, Air and water temperature.

Results

Ichthfaunistic diversity of river Tochi

During the six months study period from July to December 2018, the ichthyofaunistic composition of the River tochi district North Waziristan has been explored. A total of 604 specimens fishes were collected which comprised of 21 fish species. The total reported fish species of the study were belonged to 5 orders, 7 families and 9 different genera. The reported species were *Barilius modestus*, *Barilius naseeri*, *Barilius vagra*, *Barilius pakistanicus*, *Gara gotyla*, *Aspidoparia morar*, *Crossocheilus diplocheilus*, *Cyprinion watsoni*, *Cyprinus carpio*, *Puntius conchoni*, *Puntius sophore*, *Cirrhinus mrigala*, *Labeo rohita*, *Schistura curtistigma*, *Schistura prashari*, *Schistura afaciata*, *Channa gachua*, *Ompok pabda*, *Glyptothorax naziri*, *Oreochromis niloticus* and *Mastacembelus armatus*. All the reported species with their taxonomic position is given in the following table 1.

Relative abundance of fish fauna

In order to determine relative abundance of fish fauna of river tochi, fish catch trip was arranged in each month from July to December, 2018. The following table 2 and fig. 1 show the month wise catch of number of specimens of all reported species.

Table 1. Reported fish species from river Tochi

S. No	Order	Family	Genus	Genus and Species
1	Cypriniformes	Cyprinidae	<i>Barilius</i>	<i>Barilius modestus</i>
2				<i>Barilius naseeri</i>
3				<i>Barilius vagra</i>
4				<i>Barilius pakistanicus</i>
5			Gara	<i>Gara gotyla</i>
6			Aspidoparia	<i>Aspidoparia morar</i>
7			<i>Crossocheilus</i>	<i>Crossocheilus diplocheilus</i>
8			Cyprinion	<i>Cyprinion watsoni</i>
9			Cyprinus	<i>Cyprinus carpio</i>
10			Puntius	<i>Puntius conchoni</i>
11				<i>Puntius sophore</i>
12			Cirrhinus	<i>Cirrhinus mrigala</i>
13			Labeo	<i>Labeo rohita</i>
14		Nemacheilidae	Schistura	<i>Schistura curtistigma</i>
15				<i>Schistura prashari</i>
16				<i>Schistura affaciata</i>
17	Channiformes	Channidae	Channa	<i>Channa gachua</i>
18	Siluriformes	Siluridae	Ompok	<i>Ompok pabda</i>
19		Sisoridae	Glyptothorax	<i>Glyptothorax naziri</i>
20	Perciformes	Cichilidae	Oreochromis	<i>Oreochromis niloticus</i>
21	Mastacembeliformes	Mastacembelidae	Matacembelus	<i>Mastacembelus armatus</i>

Table 2. Month wise relative abundance of fish fauna

S. No.	Fish Species	July	Aug	Sep	Oct	Nov	Dec	Tot	Catch (%)
1	<i>Barilius naseeri</i>	4	6	2	3	4	8	27	4.5
2	<i>B. modestus</i>	5	2	4	5	2	4	22	3.6
3	<i>B. vagra</i>	7	11	3	10	14	16	61	10.1
4	<i>B. pakistanicus</i>	5	9	4	8	6	5	37	6.1
5	<i>Gara gotyla</i>	2	5	2	3	6	4	22	3.6
6	<i>Aspidoparia morar</i>	9	18	30	20	40	25	142	23.5
7	<i>Crossocheilus diplocheilus</i>	2	6	5	4	1	1	19	3.1
8	<i>Cyprinion watsoni</i>	2	1	0	2	0	0	5	0.8
9	<i>Cyprinus carpio</i>	2	4	7	6	7	5	31	5.1
10	<i>P. sophore</i>	4	8	10	9	5	7	43	7.1
11	<i>P. conchoni</i>	6	1	3	5	4	6	25	4.1
15	<i>Labeo rohita</i>	2	3	1	3	5	4	18	3.0
17	<i>Cirrhinus mrigala</i>	2	1	2	3	2	2	12	2.0
12	<i>Schistura curtistigma</i>	6	7	8	3	2	1	27	4.5
13	<i>Schistura prashari</i>	2	2	3	4	2	8	21	3.5
14	<i>Schistura affaciata</i>	6	5	3	1	8	0	23	3.8
19	<i>Channa gachua</i>	2	3	0	2	1	3	11	1.8
16	<i>Ompok pabda</i>	2	4	0	3	2	4	15	2.5
18	<i>Glyptothorax naziri</i>	2	2	2	5	1	2	14	2.3
20	<i>Oreochromis niloticus</i>	1	4	0	5	4	2	16	2.6
21	<i>Mastacembelus armatus</i>	2	4	1	2	1	3	13	2.1
	Total	75	106	90	106	117	110	604	-----

Figure 1. Relative abundance of fish species
Morpho-metric measurement of reported fish species

Morpho-metric measurement of at least three specimens of each species was taken each

month and the average was taken as final measurement. The following table 3 shows the average morpho-metric measurement of all reported species.

Table 3. Average morpho-metric measurement of collected fish specimens

S. No	Fish Species	T.L	S.L	F.L	P.O.L	H.D	E.D	B.D	B.W
01	<i>Barilius naseeri</i>	7.3	5.7	6.7	6.3	1.4	0.2	1.1	0.8
02	<i>B. modestus</i>	8.4	5.9	6.9	6.4	1.4	0.3	1.5	0.8
03	<i>B. vagra</i>	8.4	6.4	7.2	6.8	1.7	0.4	1.1	0.7
04	<i>B. pakistanicus</i>	8	6.3	7	5.4	1.7	0.4	1.7	0.8
05	<i>Gara gotyla</i>	15.1	10.9	12.7	8.9	2.7	0.4	2.1	1.9
06	<i>Aspidoparia morar</i>	11.7	9.3	10.2	8.2	2.0	0.4	1.6	1.1
07	<i>Crossocheilus diplocheilus</i>	14.3	11.5	12.7	9.6	2.2	0.3	2.6	2.4
08	<i>Cyprinion watsoni</i>	12.5	9.6	10.5	8.1	1.9	0.3	2.3	2.1
09	<i>Cyprinus carpio</i>	19.2	15.6	17.9	16.2	3.3	0.5	2.9	2.4
10	<i>Puntius sophore</i>	8.9	6.8	7.8	5.9	1.7	0.3	2.3	1.0
11	<i>Puntius conchoni</i>	8.1	6.7	7.3	5.7	1.2	0.4	1.7	0.9
12	<i>Labeo rohita</i>	19.2	15.6	17.6	14.4	4.1	0.5	3.0	1.6
13	<i>Cirrhinus mrigala</i>	13.2	10.8	12.4	11.2	2.4	0.4	2.1	1.3
14	<i>Schistura curstigma</i>	4.6	3.9	4.2	3.1	0.9	0.1	0.5	0.6
15	<i>S. prashari</i>	4.5	3.8	4.3	3.1	0.8	0.1	0.6	0.6
16	<i>S. affaciata</i>	4.7	3.9	4.2	3.2	0.9	0.1	0.5	0.5
17	<i>Channa gachua</i>	9.3	7.8	-	8.1	1.6	0.5	1.1	0.9
18	<i>Ompok pabda</i>	15.8	13.4	14.5	14.2	3.2	0.5	3.3	1.6
19	<i>Glyptothorax naziri</i>	9.3	7.5	8.2	6.2	1.5	0.2	1.8	1.3
20	<i>Oreochromis niloticus</i>	10.9	8.3	-	7.1	3.1	0.9	3.2	1.5
21	<i>Mastacembelus armatus</i>	32	28	-	29	2.8	0.4	2.4	2.1

Results of water quality parameters

The investigated physico-chemical parameters of the water include water temperature, pH, electrical conductivity, salinity, total hardness, total alkalinity, calcium hardness, magnesium

hardness, total suspended solids, total dissolved solids and free CO₂. All the parameters of the water of the river tochi are fall in the optimum range. The recorded mean values of water quality parameters are shown in the following table 4.

Table 4. Average values of different water quality parameters of river Tochi

Parameters	July	Aug	Sep	Oct	Nov	Dec	Mean	S.D
Air Temp (°C)	41	32	30	23	21	17	27.33	8.73
Water Temp (°C)	34	25	21	15	13	11	19.83	8.68
pH	6.9	7.1	7.2	7.1	7.35	6.8	7.07	0.20
E.C (μs/cm)	399	495	450	500	493	520	476.17	44.19
Salinity (ppt)	0.27	0.31	0.25	0.33	0.33	0.36	0.30	0.04
T. H (mg/L)	121	129	125	122	130	139	127.67	6.62
Ca. H (mg/L)	81	78	80	84	89	92	84	5.48
Mg .H (mg/L)	39	41	45	38	41	47	41.83	3.48
TSS (mg/L)	175	154	180	124	175	150	159.67	21.36
TDS (mg/L)	370	410	394	400	435	412	403.5	21.59
Free CO ₂ (mg/L)	18	16	12	11	17	16	15	2.82
T. A (mg/L)	78	74	80	89	80	81	80.33	4.92

Discussion

This study was aimed to determine the fish fauna of river Tochi along with water quality at district North Waziristan. Shahjehan and Khan [11] reported fourteen species from River Tochi (Gambilla) at District Lakki Marwat K. P. (Pakistan). Their reported species were *Salmostoma punjabensis*, *Barilius vagra*, *Puntius sophore*, *Mastacembelus armatus*, *Puntius ticto*, *Mystus bleekeri*, *Wallago attu*, *Glyptothrax punjabensis*, *Tor macrolepis*, *Aspidoparia morar* and *Channa punctatus*.

As for as the present study is concerned, 21 species are reported from River Tochi. Likewise the previous record, the catch of this study is also dominated by family Cyprinidae and among the total 21 species, 13 species belong to family Cyprinidae, 3 to family Nemacheilidae, one to family Channidae, Siluridae, Sisoridae, Cichilidae and Mastacembelidae each.

Species like *Barilius vagra*, *Puntius sophore*, *Mastacembelus armatus* and *Aspidoparia morar* were also reported by Shahjehan and Khan [11]. Besides this all the species were not reported from river tochi earlier but are

reported from different water bodies of adjoining areas (water bodies of district Bannu).

Mirza *et al.* [17], studied fish fauna River Kurram which flows at the side of river tochi in district bannu. They report 51 Species of fish from River Kurram. Among these most of the species are in common with fauna of river tochi i-e *Barilius modestus*, *Barilius vagra*, *Barilius pakistanicus*, *Puntius sophore*, *Puntius conchoni*, *Gara gotyla*, *Crossocheilus diplocheilus*, *Aspidoparia morar*, *Cyprinion watsoni*, *Cyprinus carpio*, *Cirrhinus mrigala*, *Labeo rohita*, *Schistura prashari*, *Channa gachua*, *Ompok pabda* and *Mastacembelus armatus*.

Conclusion

Among the reported species, 12 species are the new record from this river which are also recorded from different tributaries rivers and water bodies of the area. All water quality parameters results also fall in standard range and are suitable for fish life.

Authors' contributions

Conceived and designed the experiments: HJU Rehman & MN Khabir, Performed the

experiments: MN Khabir & HJU Rehman, Analyzed the data: Z Hassan, Contributed materials/ analysis/ tools: I Khan, M Kamal & A Sohail, Wrote the paper: MN Khabir.

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