

First comprehensive study on ichthyofaunal diversity of River Kurram Khyber Pakhtunkhwa Pakistan

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Abstract

Highlighting the importance of fish species such as economical, ecological, medical, cheap, and rich sources of animal portions and also more diverse groups among vertebrates the present study was aimed to explore the fish diversity of River Kurram, Khyber Pakhtunkhwa Pakistan from September 2019 to September 2022. Fish specimens were collected from 12 different sites by the help of local fishermen by using cast nets, collected specimens were washed and preserved in 90% ethanol for further observation. A total of 1902 specimens were collected and identified which belong to six orders, eight families, 22 genera, and 35 species. The most diverse orders were cypriniforms followed by suliriform, Perciform, Salmoniforms, and Chenniforms, while the less diverse order was Mastacembeliforms representing only one species. In family-wise diversity, the more diverse family was Cyprinidae represented by 19 species, and less diverse was Mastacembelidae representing only one species *Mestacembelus armitus*. Representing 241 specimens and 12.7% of the total collected specimens, followed by *Garra gotta* 139 specimens and 7.3%, various *Pakistanikus* 128 specimens and 6.7%, and *Tor putitora* 122 specimens and 6.4% of total collection. On the hand, the specimens of *Cyprinus watsoni* and *Schistura shadwalensis* were observed rarest in number every 11 specimens with 0.58% of the total specimens in species wise distribution the most abundant species was *Schizothorax plageostomus* which was collected from almost all study area sites except few sites in upper reign.

Keywords: Ichthyofauna, River Kurram, Khyber Pakhtunkhwa

Introduction

Fish can be defined as a cold-blooded vertebrate that adapts to live in water, respire through gills, and has limbs in the form of fins (Iqbal & Lubna, 2023; Malabarba & Malabarba, 2020). Ichthyofauna represent an essential component of the aquatic ecosystem and are highly valued for their economic, social, and aesthetic importance (N'Zi et al., 2015). Similarly, the Food and Agriculture Organization (FAO) reported that fish produce 91.3 million tons of food of which 79.7 tons are produced by marine water and 11.6 tons by freshwater fish. Out of 91.3 million tons, 86% are consumed by humans and the remaining is utilized as a health supplement for a human being as a food source for livestock and aquaculture (Lynch & MacMillan, 2020). Medically, fish is a healthy food, providing macro and micronutrients, polyunsaturated fatty acid, and rich quality animal proteins making it more reasonable than other animal proteins. As compared to terrestrial animals, fish's body is rich in some minerals like Iodine, Selenium, Zinc, Calcium and micronutrients like vitamin A, and vitamin D, which are essential to prevent chronic diseases like hypertension, coronary heart disease, diabetes type-2, obesity, and cancer (Mohanty et al., 2019). Moreover, fishes are environmental indicators and they show the physical, chemical, and biological status of water bodies in both fresh and marine ecosystems (Whitfield & Elliott, 2002). A fish database (fishbase) recorded more than 34000 species of Fish which are the most abundant group of vertebrates that are different from one another by size, shape, color, habits, and habitat (Tedesco et al., 2017). In 2010 about 32000 fish species were reported of which 16764 belong to marine water, 15170 belong to freshwater, and 180 species were from brackish water. Moreover each year 100-150 new marine species are being added to ichthyofauna (Eschmeyer & Polack, 2010). According to (Dawson, 2012) freshwater occupies less than 1% of the aquatic environment and represents 48% of fish fauna about 13000 fish species out of 27000 while marine water occupies 99% aquatic environment and represents about 14000 fish species. Geographically freshwater fishes have a different population in different regions, out of 13000 species and 2513 genera Neotropical region is the more abundant region representing 4,035 species (705 genera) followed by the tropical region 2,938 (390 genera), oriental represents 2,345 (440 genera), in the Palearctic 1,844 (380 genera), Nearctic 1,411 (298 genera) while Australian represent very least population 261 (94 genera) (Levêque et al., 2008). The distribution of fish in freshwater is affected by different ecological features like stream gradient, rainfall, water chemistry, temperature, and latitude (Reis et al., 2016). Moreover, in the recent decade fish diversity is badly affected by

different aquatic pollution, especially heavy metals and pesticides (Ullah et al., 2022; Habib et al., 2024; Naz et al., 2022). The present study is aimed to explore the fish diversity of River Kurram, Khyber Pakhtunkhwa Pakistan from September 2019 to September 2022.

Martial and methods

Study area

The river Kurram is a large river that originated from Kohe e surfed (Speen Gher) in Paktia province of Afghanistan and entered into district Kurram formally known as Kurram agency, then entering to the district Bannu at the north-western side, rapid flow to the Lakki Marwat at the south (Ali et al., 2018). Water sources of the river are rainfall which mostly occurs in monsoons in summer, melting snow in winter, and drainage from the surrounding areas (Rahman et al., 2022). Their water is the main source of irrigation of lower Kurram, Bannu, and Lakkimarwat and plays very important role in their agriculture (Zafar et al., 2017). The total length of the river is 240 KM but its width and water depth are variable in different areas, water flow also decreases down the river from top to bottom, temperature in summer remains pleasant from 17C⁰ to 31 C⁰ while in winter it goes below the freezing point depend upon from sea level (Ali et al, 2022).

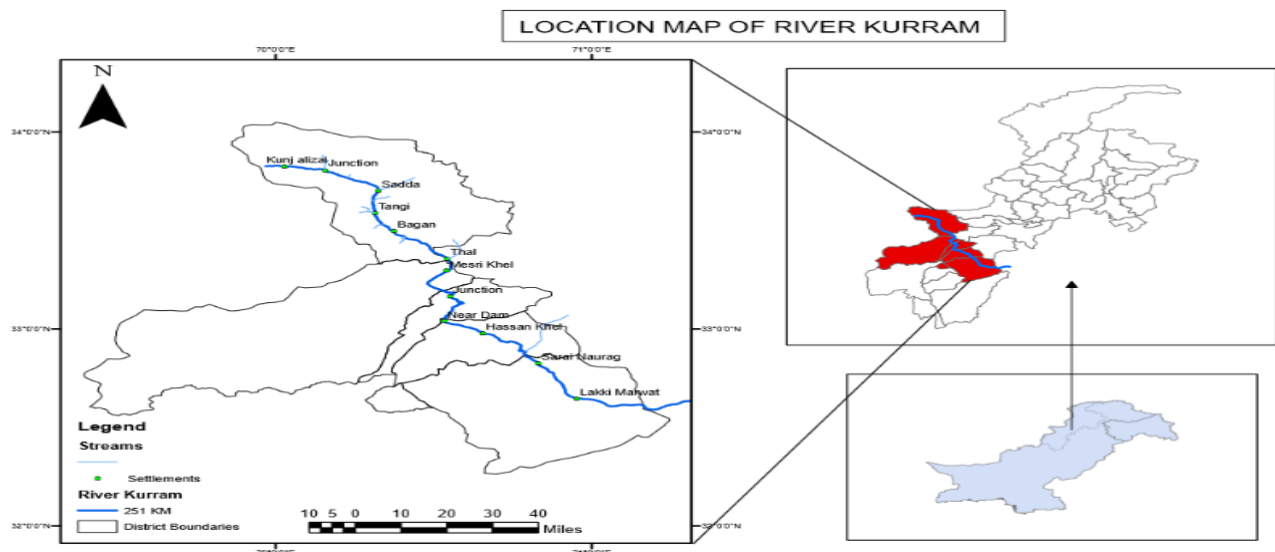


Figure 1. Study area map showing the collection sites of River Kurram.

Fish collections

Fish samples were collected from fourteen different sites of River Kurram each two months from 2019 to 2021 with the help of local fishermen. Different fishing gears including simple hooks,

rods, and different types of nets like cast nets and hand nets. Collection was repeated from different sites at different seasons to ensure the seasonal variation among the species

Morphological identification and morphometry

The collected samples were shifted to the laboratory of the zoology department at Islamia College Peshawar for morphological identification with the help of different standard fish identification keys (Jayram, 1999; Talwar & Jhingran, 1991). Specimens were identified based on external morphological features such as body shape, position of mouth, position of fins, number and types of fin rays, types and numbers of lateral line scales, number and length of barbels and their position, pattern of the body color and measurement of various morphometric variables (Mirza & Sandhu, 2007; Mirza, 1990).

Table 1. Details of collection sites, GPS location and mean annual temperature.

Site Number	Name	Latitude	Longitude	Mean Annual Temp. C°
01	Kunj alizai	33°49'27.48"N	70° 1'40.73"E	15
02	Gubad shah	33°55'22.84"N	70° 8'14.92"E	17
03	Junction	33°48'23.02"N	70° 9'23.12"E	16
04	Sadda	33°42'6.61"N	70°19'27.78"E	18
05	Tangi	33°35'21.51"N	70°18'50.25"E	19
06	Bagan	33°29'44.75"N	70°22'29.28"E	20
07	Thal	33°21'27.07"N	70°32'31.87"E	21
08	Mesri khel	33°17'44.61"N	70°32'24.25"E	22
09	Junction	33° 9'57.82"N	70°33'2.65"E	23
10	Near dam	33° 2'22.17"N	70°32'1.38"E	23
11	Hassan khel	32°58'38.27"N	70°39'16.79"E	23
12	Sarai naurag	32°49'32.35"N	70°49'49.58"E	24
13	Lakki marwat	32°38'48.33"N	70°57'6.14"E	24
14	Junction	32°37'26.12"N	71°21'50.11"E	24

The details of the collecting sites from where fish specimens were collected, their GPS coordinates, and the average annual temperature is mentioned in Table 1. Kunj Alizai, Qubad Shah, Junction, Sadda, Tangi, Bagan, Thal, Mesri Khel, Junction, Near Dam, Hassan Khel, Sarai naurang, Lakki Marwat and Junction. The average annual temperature was maximum in the junction and Lakki Marwat, where the temperature was recorded 24 Co. In comparison, the minimum temperature was recorded in Kunj Alizai at about 15 Co, then the continuous increase from Kunj Alizai to Lakki Marwat.

Table 2. Details of fish species collected from River Kurram Khyber Pakhtunkhwa Pakistan

Sr. No.	Order	Family	Species
1.	Cypriniformes	Cyprinidae	<i>Carassius auratus</i>
2.			<i>Cyprinus Carpio</i>
3.			<i>Barilius modestus</i>
4.			<i>Barilius vagra</i>
5.			<i>Barilius pakistanicus</i>
6.			<i>Cyprinus watsoni</i>
7.			<i>Puntius ticto</i>
8.			<i>Puntius sophore</i>
9.			<i>Schizothorax plagiostomus</i>
10.			<i>Schizothorax Labiatus</i>
11.			<i>Schistura alepidote</i>
12.			<i>Schistura shadwalensis</i>
13.			<i>Schistura prashari</i>
14.			<i>Tor putitora</i>
15.			<i>Cirrhinus mrigala</i>
16.			<i>Crossocheilus diplocheilus</i>
17.			<i>Garra gotyla</i>
18.		Nemacheilidae	<i>Triplophysa naziri</i>
19.			<i>Triplophysa choprai</i>
20.			<i>Acanthocobitis botia</i>
21.	Siluriformes	Sisoridae	<i>Glyptothorax stocki</i>
22.			<i>Glyptosternon reticulatum</i>
23.			<i>Glyptothorax punjabensis</i>
24.			<i>Glyptothorax naziri</i>
25.			<i>Glyptothorax kashmirensis</i>
26.		<i>Ompak pabda</i>	
27.	Ailiidae	<i>Mystus bleekeri</i>	
28.	Chenniforms	Chennidae	<i>Channa gachua</i>
29.			<i>Channa punctate</i>
30.	Salmoniforms	Salmonidae	<i>Oncorhynchus mykiss</i>
31.			<i>Salmo trutta</i>
32.	Mastacembeliforms	Mastacembelidae	<i>Mastacembelus armatus</i>
33.	Perciform	Cichlidae	<i>Oreochromis aureus</i>
34.			<i>Oreochromus niloticus</i>
35.			<i>Oriochromis mozabica</i>

Collected fish specimens belong to six orders, eight families, 22 genera and 35 species. The most diverse order was cypriniforms followed by suliriform, Perciform, Salmoniforms and Chenniforms, while the less diverse order was Mastacembeliforms representing only one species.

In family wise diversity more diverse family was Cyprinidae represented by 19 species followed by Sisoridae, Cichilidae, Salmonidae, Chennidae, and Nemacheilidae, and less diverse was mastacembelidae representing only one species. In species-wise distribution the most abundant species was *Schizothorax plageostomus* in almost all study area sites. Table 3 shows the percentage of the total fish population presented by each species. During collection, the more abundant species was *Schizothorax palgiostomus*, representing 241 specimens and 12.7% of the total collected specimens, followed by *Garra gotta* 139 specimens and 7.3%, various *pakistanikus* 128 specimens and 6.7%, and *Tor Putitora* 122 specimens and 6.4%. On the other hand, the specimens of *Cyprinus watsoni* and *schistura shadwalensis* were observed rarest in number each 11 specimens with 0.58% of the total specimens, there low numbers may be due to some ecological pressure or habitat non-suitability. Among the collecting sites, more specimens and species were collected from the junction of River Kurram and River Kabul. During collection, 231 specimens were collected, which belonged to 33 species, while the site1 show the very little number of specimens, which belonged to only two species.

Table 3 summarizes the numbers of specimens, species diversity, species richness, Shannon Diversity index and Simpson diversity index among all 12 collection sites. Sites 1 and 3 show very low species diversity and richness, with very few species communities, while from site 4 onward, a very noticeable increase was observed both in the diversity index and species communities. Among all sites, species diversity was more uniform among sites 7 and 14, and their reason may be due to habitat suitability for species.

Table 3. Diversity index of collected fish species.

Site No.	Numbers of specimens	Species richness	Shannon Diversity Index	Simpson Diversity Index
Site 1	36	2	0.4	0.24
Site 2	34	2	0.58	0.40
Site 3	27	3	0.89	0.54
Site 4	40	9	1.9	0.85
Site 5	66	17	2.4	0.88
Site 6	100	21	2.5	0.91
Site 7	77	22	2.7	0.94
Site 8	109	29	2.9	0.94
Site 9	123	29	3.0	0.94
Site 10	110	27	3.0	0.93
Site 11	114	27	3.0	0.94
Site 12	105	29	3.0	0.94
Site 13	213	26	3.0	0.94
Site 14	231	26	3.0	0.94

Discussion

The current study aims to determine the ichthyofauna of the River Kurram, Khyber Pakhtunkhwa, Pakistan. A total of 1902 fish specimens were collected from 12 selected sites: Kunj Alizai, Gubad Shah, Junction, Sadda, Tangi, Bagan, Thal, Mesri Khel, Junction, near Dam, S Hassan Khel, Sarai Naurag, Lakki Marwat, and Junction between River Kurram and Kabul by local fishermen using cast nets of size 2-3 to 3-5mm. Sites show noticeable temperature variation between 15 C⁰ to 24C⁰ annually, which greatly influences the ichthyofauna, Kunjalizai to sadda temperature very low even in winter temperature down to freezing point and summer it increases to 20 C⁰, due to low average temperature upper sites have very low species diversity as compared to the lower region sites possessing more average temperature, More species diversity and population in the lower Kurram may be due to low ecological pressure, less anthropogenic activates and more habitat suitability. The collected fish specimens belong to six orders, eight families, 22 genera, and 35 species. The most diverse order was cypriniforms, represented by 20 species, followed by Siluriformes, represented 7 species, Perciform representing 3 species, Salmoniforms representing 2 species and Chenniforms representing 2 species, while the less diverse order was Mastacembeliforms, representing only one species. Similarly, mirza et al (1993) reported 13 fish species from River Kurram and its tributaries in which cyprinidae representing 7 species like aspidoporia morar, barilius pakistanicus, garra gotyla, crossocheleius diplocheilus, schizothorax plagiostomus, racoma labiate, schizocypris brucei, while nemacheilidae representing two species and sisoridae representing 4 species. Like River Kurram other major water bodies of Khyber Pakhtunkhwa also possess the same diversity of fish with little variation like Wahab & yousafzai, (2017a & 2017b) documented 10 species of family cyprinidae and 5 species of family sisoridae from River Panjkora. Similarly, Ahmad et al (2014) recorded 14 species in which 6 species belong to family cyrinidae, 2 species to channidae while mastacembelifdae, Salmonidae and sisoridae was represented by single spices from River panjkora Dir Upper region, ullah et al (2014) documented 16 species from Konhaye stream a major tributary of Panjkora in which 11 species belong to cyprinidae, 2 species to channidae, while nemachelidae, sisoridae and mastacembelidae represented by single species.

Different authors documented fish diversity in River swat in different years and from different regions but family cyprinidae was recorded the dominant family in river like Akhtar et al 2014

reported 14 species from River Swat, yousafzai et al (2013) documented 38 species from river Swat at Charsadda region, in which 20 species belong to cyprinidae, 4 species to nemacheilidae, 6 species to sisoridae, 2 species to schilbidae and channidae while mastacembelidae, belonidae and chandidae represented by single species. Another study conducted by Akhtar et al 2014 on River Swat reported 18 species, 14 belong to cyprinidae, 3 belonged to sisoridae and mastacembelidae represented by single species. River Kabul a large River based on their water and catchment area also show similarity in diversity, Khattak et al 2015 recorded 24 species at the Nowshera region in which family cyprinidae was the most abundant representing 14 species, Channidae, bagridae and siluridae represented by two species, while nemacheilidae, mastacembelidae, schilbidae and sisoridae represented by single species. Thus, family cyprinidae is the most abundant species in River Kurram But also in all major rivers of Khyber Pakhtunkhwa, its mean species of cyprinidae show more adaptation to environmental conditions. In species abundance we found schizothorax plageostomus is the more abundant species in the study areas as compared to other species of family cyprinidae, Schizothorax plageostomus, representing 241 specimens and 12.7% of the total collected specimens, followed by Garra gotta 139 specimens and 7.3%, various pakistanikus 128 specimens and 6.7%, and Tor Putitora 122 specimens and 6.4%. On the other hand, the specimens of Cyprinus watsoni and schistura shadwalensis were observed as rarest in number each 11 specimens with 0.58% of the total specimens, their low numbers may be due to some ecological pressure or habitat non-suitability. Similarly, Haseeb & yousafzai, 2023 also recorded schizothorax plageostomus as a most abundant species from all major Rivers (Panjkora, Swat, Kabul and Kurram) of Khyber Pakhtunkhwa.

Conclusion

It is the first comprehensive study on the Ichthyofauna of River Kurram and results of the current study report a total of 35 species belonged to 6 orders, 8th families, 22 genus and 35 species. Current study also concluded that upper portion of the river is very suitable for cold water fish's e, g trout due to low temperature while lower portion is very suitable for carps rearing due to moderate temperate temperature.

References

- Ahmad, L., Saeed, K., Khan, S., & Akhtar, N. (2014). Ichthyofaunal diversity of River Panjkora Upper Dir Khyber Pakhtunkhwa Pakistan. *Journal of Zoology Studies*, 1(6), 27-32.
- Akhtar, N., Khan, S., & Saeed, K. (2014). Exploring the fish fauna of River Swat, Khyber Pakhtunkhwa, Pakistan. *World Journal of Fish and Marine Sciences*, 6(2), 190-194.
- Ali, J., Khan, M. A., Nazneen, S., Muhammad, J., Nasir, M. J., Shah, M. T., & Khan, S. (2018). Assessment of heavy metals and physico-chemical characteristics of water and sediments, Kurram River (Pakistan). *Journal of Himalayan Earth Science*, 51(1).
- Ali, M., Yar, P., Salman, K., Hussain, W., Hussain, K., Hussain, G., & Bussmann, R. W. (2022). Land use and land cover modification and its impact on biodiversity and the ecosystem services in District Kurram, Pakistan. *BLACPMA*, 21.
- Dawson, M. N. (2012). Species richness, habitable volume, and species densities in freshwater, the sea, and on land. *Frontiers of Biogeography*, 4(3).
- Eschmeyer, W. N., Fricke, R., Fong, J. D., & Polack, D. A. (2010). Marine fish diversity: History of knowledge and discovery (Pisces). *Zootaxa*, 2525(1), 19-50.
- Habib, S. S., Naz, S., Fazio, F., Cravana, C., Ullah, M., Rind, K. H., ... & Khayyam, K. (2024). Assessment and bioaccumulation of heavy metals in water, fish (wild and farmed), and associated human health risk. *Biological Trace Element Research*, 202(2), 725-735.
- Haseeb, A., & Yousafzai, A. M. (2023). Assessment of ichthyofaunal diversity of family Cyprinidae in River Panjkora Dir, Khyber Pakhtunkhwa, Pakistan. *Brazilian Journal of Biology*, 84, e271574.
- Iqbal, S., & Lubna, M. (2023). Biodiversity of fish fauna of River Khiali at District Charsadda, Khyber Pukhtoonkhwa, Pakistan. *International Journal of Pure and Applied Zoology*, 11, 1-12.
- Jayaram, K. C. (1999). *The freshwater fishes of the Indian region*.
- Khattak, R. H., Aziz, F., & Ejaz-Ur-Rahman, Z. F. (2015). Ichthyofauna of River Kabul at Nowshera, Khyber Pakhtunkhwa, Pakistan. *International Journal of Fauna and Biological Studies*, 2(2), 57-61.
- Levêque, C., Oberdorff, T., Paugy, D., Stiassny, M. L. J., & Tedesco, P. A. (2008). Global diversity of fish (Pisces) in freshwater. *Freshwater Animal Diversity Assessment*, 545-567.
- Lynch, A. J., & MacMillan, J. R. (2020). The role of fish in a globally changing food system. *Agroclimatology: Linking Agriculture to Climate*, 60, 579-593.
- Malabarba, L. R., & Malabarba, M. C. (2020). Phylogeny and classification of Neotropical fish. In *Biology and Physiology of Freshwater Neotropical Fish* (pp. 1-19). Academic Press.
- Mirza, M. R. (1982). A contribution to the fishes of Lahore. Lahore: *Urdu Bazar*.
- Mirza, M. R. (1990). *Pakistan ki Taaza Pani k Machlian*. Urdu Science Board, 31-35. *Journal of Science and Technology*, 23, 71-72.
- Mirza, M. R., & Sandu, A. A. (2007). *Fishes of the Punjab, Pakistan*. Polymer Publications. Lahore: *Urdu Bazar*.
- Mirza, M. R., Ali, I., & Javid, M. N. (1993). A contribution to the fishes of Kurram Agency, Pakistan. *Punjab University Journal of Zoology*, 8, 37-40.
- Mohanty, B. P., Mahanty, A., Ganguly, S., Mitra, T., Karunakaran, D., & Anandan, R. (2019). Nutritional composition of food fishes and their importance in providing food and nutritional security. *Food Chemistry*, 293, 561-570.

- Naz, S., Fazio, F., Habib, S. S., Nawaz, G., Attaullah, S., Ullah, M., ... & Ahmed, I. (2022). Incidence of heavy metals in the application of fertilizers to crops (wheat and rice), a fish (Common carp) pond and a human health risk assessment. *Sustainability*, 14(20), 13441.
- N'Zi, K. G., Yao, S. S., Bi, G. G., & Ndouba, V. (2015). Update of ichthyofauna diversity and ecological status of a coastal River Nero (Côte d'Ivoire–West Africa). *Saudi Journal of Biological Sciences*, 22(3), 265-273.
- Rahman, G., Rahman, A. U., Anwar, M. M., Dawood, M., & Miandad, M. (2022). Spatio-temporal analysis of climatic variability, trend detection, and drought assessment in Khyber Pakhtunkhwa, Pakistan. *Arabian Journal of Geosciences*, 15(1), 81.
- Reis, R. E., Albert, J., Di Dario, F., Mincarone, M., Petry, P., & Rocha, L. (2016). Fish biodiversity and conservation in South America. *Journal of Fish Biology*, 89(1), 12-47.
- Talwar, P. K., & Jhingran, A. G. (1991). *Inland fishes of India and adjacent countries* (Vol. 2). CRC Press.
- Tedesco, P. A., Beauchard, O., Bigorne, R., Blanchet, S., Buisson, L., Conti, L., & Hugueny, B. (2017). A global database on freshwater fish species occurrence in drainage basins. *Scientific Data*, 4(1), 1-6.
- Ullah, M., Yousafzai, A. M., Muhammad, I., Ullah, S. A., Zahid, M., Khan, M. I., ... & Khan, H. (2022). Effect of cypermethrin on blood hematology and biochemical parameters in freshwater fish *Ctenopharyngodon idella* (Grass Carp). *Cellular and Molecular Biology (Noisy-le-Grand, France)*, 68(10), 15.
- Ullah, S., Hassan, Z., & Begum, M. (2014). The edible ichthyofauna of Konhaye Stream District Dir Lower, Khyber Pakhtunkhwa. *Pakhtunkhwa Journal of Life Science*, 2(3-4), 87-95.
- Wahab, A., & Yousafzai, A. M. (2017). Cyprinid fauna (Cypriniformes) of River Panjkora, District Lower Dir, Khyber Pakhtunkhwa, Pakistan. *Pure and Applied Biology*, 6(4), 1354-1365.
- Wahab, A., & Yousafzai, A. M. (2017). Quantitative attributes of family Sisoridae (Siluriformes) with a new record of *Glyptothorax kashmirensis* from River Panjkora, District Lower Dir, Khyber Pakhtunkhwa, Pakistan. *Journal of Entomology and Zoology Studies*, 5(2), 741-745.
- Whitfield, A. K., & Elliott, M. (2002). Fishes as indicators of environmental and ecological changes within estuaries: A review of progress and some suggestions for the future. *Journal of Fish Biology*, 61, 229-250.
- Yousafzai, A. M., Khan, W., & Hasan, Z. (2013). Fresh records on water quality and ichthyodiversity of River Swat at Charsadda, Khyber Pakhtunkhwa. *Pakistan Journal of Zoology*, 45(6).
- Zafar, S., Khan, A., Ullah, H., Khan, M. S., Khan, I., Hameed, A., ... & Yasmeen, G. (2017). Assessing impact of effluent discharge on irrigation water quality in southern region of Khyber Pakhtunkhwa, Pakistan. *Environmental Monitoring and Assessment*, 189, 1-14.

Table 3: Location-wise collection from River Kurram Khyber Pakhtunkhwa Pakistan

Species Name	Site1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site10	Site11	Site 12	Site 13	Site14	Total	Percentage
<i>Carassius auratus</i>	-	-	-	-	-	-	-	2	2	5	4	4	13	17	47	2.48%
<i>Cyprinus Carpio</i>	-	-	-	-	-	-	-	-	-	-	3	9	21	23	56	2.95%
<i>Barilius modestus</i>	-	-	-	-	-	-	3	3	2	7	12	17	12	21	77	4.06%
<i>Barilius vagra</i>	-	-	-	-	3	3	7	12	15	17	21	27	12	9	126	6.64%
<i>Barilius pakistanicus</i>	-	-	-	-	2	5	7	12	11	19	23	17	21	11	128	6.75%
<i>Cyprinus watsoni</i>	-	-	-	-	-	-	-	1	-	3	2	5	-	-	11	0.58%
<i>Puntius ticto</i>	-	-	-	-	-	-	7	3	4	1	6	4	-	-	25	1.31%
<i>Puntius sophore</i>	-	-	-	-	-	3	7	8	12	1	-	-	-	-	31	1.63%
<i>Schizothorax plagiostomus</i>	-	-	7	13	21	23	17	19	27	31	22	17	15	29	241	12.71%
<i>Schizothorax Labiatus</i>	-	-	-	-	-	-	-	3	1	9	2	11	5	7	38	2.00%
<i>Schistura shadwalensis</i>	-	-	-	3	2	2	-	-	2	-	-	2	-	-	11	0.58%
<i>Schistura alepidote</i>	-	-	-	-	-	-	-	2	3	5	-	3	7	5	25	1.31%

<i>Schistura prashari</i>	-	-	-	-	-	-	-	2	3	7	4		3	7	26	1.37%
<i>Tor putitora</i>	-	-	-	-	3	5	5	3	9	9	21	19	27	21	122	6.43%
<i>Cirrhinus mrigala</i>	-	-	-	-	-	-	-	3	-	-	-	3	5	3	14	0.73%
<i>Crossocheilus diplocheilus</i>	-	-	-	5	3	7	6	11	12	7	9	5	3	2	70	3.69%
<i>Garra gotyla</i>	-	-	-	4	6	12	14	16	12	21	12	17	12	13	139	7.33%
<i>Triplophysa naziri</i>	-	-	-	-	5	3	1	2	9	7	-	-	2	5	34	1.79%
<i>Triplophysa choprai</i>	-	-	-	-	2	1	3	5	3	-	2	-	-	-	16	0.84%
<i>Acanthocobitis botia</i>	-	-	-	-	3	3	-	5	3	-	2	-	-	-	16	0.84%
<i>Glyptothorax stocki</i>	-	-	-	-	3	5	7	18	16	10	5	3	7	5	79	4.16%
<i>Glyptosternon reticulatum</i>	-	-	-	-	-	3	4	6	11	8	6	8	7	3	56	2.95%
<i>Glyptothorax punjabensis</i>	-	-	-	-	-	1	5	7	3	1	-	3	2	5	27	1.42%
<i>Glyptothorax naziri</i>	-	-	-	-	-	3	3	5	7	3	5	3	7	5	41	2.16%
<i>Glyptothorax kashmirensis</i>	-	-	-	2	1	3	2	2	4	3	7	4	3	7	38	2.00%

<i>Ompak pabda</i>	-	-	-	-	-	3	7	4	2	3	7	9	-	-	35	1.84%
<i>Mystus bleekeri</i>	-	-	-	-	-	3	7	4	-	3	7	3	3	5	35	1.84%
<i>Channa gachua</i>	-	-	-	-	2	-	5	7	-	-	3	4	5	7	33	1.74%
<i>Channa punctate</i>	-	-	-	3	7	7	6	4	6	9	4	5	6	5	62	3.27%
<i>Oncorhynchus mykiss</i>	31	25	17	3	-	-	-	-	-	-	-	-	-	-	76	4.01%
<i>Salmo trutta</i>	5	9	3	5	-	-	-	-	-	-	-	-	-	-	22	1.16%
<i>Mastacembelus armatus</i>	-	-	-	2	3	5	2	7	17	11	16	7	5	9	84	4.43%
<i>Oreochromis aureus</i>	-	-	-	-	-	-	-	-	3	5	2	5	2	3	20	1.05%
<i>Oreochromis niloticus</i>	-	-	-	-	-	-	-	-	5	7	4	3	5	3	27	1.42%
<i>Oriochromis mozabica</i>	-	-	-	-	-	-	-	-	1	3	2	4	3	1	14	0.3%
Total	36	34	27	40	66	100	125	175	205	215	213	221	213	231	1902	100%
Percentage	1.89%	1.78%	1.41%	2.10%	3.47%	5.25%	6.57%	9.20%	10.77%	11.30%	11.19%	11.61%	11.19%	12.14%	100%	

Site1= Kunj Alizai, Site 2= Gubad shah Site 3= Junction, Site 4= Sadda, Site 5 = Tangi, Site 6= Bagan, Site7 =Thal, Site 8 = Mesri khel,
Site 9= Junction, Site 10= near dam, Site 11= Hassan khel, Site 12= Sarai naurag, Site 13=Lakki marwat, Site 14= Junction