

# Checklist of the First Recorded Fish (Actinopterygii: Ostariphyssi) Fauna from River Panjkora near Shaheed Benazir Bhutto University, Sheringal, Khyber Pakhtunkhwa, Pakistan for Biodiversity and Conservation

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**Abstract:** Fishes (Actinopterygii: Ostariphyssi) are vertebrates (animals with backbones) having a streamlined body with gills for breathing, fins for swimming and scales for protection. The present study was conducted to prepare the checklist of the first recorded fish fauna of River Panjkora near Shaheed Benazir Bhutto University, Main Campus, Sheringal, Dir Upper (DU), Khyber Pakhtunkhwa (KP), Pakistan during June 2013 to July 2014 for determining of biodiversity for conservation purposes. The fishes were collected by different fish-nets like cast-net, hook-net, hand-net and locally adopted devices. The 3 species belong to 2 families and 2 genera were recorded from River Panjkora near SBBU. However, the specimens ( $n_t=102$ : total;  $n_i=61$ : identified;  $n_{ui}=41$ : unidentified) were the chirruh snow trout, *Shizothorax esocinus* Heckle, 1838 ( $n_{S. esocinus}=43$ ) and Khont, *Shizothorax plagiostomus* Heckle, 1838 ( $n_{S. plagiostomus}=13$ ) belong to order Cypriniformes, and family Cyprinidae. Moreover, Chukaysary, *Nangra robusta* Mirza and Awan, 1973 ( $n_{N. robusta}=5$ ) belongs to order Siluriformes, and family Sisoridae. Minimum and maximum total length was observed of *N. robusta* ( $M\pm SD$ :  $12\pm 1$  cm;  $n=5$ ) and *S. esocinus* ( $18\pm 3$  cm;  $n=43$ ), respectively. However, the average minimum and maximum fork length was observed in *N. robusta* ( $11\pm 1$  cm;  $n=5$ ) and *S. esocinus* ( $16\pm 2$  cm;  $n=43$ ), respectively. Moreover, the same standard length was *N. robusta* ( $10\pm 1$  cm;  $n=5$ ) and *S. esocinus* ( $14\pm 2.3$  cm;  $n=43$ ), respectively. Furthermore, the same diameter (dm) was *N. robusta* ( $3\pm 0.3$  cm) and *S. plagiostomus* ( $3\pm 1$  cm;  $n=13$ ), respectively. It is concluded that in River Panjkora, the fish species are rare due to overfishing and anthropogenic activities. It is required to provide knowledge about importance and conservation of fishes to the local community for their awareness and education.

**Keywords:** Cyprinidae, *Nangra* Sp, River Panjkora, *Shizothorax* Sp, Sisoridae.

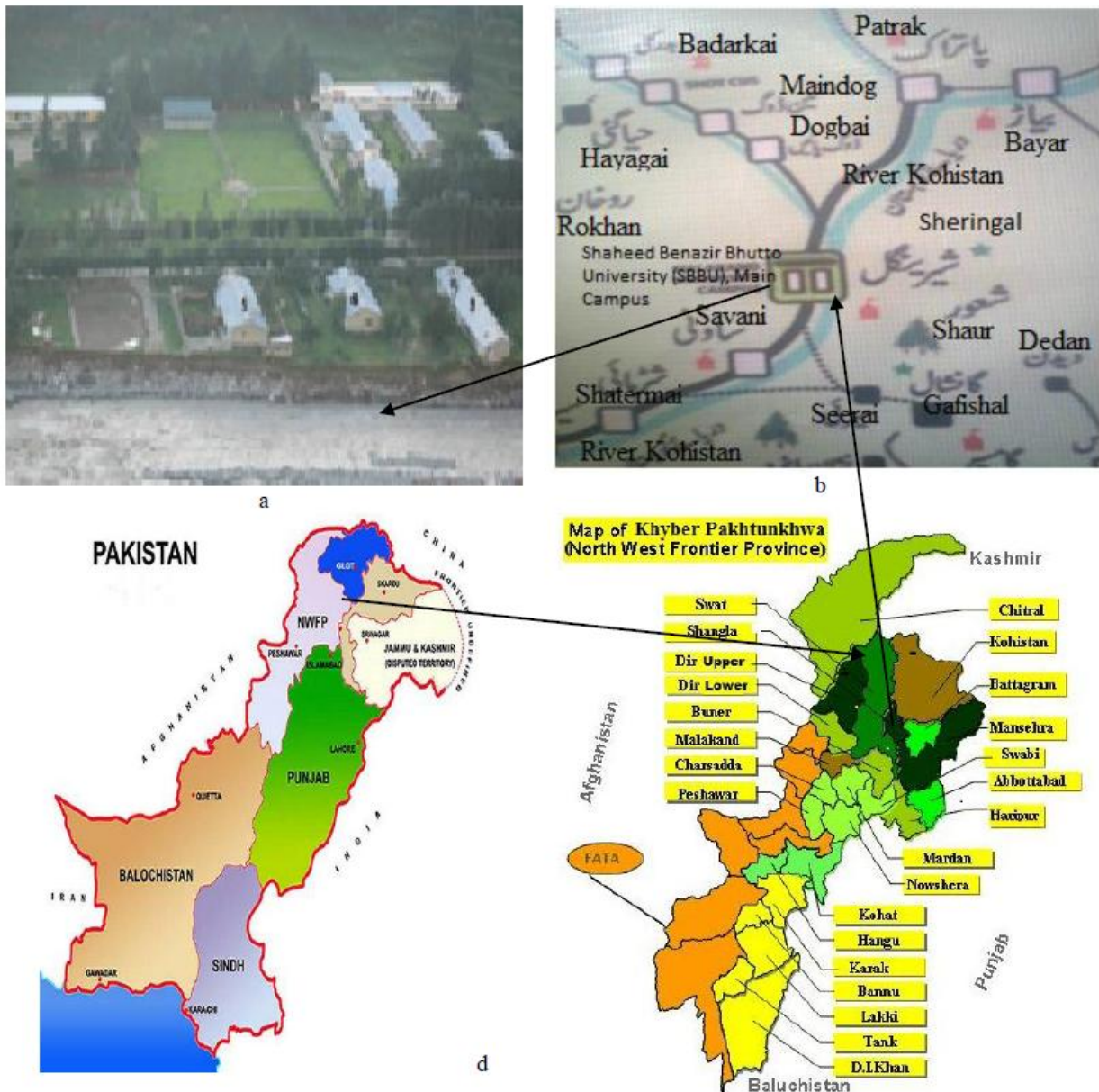
## I. INTRODUCTION

The fishes (Vertebrata: Pisces) are aquatic and cold-blooded vertebrates with fins. They are one of the prime important elements in the aquatic habitat and play a key role in economy of many nations, as they have been stable item in the diet of many people (Essetchi et al., 2003). They are diverse group of animals that live and breathe in water. All fishes are vertebrates (animals with backbone) with gills for breathing. Most fish have fins for swimming, scales for protection, and a streamlined body for moving easily in water (Premium, 2009). Their statistic in world are 28,900 (fresh and salt-waters) species are present, out of these 13,000 freshwater species (2,513 genera and 170 families) strictly freshwater species live in lakes and rivers that cover only 1%, while the remaining 16,000 species live in salt water covers a full 70% of the earth surface (Leveque et al., 2008).

Various ichthyologists classified fishes differently. Some of the classifications are very complex and divide fishes into more than 100 orders and suborders. In the most generally used system, the subphylum Vertebrata is divided into 2 super classes: Agnatha, which includes the lamprey and other fishes without jaws; and Gnathostomata, which includes fishes with hinged jaws. The latter are further divided into the class Chondrichthyes, the cartilaginous fishes such as the sharks, rays, and chimaeras, and the class Osteichthyes, the bony fishes. The bony fishes are made up of the subclass Sarcopterygii, lobe-finned fishes, and the subclass Actinopterygii, ray-finned (or spiny-finned) fishes. The recent ray fins consist of 2 groups, the Chondrostei and the Neopterygii, which includes the large division Teleostei or modern bony fishes (Bihar et al., 2012). About 179 species were found in Pakistan, however,

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they belong to 82 genera, 26 families, 10 orders, 5 super classes, and 3 cohorts (Mirza and Bhatti, 1999). There are 2 exotic and 26 indigenous cold water fish species in Pakistan, mainly restricted to the north of the country's Khyber Pakhtunkhwa (KP), and Northern Areas. The stocks of indigenous fish have been threatened by overfishing and deterioration of the environment. Exotic species like brown trout, *Salmo trutta fario* L, 1758 has established self-reproducing stocks in a number of rivers, and the rainbow trout, *Onchorhynchus mykiss* Walbaum, 1792 is cultured. Indigenous fish protection and domestication are major priorities. Raising awareness among the local population of the need to protect fishery resources and social uplift of fishers are 2 major areas for future action. Other needs are the establishment of a database management system, and encouraging regional cooperation and networking to resolve issues of common interest (Yaqoob, 2002).



Sheringal valley is located between the 72-20° east longitudes and 35-28° north latitude in Pakistan. Altitude is approximately 2000 m above the sea level. This is a small valley situated northern site of district Dir Upper (DU), KP, Pakistan. Bajaur Agency and Jandool is located toward the west, while it is surrounded by district Swat and Malakand Agency from the East and South, respectively. Total area covered by this hilly valley is 7992.67 hec. The Northern part is generally covered with forests. The river Panjkora flows towards the north south. The climate is

somewhat cold in winter and warm in summer. The minimum and maximum temperature in January has been recorded as -2.3 °C and 11.22 °C, respectively (Figure 1). The Sheringal is home to a number of wildlife species including mammals such as the snow leopard, *Panthera uncia* (Schreber, 1775); common leopard, *Panthera pardus* (L, 1758); musk deer, *Moschus anhuiensis* (L, 1758); black bear, *Ursus americanus* (Pallas, 1780); wolf, *Canis lupus* (L, 1758); yellow throated marten, *Martes flavigula* (Pinel, 1792); red fox, *Vulpes vulpes* (L, 1758); pika, *Ochotona daurica* (Link, 1795); golden marmot, *Marmota caudate* (Geoffroy, 1844) and rhesus monkey, *Macaca mulatta* (Zimmermann, 1780). Himalayan monal pheasant, *Lophophorus impejanus* (Latham, 1790); Himalayan snow cock, *Tetraogallus himalayensis* (Gray, 1848) and snow partridge, *Lerwa lerwa* (Hodgson, 1837) are some of the key bird species found here. At different elevation different types of vegetation occurs in Sheringal. Blue pine, *Pinus wallichiana* (Jacks, 1839) is dominated species with scattered trees of Himalayan cedar, *Cedrus deodara* (Don, 1831) with frequent occurrence of Himalayan poplar, *Populus ciliatae* (Royle, 1888) (Hazrat et al., 2011) (Figure 1). The objective of the present research is to prepare the checklist of the first recorded fish (Actinopterygii: Ostariophysii) fauna for determining biodiversity for conservation purposes in River Panjkora near Shaheed Benazir Bhutto University, Main Campus, Sheringal, DU, KP, Pakistan, to educate the people of the community about their economic importance and to create them awareness to prevent anthropogenic activities, which disturb them and their habitats.

## **II. MATERIALS AND METHODS**

### **2.1. Habitat**

The people of Sheringal, Dir Upper (DU), Khyber Pakhtunkhwa (KP), Pakistan usually concern with agriculture. Total area covered by this hilly valley is 7992.7 acres. The population is about 20,000 and literacy rate is 51%. River Panjkora flows, meanderingly, through this lush green valley. Its average depth is about 3 feet, while width is 15-25 feet. It is northern in KP and north-western in Pakistan. It rises high in the Hindu Kush and flows south through DU and Lower Dir (LD) districts and joins the Swat river near Chakdara, Malakand, KP. The present research was conducted during June 2013-August 2014 in study area, River Panjkora located in Sheringal, DU, KP, Pakistan (Figure 1) (Hazrat et al., 2011).

### **2.2. Sampling of Fishes**

Fishes were collected (n=61) from different sites (south-east, north-east and north-west) of River Panjkora at Sheringal near Shaheed Benazir Bhutto University (SBBU), Main Campus. The collection was made for 3 months daily basis during October-December 2013. During collection, different types of instruments were used like hand net, cast net, hooks, and other locally adopted methods were also used. The collected fish were brought into the laboratory, Department of Zoology (DOZ), SBBU, Sheringal, DU, KP, Pakistan faint by mortin® (CIC Enterpriser, Lahore, Pakistan) in a bottle. Collected fishes were identified with the help of keys, literature available (Mirza and Sandhu, 2007; Jayaram, 1999), experts, pictures, already identified specimens and internet.

### **2.3. Measurement**

The morphometric measurements of total length, standard length, fork length, and diameter of fishes were calculated with the help of scales.

### **2.4. Statistics**

Computer Program Microsoft Excel (CPMSE) and Statistical Package for Social Sciences (SPSS) version 16 were used for analyzing of data. These specimens (n<sub>i</sub>=61) were preserved in 10% formalin solution and were deposited in the Laboratory cum Museum (LCM), DOZ, SBBU.

## **III. RESULTS**

During the present research, the checklist of the first recorded fish (Actinopterygii: Ostariophysii) fauna was prepared for determining of biodiversity for conservation purposes in River Panjkora near SBBU, Main Campus, Sheringal, DU, KP, Pakistan (Table 1). For this purpose, fish samples were collected (n<sub>i</sub>=102: total) from both side of river, however, identified specimens (n<sub>i</sub>=61) were belonging to 2 families, moreover, some of the specimens remained to identified (n<sub>ui</sub>=41). The collected specimens were chirruh snow trout, *Shizothorax esocinus* Heckle, 1838 (n<sub>s. esocinus</sub> =43); Khont, *Shizothorax plagiostomus* Heckle, 1838 (n<sub>s. plagiostomus</sub> =13) and Chukaysary, *Nangra robusta* Mirza and Awan, 1973 (n<sub>N. robusta</sub> =5) (Table 1).

**Table1.** Checklist of biodiversity of the first recorded fish (Actinopterygii: Ostariphysi) fauna collected from River Panjkora near Shaheed Benazir Bhutto University, Main Campus, Sheringal, Dir Upper, Khyber Pakhtunkhwa, Pakistan during June 2013-August 2014

Phylum	:	Chordata
Sub-Phylum	:	Vertebrata
Super-Class	:	Actinopterygii
Class	:	Pisces
Sub-Class	:	Neopterigii
Super-Order	:	Ostariphysi
Order	:	Cypriniformes
Family	:	Cyprinidae
Reported species 1: Snow trout, <i>Shizothorax esocinus</i> Heckle, 1838		
Reported species 2: Khont, <i>Shizothorax plagiostomus</i> Heckle, 1838		
Order	:	Siluriformes
Family	:	Sisoridae
Reported species 3: Chukaysary, <i>Nangra robusta</i> Mirza and Awan, 1973		

During the present research, the biodiversity of the first recorded 3 fish ( $n_i=61$ ) have been studied in River Panjkora near SBBU, Main Campus, Sheringal, DU, PK. Moreover, their status and biotype in descending order is: *Shizothorax esocinus* (frequent; found at surface of River Panjkora) > *Shizothorax plagiostomus* (common; found at middle of River Panjkora) > *Nangra robusta* (rare; found at deep of River Panjkora) (Table 2).

**Table2.** The biotype and status of the first recorded fishes fauna from River Panjkora near Shaheed Benazir Bhutto University, Main Campus, Sheringal, Dir Upper, Khyber Pakhtunkhwa, Pakistan during June 2013-August 2014

SNo	Family	local name	Common name	Scientific name	n*	Authority, year	Bio-type*	Status*
1	Cyprinidae	Asli mahay	Chirruh snow trout	<i>Shizothorax Esocinus</i>	43	Heckle, 1838	S	F
2	Cyprinidae	Mahay	khont	<i>Shizothorax plagiostomus</i>	13	Heckle, 1838	M	C
3	Sisoridae	Chukaysary	synonyms	<i>Nangra robusta</i>	5	Mirza and Awan, 1973	D	R

\*F: Frequent; C: Common; R: Rare; n: number of specimen; total number of specimens identified ( $n_i=61$ ); Biotype: S: found at surface; M: found at middle; D: found deep in River Panjkora

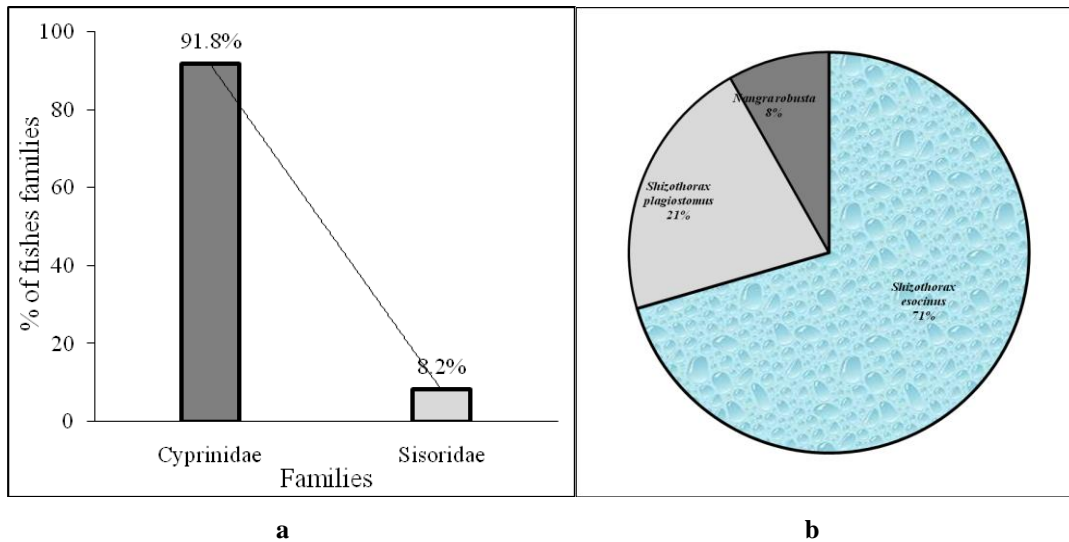
The species collected from river Panjkora have total length: *Shizothorax esocinus* ( $18\pm 3$ ) > *Shizothorax plagiostomus* ( $17\pm 4$ ) > *Nangra robusta* ( $12\pm 1$ ); however, fork length: *Shizothorax esocinus* ( $16\pm 2$ ) > *Shizothorax plagiostomus* ( $15\pm 2$ ) > *Nangra robusta* ( $11\pm 1$ ); moreover, standard length: *Shizothorax esocinus* ( $14\pm 2.3$ ) > *Shizothorax plagiostomus* ( $12.4\pm 1.4$ ) > *Nangra robusta* ( $10\pm 1$ ); furthermore, diameter: *Shizothorax plagiostomus* ( $3\pm 1$ ) > *Shizothorax esocinus* ( $3.4\pm 0.5$ ) > *Nangra robusta* ( $3\pm 0.3$ ) (Table 3).

**Table3.** Morphometric measurements of the first recorded fish species from River Panjkora near Shaheed Benazir Bhutto University, Main Campus, Sheringal, Dir Upper, Khyber Pakhtunkhwa, Pakistan during June 2013-August 2014

S No	Name			n*	Length M $\pm$ SD* (cm)			
	Common	Scientific	Family		Total	Fork	Standard	Diameter
1	Chirruh snow trout	<i>Schizothorax esocinus</i>	Cyprinidae	43	18 $\pm$ 3	16 $\pm$ 2	14 $\pm$ 2.3	3.4 $\pm$ 0.5
2	Chukaysary	<i>Nangra rhobusta</i>	Sisoridae	5	12 $\pm$ 1	11 $\pm$ 1	10 $\pm$ 1	3 $\pm$ 0.3
3	Khont	<i>Schizothorax plagiostomus</i>	Cyprinidae	13	17 $\pm$ 4	15 $\pm$ 2	12.4 $\pm$ 1.4	3 $\pm$ 1

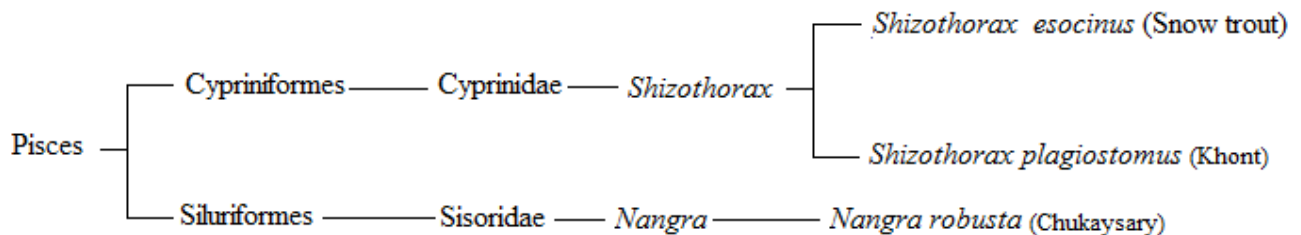
\*M: mean; SD: standard deviation; n: number of specimen collected; data were analyzed by MS Excel at  $p < 0.01$ ; means within a column are not significantly different

Further, their families' wise frequency distribution (FD) in descending order is as follows: Cyprinidae: 91.8% > Sisoridae: 8.2%. Furthermore, the same for species' wise is as following: *Shizothorax esocinus*: 70.50% > *Shizothorax plagiostomus*: 21.30% > *Nangra robusta*: 8.20% (Figure 2 a and b).



**Fig2.** Frequency distribution (FD) of the first recorded fish (Actinopterygii: Ostariphyssi) fauna of River Panjkora near Shaheed Benazir Bhutto University, Main Campus, Sheringal, Dir Upper, Khyber Pakhtunkhwa, Pakistan during June 2013-August 2014; family wise FD: a; species wise FD: b; %: percentage; trend line: polygonal; sample size of identified specimen:  $n_i=61$

The cluster analysis of the first recorded fish species of River Panjkora shows class Pisces (super class: Actinopterygii; super order: Ostariphyssi) with their orders: Cypriniformes and Siluriformes and families: Cyprinidae and Sisoridae. Therefore, family Cyprinidae comprised larger number of fishes (91.8%) and Sisoridae comprised smaller number of fish (8.2%) (Figure 3).



**Fig3.** The cluster of class Pisces (Actinopterygii: Ostariphyssi) with orders, families, genus and species (the first recorded) collected from of River Panjkora near Shaheed Benazir Bhutto University (SBBU), Sheringal, Dir Upper (DU), Khyber Pakhtunkhwa (KP), Pakistan during June 2013-August 2014; sample size of identified specimens: ( $n_i=61$ )

#### IV. DISCUSSIONS

In the present research, collection and identification of the fishes of river Panjkora near SBBU, Sheringal, DU, KP, Pakistan was conducted during June 2013-August 2014. For this task fishes samples ( $n_i=61$ ) were collected from both side of river. However, 3 species under 2 genera, 2 families and 2 orders were recorded. The checklist of fish (Actinopterygii: Ostariphyssi) fauna from River Panjkora, Sheringal, DU, KP, Pakistan was prepared for determining of biodiversity for conservation purposes. Bhat et al. (2005) carried a study on the biology of fishes of river Lidder (Jammu and Kashmir) during 2003-2005. Seven species of fishes were collected from the river, out of which, 3 was

commercially important species, i.e., *S. plagiostomus* (n=133), *S. esocinus* (n=70) and *S. labiatus* (n=40). In the present Ichthyofauna study, the observed commercially important species collected belong to family Cyprinidae, i.e., *S. plagiostomus* (n=13), *S. esocinus* (n=43), which shows somewhat similarity in both of the results. Similarity in the results may be either due to environmental factor and the same habitat, i.e., fresh water.

Bhat et al. (2012) worked on 3 morphometric measurements, i.e., maximum standard length, fork length and total length of 3 species of family Cyprinidae, i.e., *S. plagiostomus* (18±2; 20±5 and 22±2 cm), *S. esocinus* (17±3; 19±2 and 21.3 cm) and *S. labiatus* (16±2 ; 18±3 and 20±4 cm). Their morphometric parameters of 3 species were statically different. In the present study, the morphometric measurements included were as total length: *S. esocinus* (18±3 cm) > *S. plagiostomus* (17±4 cm) > *N. rhobusta* (12±1 cm); however, fork length: *S. esocinus* (16±2 cm) > *S. plagiostomus* (15±2 cm) > *N. rhobusta* (11±1 cm); moreover, standard length: *S. esocinus* (14±2.3 cm) > *S. plagiostomus* (12.4±1.4 cm) > *N. rhobusta* (10±1 cm). It shows same type of variation in morphometric measurements. The similarity in the results may be either due to the same environmental condition like temperature and same method used for measurement.

Muhammad et al. (2014) reported a total of 11 fish species belonging to 4 orders and 4 families were recorded from river Panjkora at DU. The richest family represented by 7 species were Cyprinidae (*S. esocinus*, *Racoma labieta*, *S. plagiostomus*, *Crossocheilus diplocheilus*, *Gara gotyla*, *Barilius pakistanicus* and *Carassius auratus*) followed by Sisoridae (*Gagata cenia* and *Glyptothorax punjabensis*). The family Channidae and Salmonidae were comprised of one species each, *Channa punctata* and *Onchoryncus mykiss*, respectively. In the present Ichthyofauna study, the richest family was Cyprinidae represented by 2 species (*S. esocinus* and *S. plagiostomus*) followed by family Sisoridae represented by only 1 species (*N. robusta*). Less number of species was observed in the current study, which may be due to limited area and short timing for collection.

Hasan et al. (2013) worked on river Swat and reported fish (n=50) species consisting of 16 edible fish species including *C. auratus*, *C. gachua*, *C. punctatus*, *C. diplocheilus*, *Clupisoma garua*, *C. naziri*, *Cyprinus carpio*, *Eutropiichthys vacha*, *L. diplostomus*, *Mastacembuls armatus*, *Mystus bleekeri*, *O. mykiss*, *R. labiata*, *Salmotrutta fario*, *S. plagiostomus* and *Tor macrolepis* after their survey from 2004-2010. In the present study, the total numbers of species collected were 3. All of them were edible, i.e., *S. esocinus* and *S. plagiostomus* and *N. rhobusta* and no non-edible fish were found. It shows that the numbers of edible fish diversity are less as compared to non-edible in Hasan et al. research. The difference in the results may be either due to variation in the environment or natural disaster such as flood (which was occurred in 2010 at river Panjkora Sheringal, DU and a lot of numbers of fishes were lost during that time).

The present study announcing the discovery of a population of *N. robusta* at River Panjkora, Sheringal, Pakistan. However, it is known that the type locality of this species is the Jinnah Barrage near Kalabagh, and that both the Jinnah Barrage and Sheringal lie within the Indus drainage (email correspondence to Prof Dr Rohan Pethiyagoda, Australian Museum, Sydney, Australia). Moreover, before the present study, it was not collecting from this river. Accordingly, it is unsurprising that this species occurs at Sheringal, on the other hand, it is surprising why *N. robusta* was not collected before. At any event, the discovery of this species at Sheringal is sufficient significance as to warrant the presence of it in River Panjkora, Sheringal, DU, Pakistan.

#### 4.1. Conservation Measures

The limitations encountered during the research were the climatic conditions of the study area, shortage of time for the collection, unawareness of the people about importance of fish and initially inexperience of proper catching practices by authors. Additionally, in both side of River Panjkora, fishers and other people who like fishing, often they did fishing by generating strong electric shocks by generators to collect the great number of fishes and they use dynamites. Therefore, no proper conservation of the Panjkora River, no proper methods of collection and overfishing, on the other hand, people of Sheringal are mostly illiterate; consequently, they poured every type of garbage in the river, which is not only polluted the water of river, as well as harm to fish fauna of river as well as other fauna and flora. Furthermore, such unhygienic conditions, i.e., garbage, sewage, and waste products etc were thrown into the river, which change the quality of water, may lead to decrease the numbers of such fish species. In 2010, the flood destructed the habitat of the fish species in the River Panjkora, therefore, a lot of fishes were lost or may be migrated. Moreover, which led lesser number of fish species were collected according to the expectation at the present.

From the present investigation, it was conclude that the population of fish fauna is expected to decline in River Panjkora of Pakistan due to overfishing, destruction of natural habitats and high levels of anthropogenic activities in



the same river. There are no effective protection measures for these fishes and water. However, for their protection, the Government of KP, Pakistan took the following steps: 1) The fishes, which is suspected to travel through this river during migration, has been declared “protected” and fishing, killing and capturing of such fishes have been completely banned; 2) Fishing, hunting, killing or capturing of fishes by means of fire arms or any other device has been prohibited; 3) Limited dealing in fishing trade or business is allowed; 4) Fishing is allowed only in the non-breeding seasons.

In order to protect and restore the fishes population and their habitats, the following specific suggestions for protection at the local level may be taken: 1) The rules regarding fishing in this river need to be revised, they must be oriented more towards protection and their implementation may be guaranteed; 2) Techniques to improve their breeding should be implemented; 3) Study the factors behind poor reproduction and rates of recruitment in fishes populations with an effective reintroduction of the specific species; 4) Expand cooperation and collaboration among experts, ichthyologists, conservationists, researchers and those working in the breeding range of fish populations; 5) Take eco-tourism measures and extend public education programs involving the farmers, fishermen and local community; 6) Habitats may be protected from agro-industrial chemical pollutions; 7) Fee proposes Rs 1000 and 500/ fisher man for the spring and fall fishing, respectively, may be implemented; 8) Fee proposes for possessing a license is Rs 500 for River panjkora; 9) It may be discouraged possession of fishes domestic aquariums; 10) To discourage fishing by the young people, therefore, fishing license may be issued only to persons over 18 years of age.

## **V. CONCLUSION**

The present research is the new report from the river Panjkora, Sheringal especially with respect to fisheries biology. Only 3 species, i.e., *S. plagiostomus*, *S. esocinus* and *N. rhobusta* were reported belong to families Cyprinidae and Sisoridae, respectively, therefore, there very low biodiversity was observed. It was concluded that the population of fishes is expected to decline in River Panjkora of Pakistan due to overfishing, destruction of natural habitats and high levels of anthropogenic activities.

## **Recommendations**

During the present research, fish fauna of the Sheringal has been identified. Furthermore, following study is recommended for the same:

- Further study on the fish fauna may be recommended to explore as many as collection increased.
- Ecology and biology of the fish of the present and adjacent areas may be recommended.
- Study on the external body of fish may be necessary to identified.
- Feeding habit and food preference of the fish fauna may be recommended.
- Population dynamics of the fish fauna of the study area may be needed.
- Further study on fish fauna may be recommended with respect to specific place and time.
- A detail study is required for further exploration of fish fauna of River Panjkora, Sheringal, KP, Pakistan with special reference to the taxonomy, physiology and ecology.

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## **REFERENCES**

- [1] Bhat, F. A., Balkhi, M. H. and Yousuf, A. R. (2012) Fish diversity in the Kashmir Himalaya. In: Biodiversity, development and Poverty elevation; International day for biological biodiversity. Department of Botany University of Kashmir 24-27.
- [2] Bhat, F. A., Mehdi, D., Yousuf, A. R., Siraj, S. and Qadri, B. (2005) Ecology of Fish in Wanghat nallah (tributary of Sind stream) with a note on the impact of Wanghat Barrage on the spatial distribution of fish. Journal of Research Development 6:117-128.

- [3] Bihar, S., Kumar, P. and Wanganeo, A. (2012) Biodiversity of fish. *Journal of Chemical, Biological and Physical Sciences* 2(2): 1107-1114.
- [4] Essetchi, B. L., Hocutt, C. H. and Wiley, E. O. (2003) *Zoogeography of North American fresh water fish*. New York, America 67(2): 56-66.
- [5] Hasan, Z., Ahmad, I., Yousuf, M., Rehman, L. and Khan, J. (2013) Fish Biodiversity of River Swat. *Pakistan Journal of Zoology* 45(1): 283-289.
- [6] Hazrat, A., Shah, J. and Nisar, M. (2011) Medicinal plants of Sheringal Valley, Dir Upper, KPK, Pakistan. *FUUAST Journal of Biology* 1(2): 131.
- [7] Jaram, K. C. (1999) *Freshwater fishes of Indian region*. Narendra Publishing house, Delhi, India 1-41.
- [8] Leveque, C., Oberdorff, T., Paugy, D., Stiassy, M. L. J. and Tedesco, P. A. (2008) Global diversity of fish in freshwater. *Hydrobiology* 595: 545-567.
- [9] Mirza, M. R. and Bhatti, M. N. (1999) Biodiversity of the freshwater fishes of Pakistan and Azad Kashmir. (36-44). In: *Aquatic Biodiversity of Pakistan*. Illmi Kotab Khana, Lahore, Pakistan 1-522.
- [10] Mirza, M. R. and Sandhu, A. A. (2007) *Fishes of Punjab, Pakistan*. Polymer Publications, Rahat, Market, Urdu Bazaar, Lahore 1-47.
- [11] Muhammad, I., Hasan, Z., Ullah, S., Ullah, W. and Ullah, H. (2014) A preliminary survey of fish fauna of river Panjkora at District Upper Dir, Khyber Pakhtunkhwa Pakistan. *Journal of Biodiversity and Environmental Sciences* 5(1): 362-368.
- [12] Online maps, (2013) [www.google earth.com](http://www.google.com); (Accessed: 7/7/2013).
- [13] Premium Microsoft Encarta (2009) Characteristics of fish. 1-40.
- [14] Yaqoob, M. (2002) the cold water fisheries of Pakistan. *Aquaculture Fisheries Research*
- [15] Institute, National Agriculture Research Centre, Park Road, Islamabad, Pakistan 1(3):1-5