



Short Communication

Diversity and Distribution of Genera *Schizothorax* and *Schizothorichthyes* in River Swat, Pakistan

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ABSTRACT

Morphometric characters and meristic counts of genera *Schizothorax* and *Schizothorichthyes* have been studied from River Swat, Pakistan. Monthly collection of both Genuses was conducted and identified on morphometric and meristic counts and fin formula. The minimum and maximum range, mean, standard error, percentage of various parameters in total length and head length were estimated. The meristic characters showed very limited or no variation in all four species. A total of 28 specimens, including 6 species belonging to genera *Schizothorax* and *Schizothorichthyes* were investigated. The species found in river Swat were *Schizothorax plagiostomus*, *Schizothorichthyes esocinus*, *Schizothorichthyes labiatus*, *Schizothorax richardsonii*, *Schizothorax sinuatus* and *Schizothorichthyes macrophthalmus*. Among these species, *Schizothorax richardsonii* is considered as vulnerable and is a valuable game fish species according to IUCN 2017 and needs urgent protection and proactive conservation efforts to save from becoming extinct in most of its range. The most abundant species of river swat was *Schizothorax plagiostomus* while the least abundant species was *Schizothorichthyes macrophthalmus*. However, all of the species of genera *Schizothorax* and *Schizothorichthyes* facing drastic decline in their distribution range and within River Swat due to introduction of exotic salmonids and overfishing.

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Authors' Contributions

MRK conducted the research work. BAR wrote the manuscript. MSA proof read the article. BAR and MSA analyzed the data.

Key words

Schizothorax, *Schizothorichthyes*, Meristic counts, Morphometric measurements, River Swat.

River Swat is an important habitat for many species of birds and major hub for fresh water fishing industry of the region. It inhabits almost 39 fresh water fish species (Mirza, 2007). Among these, subfamily Schizothoracinae (snow trout) are a group of endemic fishes and sub-family *Schizothorax* are a group of game fish living in river swat. Protecting the water ecosystem may result in preventing habitat and biodiversity loss (Mragules and Pressy, 2000) and ultimately support the fresh water industry in Pakistan. Pakistan has approximately 180 freshwater fish species, containing representatives of essential groups like loaches, carps and catfish. Out of these, 28 species are recorded to be present in cold water streams of Pakistan (Mirza and Bhatti, 1999).

Morphological features of fish are associated with size of the body and habitat (Rajput *et al.*, 2013). These features are comparable with temperature of water, flow of water, depth, diversity of substrate, conductivity and location within the fresh water ecosystem (Mir *et al.*, 2013). Intraspecific variation in the population of snow trout (*Schizothorax richardsonii*) is also due to variety of

habitats with the River Swat. The present study describes the morphometry, diversity and distribution of genus *Schizothorax* and *Schizothorichthyes* in River Swat.

Materials and methods

River Swat arises from glacial fed waters of Hindukush Mountains throughout the year, flowing across the Kalam Valley through a ravine with a high speed flow to Madyan, lower plain regions of Swat Valley and Chakdarafor about 160 km. At the far south of valley, at the second time this river flows in a ravine joining River Panjkora at Qalangi and at last near Charsadda it flows down to the River Kabul (Akhtar *et al.*, 2014).

The study area was divided into twelve different sites (Madyan (Daamanai), Qandeel, Chikrai, Kala-Kot, Bagh-Derai, Drsuh-Khela, Khwaza-Khela, Sher-Palam, NengwalaI, Manglor, Fizagat and Hayatabad (Bypass Road) (Supplementary Fig. S1). Fish were collected by fishing rods, cast nets and hand nets. The pore/hole size of the cast net was managed to capture normal length fishes and to avoid any fry and fingerling catchments. Sample were first washed in flowing water, dried and then kept on a plain platform with hard card/paper as a background and preserved in 10% formalin (Cadrin and Friedland, 1999).

The following measurements were taken from each

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specimen along with a snap shot depicting most of the morphological character for verifying and retaking of the measurements wherever required: lateral line scales; total length; fork length; standard length; pre-dorsal length; post-dorsal length; dorsal length; body depth; peduncle depth; peduncle length; pectoral fin rays; dorsal fin rays; pelvic fin rays; anal fin rays; caudal fin rays; head length; snout length; eye diameter; barble length; mouth position.

Table I.- Morphometric measurements (Mean±SEM, cm) and meristic counts (Mean±SEM) of genus *Schizothorax* recorded from River Swat.

	<i>S. plagiostomus</i>	<i>S. richardsonii</i>	<i>S. sinuautus</i>
Morphometric measurements (cm)			
Total length	19.02 ± 0.93	25.02 ± 4.16	20.70 ± 4.51
Fork length	17.67 ± 0.87	22.77 ± 3.74	19.67 ± 4.52
Standard length	15.85 ± 0.74	19.85 ± 3.25	17.55 ± 4.02
Pre-dorsal length	8.26 ± 0.41	10.37 ± 1.54	9.52 ± 1.89
Post-dorsal length	5.88 ± 0.32	7.87 ± 1.21	6.30 ± 1.42
Dorsal length	5.78 ± 0.39	7.20 ± 1.31	7.50 ± 1.29
Body depth	4.03 ± 0.23	4.95 ± 1.08	4.55 ± 1.16
Peduncle depth	1.98 ± 0.15	2.32 ± 0.43	2.25 ± 0.59
Peduncle length	3.01 ± 0.23	3.45 ± 0.68	3.25 ± 0.88
Snout length	0.91 ± 0.09	0.97 ± 0.15	1.57 ± 0.49
Head length	3.75 ± 0.18	4.75 ± 0.45	4.20 ± 0.72
Eye diameter	0.45 ± 0.05	2.02 ± 1.39	0.45 ± 0.06
Barble length	0.25 ± 0.01	1.27 ± 0.57	0.35 ± 0.06
Meristic counts (cm)			
Lateral line scales	145.77 ± 7.3	142.75 ± 10.9	136.75 ± 7.9
Pectoral fin rays	15.31 ± 0.61	18.00 ± 0.91	16.00 ± 0.00
Dorsal fin rays	9.38 ± 0.21	8.25 ± 0.48	9.00 ± 0.00
Pelvic fin rays	11.23 ± 0.39	11.50 ± 0.65	11.50 ± 0.65
Anal fin rays	7.00 ± 0.23	7.75 ± 0.85	7.00 ± 0.00
Caudal fin rays	26.08 ± 3.05	33.75 ± 2.87	29.50 ± 1.19

Results and discussion

A total number of 28 fish specimens were collected from the river swat in spring season 2015. These fish species belongs to genus *Schizothorax* (Heckel) and *Schizothoraichtys* (Misra). Six species namely *Schizothorax plagiostomus*, *Schizothoraichtyses ocinus*, *Schizothoraichtys Labiatus*, *Schizothorax richardsonii*, *Schizothorax sinuautus* and *Schizothoraichtys macrophthalmus* were identified from 12 different site of the River Swat. *Schizothorax plagiostomus* was recorded the most abundant (46.82 %) species of River Swat followed by *Schizothoraichtys esocinus* (17.85 %), *Schizothoraichtys labiatus* (14.28 %), *Schizothorax richardsonii* (10.92 %), *Schizothorax sinuautus* (7.14 %) and *Schizothoraichtys macrophthalmus* (3.57 %). *Schizothorax plagiostomus* was

the only species which was distributed throughout the River Swat. However, *Schizothorax richardsonii* is vulnerable according to IUCN red list, 2017. This is a valuable game fish and need immediate protection. Various studies have been conducted in River swat for the illustration of fish fauna. All of the studies have shown variation in number of capture and fish species (Yousafzai *et al.*, 2013; Ahmed and Mirza, 1963; Mirza, 2007; Hasan *et al.*, 2013; Saeed *et al.*, 2013).

Table II.- Morphometric measurements (Mean±SEM, cm) and meristic counts (Mean±SEM) of genus *Schizothoraichtys* recorded from River Swat.

	<i>S. esocinus</i>	<i>Racomalabiata (S. labiata)</i>	<i>S. macrophthalmus</i>
Morphometric measurements (cm)			
Total length	18.44 ± 0.75	20.70 ± 3.80	17
Fork length	17.12 ± 1.03	19.32 ± 3.59	16
Standard length	15.32 ± 0.92	17.60 ± 3.31	14.5
Pre-dorsal length	8.40 ± 0.58	9.37 ± 1.72	7.5
Post-dorsal length	6.88 ± 0.73	6.17 ± 0.98	4.5
Dorsal length	5.84 ± 0.45	6.00 ± 1.26	4
Body depth	4.04 ± 0.34	3.95 ± 0.71	3.5
Peduncle depth	1.98 ± 0.20	2.02 ± 0.35	1.6
Peduncle length	2.78 ± 0.38	3.25 ± 0.60	3.4
Snout length	0.94 ± 0.17	1.40 ± 0.55	2.7
Head length	3.84 ± 0.26	4.35 ± 0.90	1.2
Eye diameter	0.50 ± 0.08	0.45 ± 0.12	0.7
Barble length	0.24 ± 0.07	0.97 ± 0.34	0.2
Meristic counts (cm)			
Lateral line scales	139.8 ± 4.3	132.50 ± 11.62	145
Pectoral fin rays	16.40 ± 0.68	16.00 ± 0.41	14
Dorsal fin rays	9.20 ± 0.20	9.25 ± 0.25	9
Pelvic fin rays	11.20 ± 0.49	10.75 ± 0.48	10
Anal fin rays	6.80 ± 0.20	7.00 ± 0.41	6
Caudal fin rays	36.60 ± 2.87	20.00 ± 0.00	20

Morphometrics measurements and meristic counts of individual fish species are given in [Tables I](#) and [II](#). Fishes are sensitive to environmental changes and quickly adapt themselves by changing necessary morphometrics and morphological characters can show differences in response to different environmental (climate, temperature) and biological (food abundance) factors (Allendorf and Phelps, 1988). In the present study, fish belong to genus *Schizothorax* were of large size compared to fish belong to genus *Schizothoraichtys*. In general fish have shown variation in morphological traits both within and between the two genera and are reported to be captured from different locations of the River Swat. It has been proved that fish are more susceptible to environmentally induced

changes and show morphological variations in relation to different localities of capture (Wimberger, 1992; Brraich and Akhter, 2015). Variations in meristic counts are also dependant on the body size and they increase with the increase in body length (Koshy *et al.*, 2008). In the present study, meristic counts of genus *Schizothorax* are more compare to genus *Schizothoraichtys* and confirm that meristic counts are directly related to body size. The lateral line scales count is highly correlated to the fish locality and climatic variations (Brraich and Akhter, 2015). The results of the present study are in confirmation to the study that highly abundant fish (*Schizothorax plagiostomus*) have more lateral scales (145-152) compared to other fish of this genus and genus *Schizothoraichtys*. The fish having more lateral scales have better adaptability in changing localities within the river (Watanabe, 1998). Generally this variety in morphology results from isolation of a population fragments within regional habitat conditions. An adequate level of isolation might develop in observable phenotypic and genetic variations within species of fish populations, as a root for separation and management of different populations (Turan, 2004). Such variations could arise because of various means such as; reproductive isolation within various populations of fishes might be driven by evolving to various breeding zones (Hourston, 1982) or through hydrographic characteristics that diminish or impede migration within territories (Iles and Sinclair, 1982). Failing to distinguish or to deal with complex populations in control groups has resulted into the spawning components erosion, leading to the diminishing or fading of genetic diversity, and other unexplored environmental conclusions (Begg *et al.*, 1999).

River Swat has suffered from severe human intervention in the last few decades resulting in habitat loss, degradation and ultimately affecting aquatic fauna. During the present study, it was observed that illegal fishing techniques; electric currents and use of explosive materials have resulted in the decrease of many important fish species. *Schizothorax richardsonii* is game fish and vulnerable and needs immediate conservation measures. Also the River Swat inhabits endangered fish species like *Schizothorax esocinus*, *Tor macrolepis* and *Cyprinus carpio* and needs immediate conservation efforts.

Supplementary material

There is supplementary material associated with this article. Access the material online at: <https://dx.doi.org/10.17582/journal.pjz/20180904060941>

Statement of conflict of interest

The authors declare no conflict of interest.

References

- Akhtar, N., Khan, S. and Saeed, K., 2014. *World J. Fish Mar. Sci.*, **6**: 190-194.
- Begg, G.A., Friedland, K.D. and Pearce, J.B., 1999. *Fish. Res.*, **43**: 1-8. [https://doi.org/10.1016/S0165-7836\(99\)00062-4](https://doi.org/10.1016/S0165-7836(99)00062-4)
- Brraich, O.S. and Akhter, S., 2015. *Int. J. Fish. aquat. Stud.*, **2**: 260-265.
- Cadrin, S.X. and Friedland, K.V., 1999. *Fish. Res.*, **43**: 129-139. [https://doi.org/10.1016/S0165-7836\(99\)00070-3](https://doi.org/10.1016/S0165-7836(99)00070-3)
- Hasan, Z., Ahmad, I. Yousuf, M. and Khan, J., 2013. *Pakistan J. Zool.*, **45**: 283-289.
- Hourston, A.S., 1982. *Canadian J. Fish. aquat. Sci.*, **39**: 1414-1422. <https://doi.org/10.1139/f82-190>
- Iles, T.D. and Sinclair, M., 1982. *Science*, **215**: 627-633. <https://doi.org/10.1126/science.215.4533.627>
- Keith, P., 2000. *Biol. Conserv.*, **92**: 265-273. [https://doi.org/10.1016/S0006-3207\(99\)00041-5](https://doi.org/10.1016/S0006-3207(99)00041-5)
- Koshy, B.E., Selvaraj, O. and Sekaran, M., 2008. *Malaysian J. Sci.*, **27**: 69-73. <https://doi.org/10.17576/pengurusan-2008-27-04>
- Leary, R.F., Allendorf, F.W., Phelps, S.R. and Knudsen, K.L., 1988. *In: Proc. Montana Acad. Sci.*, **48**: 57-70.
- Margules, C.R. and Pressey, R.L., 2000. *Nature*, **405**: 243. <https://doi.org/10.1038/35012251>
- Mir, F.A., Mir, J.I. and Chandra, S., 2013. *Contrib. Zool.*, **82**: 115-122. <https://doi.org/10.1163/18759866-08203001>
- Mirza, M.R. and Bhatti, M.N., 1999. *Proc. Semi Aquat. Biodiver. Pak.*, pp. 136-144.
- Mirza, M.R., 2007. *Biologia*, **53**: 109-172.
- Rajput, V., Johnson, J.A. Sivakumar, K., 2013. *J. Asian Biodiver.*, **5**: 102-110. <https://doi.org/10.4038/taprov5i2.6283>
- Saeed, K., Khan, S. and Haq, F., 2013. *J. Biodiver. environ. Sci.*, **3**: 83-88.
- Turan, C., 2004. *ICES J. Mar. Sci.*, **61**: 774-781. <https://doi.org/10.1016/j.icesjms.2004.05.001>
- Vörösmarty, C.J., Mcintyre, P.B., Gessner, M.O., Dudgeon, D., Prusevich, A., Green, P., Glidden, S., Bunn, S.E., Sullivan, C.A., Liermann, C.R. and Davies, P.M., 2010. *Nature*, **467**: 555. <https://doi.org/10.1038/nature09440>
- Watanabe, K., 1998. *Ichthyol. Res.*, **45**: 259-270. <https://doi.org/10.1007/BF02673924>
- Wimberger, P.H., 1992. *Biol. J. Linn. Soc.*, **45**: 197-218. <https://doi.org/10.1111/j.1095-8312.1992.tb00640.x>
- Yousafzai, A.M., Khan, W. and Hasan, Z., 2013. *Pakistan J. Zool.*, **45**: 1727-1734.



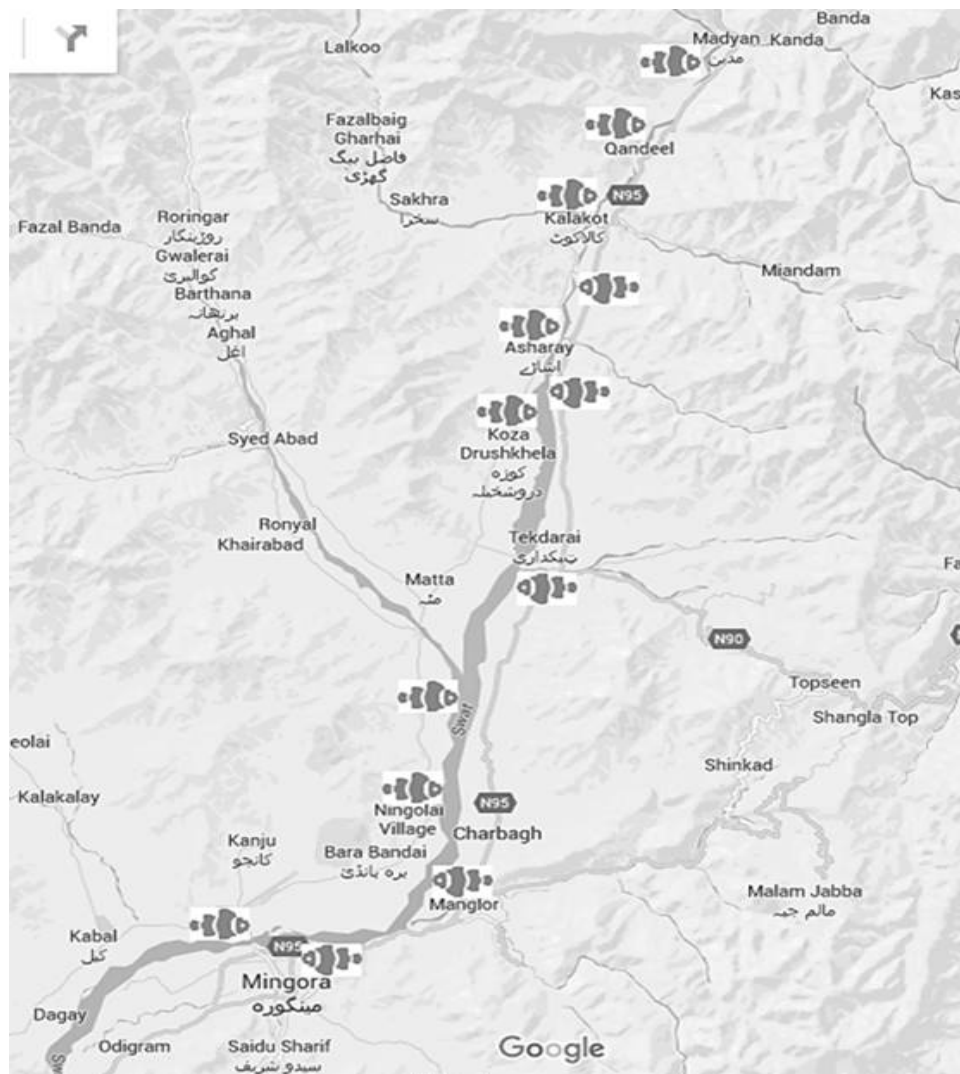
Supplementary Material

Short Communication: Diversity and Distribution of Genera *Schizothorax* and *Schizothorichthyes* in River Swat, Pakistan

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Supplementary Fig. S1. Map of study area showing study sites marked by fish sign in River Swat.

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