SCAN ME

Research Paper

INVESTIGATION OF MORPHOMETRIC CHARACTERS AND THEIR CORRELATIONS IN FISH *Channa punctatus* FROM BARABANKI, UTTAR PRADESH (INDIA)

Sakina Bano[1], Rajesh K. Srivastava[1], Chitra Singh[1], Sunil P. Trivedi[2], Shekhar Chand[3] and Arun Ratn[3*]

[1]Department of Zoology, Isabella Thoburn College, Lucknow-226007,
[2]Environmental Toxicology & Bioremediation Laboratory, Department of Zoology, University of Lucknow, Lucknow-226007,
[3]PG-Department of Zoology, Sanatan Dharm College, Muzaffarnagar-251001, India (*Corresponding Author*).

Abstract
The present study aims to measure the morphometric characters of fish, *Channa punctatus* (Bloch) from aquatic habitats of Barabanki district, Uttar Pradesh, India. The collection of fish specimens was conducted during the months of October, November and December of year 2021 for the measurement of their morphometric characters. Fifteen characters have been measured in their concerned units for each fish specimen. Conspicuously, all were genetically controlled and, till some extent, the characters were environmentally controlled. Thus, the morphometric characters illustrated mild variations in their measurements. Remarkably, the dissimilarity in standard length, head length and dorsal fin length have been observed in few fish specimens. Additionally, the positive correlations have been significantly ($p < 0.01$) detected amongst the majority of the morphometric characters of fish. Eventually, this study exemplifies that the specimens of carefully chosen fish seem to be comparatively identical as revealed by the quantification of morphometric characters, consequently deliberated as isometric progress of the tissues of fish.
Key words: *Channa punctatus*; Morphometric characters; Standard length; Head length; Dorsal fin length; Isometric progress.

INTRODUCTION
The fish species *Channa punctatus* comes under the class Actinopterygii (Ray-finned fishes), order Perciformes (Perches) and family Channidae (Snakeheads) and commonly distributed in the South East Asian countries including India, Sri Lanka, Nepal, Afghanistan, Pakistan, Bangladesh and China. Especially, in our country, this fish is

usually found in states consisting Orissa, Maharashtra, Tamil Nadu, Kerala, West Bengal, Bihar, Punjab, Andhra Pradesh, Karnataka, etc. [1]. This fish species occur in several types of habitats like ponds, swamps, brackish water and ditches and prefer stagnant waters with vegetation. In India, it is common throughout the plains and is also abundant in muddy streams. Characteristically, the body of fish *Channa punctatus* is distinctly cylindrical in cross-section, but it appears slightly flattened dorso-ventrally. The shape of mouth is semi-lunar and covered by upper and lower jaws. The jaws contain smaller teeth behind the upper jaw. Its cranium contain large scales on the top are arranged in a pattern similar to that on the head of a snake. Thus, the head of this fish looks like a snake. The head extends from the anterior end of the body up to the operculum. The body of fish is elongated and bilaterally symmetrical. The whole body is covered by scales arranged like tiles of the roof of the houses. The fish *Channa punctatus* play a key role in the aquatic food chain/web as it is preyed by large carnivorous fauna including fishes, hence upholds the ecological balance in nature. This fish species was employed for population studies. As this is a typical plain stream fish and play an imperative role to maintain the ecological balance of these streams, hence the present study on its conservation and management is very essential.

Morphometric characters are deliberated as useful implements and reliable tools for the identification of fish specimens in their stocks [2]. The identification of fishes is termed as morphological systematics [3]. The data of morphological measurements are beneficial for their taxonomic status in aquatic environment. Generally, fish show greater differences in morphological traits in between the population and within species than other vertebrates. Fish are very sensitive to environmental changes and quickly adapt themselves by changing necessary morphometries [4]. Notably, the fishes are more vulnerable to ecologically induced morphological variations. The morphometric analysis provides an important tool to make sure of genetic environmental stock identification of fish population. The differences in morphometric characters arise due to change in the environmental factors rather than genetic distinction [5, 6]. However, the changes in fish morphometries due to genetic variations result from natural selection during long period of geographical isolation.

The correlation matrix amongst the morphometric characters of individuals of fish *Channa punctatus* illustrates the morphological associations between their different

body portions. This can be used to determine the possible differences amongst separate stocks of same fish species and to assess the well-being of its specimens in natural habitats [7]. The information related to the morphometric measurements of fishes and the study of their statistical relationships is essential for taxonomic status and identification [8]. Additionally, for the behavioral study of fishes, identification shows a crucial role and a primary step towards the research exertion. The present study is intended to engender data on morphometric characters and their correlations of the fish, *Channa punctatus* (Bloch) from aquatic habitats of district Barabanki, Uttar Pradesh, India.

MATERIALS AND METHODS:

STUDY AREA

For the study of the morphometric characters, five different aquatic habitats of district Barabanki, Uttar Pradesh, India were selected to procure the specimens of fish *Channa punctatus*. Barabanki is located about 30 km east of Lucknow, the capital of Uttar Pradesh. Its geographical coordinates are 26.937834'N latitude and 81.188324'E longitude.

SAMPLE COLLECTION AND IDENTIFICATION

In the present study, 125 specimens of fish *Channa punctatus* were collected from the five different aquatic habitats of district Barabanki, Uttar Pradesh, India during the months of October, November and December of year 2021 with the help of local fishermen.

The collection was conducted by using hand nets early in the morning on speculated time intervals. Fish specimens were brought into the laboratory after their preservations in 10% formalin solution. Then, the morphometric characters were quantitatively measured accordingly to their sizes.

The scientific identification of fishes is based mainly on their external features such as mouth, body shape, length, depth and width. Subsequently, other factors including geographical range also considered for their identification. The keys were used in the identification of fishes [1, 9].

MORPHOMETRIC MEASUREMENTS

The morphometric measurements of specimens of fish *Channa punctatus* were taken in relative units like centimeter (cm) with the help of metallic divider, measuring board,

measuring tape whereas their body weight were taken in gram (gm) by using a single pan balance. The morphometric characters consist of weight (W), standard length (SL), Total length (TL), snout length (SnL), eye diameter (ED), height of dorsal fin (HDF), pre-pectoral length (PPL), anal fin height (AFH), body depth (BD), caudal length (CL), pre-pelvic length (PPvL), head length (HL), anal fin length (AFL), dorsal fin length (DFL), and caudal depth (CD).

STATISTICAL ANALYSES

All values were expressed as mean ± standard error mean (S.E.M.). They were analyzed by using SPSS software (Version 20: IBM, Armonk, NY, USA). The data values were determined by descriptive statistic at 95% confidence level for mean.

RESULTS AND DISCUSSION:

The morphometric characters of fish *Channa punctatus* from aquatic habitats of Barabanki district, India presented in **Table 1.** The morphometric parameters of *Channa punctatus* measured as mean ± S.E.M., weight (146.00 ± 9.27), standard length (13.68 ± 1.06), Total length (16.02 ± 1.22), snout length (1.64 ± 0.09), eye diameter (0.54 ± 0.02), height of dorsal fin (2.82 ± 0.42), pre-pectoral length (4.36 ± 0.20), anal fin height (2.52 ± 0.06), body depth (3.44 ± 0.12), caudal length (2.38 ± 0.18), pre-pelvic length (5.26 ± 0.17), head length (7.56 ± 0.54), anal fin length (4.32 ± 0.18), dorsal fin length (8.94 ± 0.64), and caudal depth (1.56 ± 0.12). Remarkably, fishes can rapidly acclimatize themselves by modifying their behavior and physiology and they show great sensitivity to environmental variabilities. All specimens illustrate negligible extent of environmentally induced morphological variations. In general, variations in morphological traits of fishes were almost dependent on their body size. Among vertebrates, fishes expressed higher phenotypic plasticity. Ultimately, these morphological modifications were adopted by the fishes. Similarly, Sharma *et al.* [10] have recorded the subtle variations in morphometric characters of Golden Mahseer (*Tor putitora*) for characterizing their stocks. Remarkably, Dean *et al.* [11] have been reported the differences in morphometric parameters to separate physically similar species. Also, Saini *et al.* [12] reported the morphometric differentiation of catfish *Mystus seenghala*. The variances in the morphology of individuals of many fish species were determined from different parts of Africa [13, 14].

Table 1 The range of morphometric characters (MCs) of fish *Channa punctatus* specimens were expressed from five aquatic habitats (AHs) of Barabanki district, India.

MCs	W (gm)	SL (cm)	TL (cm)	SnL (cm)	ED (cm)	HDF (cm)	PPL (cm)	AFH (cm)	BD (cm)	CL (cm)	PPvL (cm)	HL (cm)	AFL (cm)	DFL (cm)	CD (cm)
AH1	150.0 – 156.2	11.00 - 13.21	13.00 – 15.55	1.80 - 2.21	0.50 - 0.52	2.20 – 2.65	4.00 – 4.12	2.50 – 2.58	3.40 – 3.89	2.00 – 2.15	5.10 – 5.56	7.00 – 7.15	4.10 – 4.84	7.90 – 8.11	1.60 – 1.88
AH2	120.0 - 127.3	12.00 - 14.56	14.30 - 16.35	1.50 - 1.98	0.50 - 0.51	2.10 – 2.48	4.10 – 4.21	2.40 – 2.89	3.10 – 3.78	2.30 – 2.56	5.00 – 5.23	7.30 – 7.88	4.00 – 4.96	8.30 – 8.55	1.30 – 1.67
AH3	160.0 - 162.3	16.30 - 17.48	18.80 - 19.89	1.90 - 2.06	0.60 - 0.62	3.10 – 3.21	4.50 – 4.53	2.60 – 2.98	3.60 – 4.09	2.50 – 2.65	5.50 – 5.78	8.50 – 9.45	4.40 – 5.12	9.30 – 9.87	1.50 – 1.98
AH4	130.0 - 135.2	13.10 - 16.25	15.00 – 18.25	1.50 – 1.98	0.50 - 0.51	3.30 – 3.56	4.10 – 4.25	2.40 – 2.87	3.30 – 3.77	2.10 – 2.45	4.90 – 5.25	6.00 – 6.78	4.10 – 4.77	8.00 – 8.67	1.40 – 1.76
AH5	170.0 – 173.8	16.00 - 18.44	19.00 – 20.89	1.50 – 2.06	0.60 - 0.62	3.40 – 3.65	5.10 – 5.24	2.70 – 3.12	3.80 – 4.12	3.00 – 3.22	5.80 – 6.12	9.00 – 9.58	5.00 – 5.11	11.20 – 12.88	2.00 – 2.24
Mean ± S.E.M.	146.0 ± 9.27	13.68 ± 1.06	16.02 ± 1.22	1.64 ± 0.09	0.54 ± 0.02	2.82 ± 0.42	4.36 ± 0.20	2.52 ± 0.06	3.44 ± 0.12	2.38 ± 0.18	5.26 ± 0.17	7.56 ± 0.54	4.32 ± 0.18	8.94 ± 0.64	1.56 ± 0.12

(W = weight, SL = standard length, TL = Total length, SnL = snout length, ED = eye diameter, HDF = height of dorsal fin, PPL = pre-pectoral length, AFH = anal fin height, BD = body depth, CL = caudal length, PPvL = pre-pelvic length, HL = head length, AFL = anal fin length, DFL = dorsal fin length, CD = caudal depth; Values were given as mean ± S.E.M.; n = 25 specimens taken from each aquatic habitat).

Further, the correlation coefficient (r) amongst different morphometric parameters of *Channa punctatus* from Barabanki district, India, depicts in **Table 2.** The morphometric measurements of fish show the significant ($p < 0.01$) as well as the positive and negative correlations among them. The value of correlation coefficient (r) was found significant at $p < 0.01$). The correlation coefficient (r) values of following parameters were found to be very high in relation to total length. The characters like pre-pectoral length, caudal length, pre-pelvic length, eye diameter and dorsal fin length in relation to total length illustrate very high correlation coefficients. Similarly, Johal *et al.* [15] have reported that most of the characters display high degree of correlation coefficients. In fact, the values of correlation coefficients are almost comparable in agreement with the conclusions of other researchers [16, 17]. The significant correlation among morphometric parameters was described in *S. richardsonii* [18, 19]. Additionally, the established correlations can help in the association of different characters during the conducive growth of fishes. These findings were correlated with the outcomes of Soni and Ujjania [20] who determined the relationships between the morphological traits of fish specimens of rohu, mrigal (*Cirrhinus mrigala*), and catla (*Catla catla*).

Table 2 The correlation matrix was done amongst the different morphometric parameters of fish *Channa punctatus* of different aquatic habitats of district Barabanki, Uttar Pradesh, India.

	W	SL	TL	SnL	ED	HDF	PPL	AFH	BD	CL	PPvL	HL	AFL	DFL	CD
W	1.00**														
SL	0.68**	1.00**													
TL	0.70**	0.99**	1.00**												
SnL	0.42**	0.13**	0.10**	1.00**											
ED	0.84**	0.95**	0.96**	0.28**	1.00**										
HDF	0.51**	0.79**	0.76**	-0.15	0.63**	1.00**									
PPL	0.77**	0.84**	0.88**	-0.15	0.88**	0.66**	1.00**								
AFH	0.96**	0.77**	0.81**	0.26**	0.91**	0.52**	0.90**	1.00**							
BD	0.97**	0.78**	0.80**	0.25**	0.88**	0.68**	0.87**	0.97**	1.00**						
CL	0.66**	0.81**	0.87**	-0.21	0.85**	0.56**	0.98**	0.83**	0.76**	1.00**					
PPvL	0.90**	0.82**	0.87**	0.16**	0.94**	0.52**	0.95**	0.98**	0.92**	0.91**	1.00**				
HL	0.77**	0.76**	0.81**	0.22**	0.90**	0.30**	0.85**	0.90**	0.77**	0.88**	0.95**	1.00**			
AFL	0.84**	0.78**	0.83**	-0.11	0.85**	0.67**	0.98**	0.93**	0.92**	0.93**	0.94**	0.82**	1.00**		
DFL	0.76**	0.81**	0.86**	-0.16	0.87**	0.60**	1.00**	0.90**	0.85**	0.99**	0.95**	0.88**	0.98**	1.00**	
CD	0.86**	0.50**	0.55**	-0.06	0.64**	0.48**	0.84**	0.88**	0.88**	0.74**	0.84**	0.67**	0.91**	0.84**	1.00**

(**denotes the significant correlation between morphometric parameters at p < 0.01; W = weight, SL = standard length, TL = Total length, SnL = snout length, ED = eye diameter, HDF = height of dorsal fin, PPL = pre-pectoral length, AFH = anal fin height, BD = body depth, CL = caudal length, PPvL = pre-pelvic length, HL = head length, AFL = anal fin length, DFL = dorsal fin length, CD = caudal depth).

CONCLUSION:

The morphometric characters established that the test animal model fish *Channa punctatus* (Bloch) illustrate minor extent of influence of its surrounding environment. Fifteen characters have been studied. Out of them, all were almost genetically controlled, however, till minor extent, they were environmentally influenced. Thus, the morphometric characters illustrate the mild variations because of the changes in the environmental factors. Also, this study stated the relationships amongst the morphological characters and they almost significantly correlated. Further, the positive correlation coefficient indicated that the direct and proportional associations were observed among them. Additionally, It can be determined that the prevailing environmental conditions are conducive for the progressive growth of such type of fishes and their conservation in aquatic habitats.

CONFLICT OF INTEREST:

Authors declare no conflict of interest.

REFERENCES:

[1]   Talwar, P. K., and Jhingran, A. G., 1991, Inland fishes of India and adjacent countries, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India, 1 & 2, pp. 1158.

[2]   Costa, J. L., De Almeida, P. R., and Costa, M. J., 2003, A morphometric and meristic investigation of Lusitanian toadfish *Halobatrachus diductilus* (Bloch and Schneider, 1081): evidence of population fragmentation on Portuguese coast, *Sci. Mar.*, 67, pp. 219-231.

[3]   Nayman, 1965, Growth and Ecology of Fish Population, *J. Anim. Ecol.*, 20, pp. 201-219.

[4] Hossain, M. A. R., Nahiduzzaman, M., Saha, D., Khanam, M. U. H., and Alam, M. S., 2010, Landmark-based morphometric and meristic variations of the endangered carp, Kalibaus *Labeo calbasu*, from stocks of two isolated rivers, the Jamuna and Halda and a hatchery, *Zool. Stud.*, 49, pp. 556–563.

[5] Pinheiro, A., Teixeira, C. M., Rego, A. L., Marques, J. F., and Cabral, H. N., 2005, Genetic and morphological variation of *Solea lascaris* (Risso, 1810) along the Portuguese coast, *Fish. Res.*, 73, pp. 67–78.

[6]   Wimberger, P. H., 1992, Plasticity of fish body shape: the effects of diet, development, family and age in two species of *Geophagus* (Pisces: Cichlidae), *Biol. J. Linn. Soc.*, 45, pp. 197–218.

[7] King, M., 2007, Fisheries biology assessment and management. (2nd Ed.), Blackwell Scientific publications, Oxford, pp. 1-381.

[8] Narejo, N. T., 2010, Morphometric characters and their relationship in *Gudusia chapra* (Hamilton) from Keenjhar lake (Distt: Thatta), *Sindh. Pak. J. Zool.*, 42 (1), pp. 101- 104.

[9] Srivastava, G., 2016, Fishes of U.P. & Bihar, Vishwavidyalaya Prakashan, Varanasi, (ed. 2016), pp. 228, ISBN: 9789351461616.

[10]   Sharma, K. K., Mohan, V. C., and Kouser, U., 2015, Comparative accounts of merestic count and morphometric measurements of Golden mahseer (*Tor putitora*) among Chenani hydroelectric dam, Jhajjar stream and Dansar stream (J&K) India, *Indian Journal of Applied Research*, 5, pp. 772-774.

[11] Dean, G. F., Jeffrey, W. N., Thomson, N.T., and Bruce, M. D., 2002, Application of truss analysis for the quantification of changes in fish condition, *Journal of Aquatic Ecosystem Stress and Recovery*, 9, pp. 115- 125.

[12]   Saini, A., Dua, A., and Mohindra, V., 2008, Comparative morphometrics of two populations of giant river catfish (*Mystus seenghala*) from the Indus river system, *Integrative Zoology*, 3, pp. 219-226.

[13]   El-Zaeem, S. Y., Ahmed, M. M., Salama, M. E. S., and El-Kader, W. N. A., 2012, Phylogenetic differentiation of wild and cultured Nile tilapia (*Oreochromis*

niloticus) populations based on phenotype and genotype analysis, *Afr. J. Agric. Res.*, 7, pp. 2946- 2954.

[14] Ikpeme, E. V., Ekerette, E. E., Udensi, O. U., and Ozoje, M. O., 2017, Assessment of Morphological Variation in Wild and Cultured Populations of Tilapia Fish (*Oreochromis niloticus*), *J. Adv. Biol. Biotech.*, 13, pp. 1-10.

[15] Johal, M. S., Negi, R. K., and Negi, T., 2003, Age and growth of golden mahseer *Tor putitora* from Pong reservoir, Himachal Pradesh, India, *Him. J. Env. Zool.,* 17 (1), pp. 17-29.

[16] Nahar, A., Hanif, M. A., Siddik, M. A. B., Chaklader, M. R., and Islam, M. A., 2018, Length-weight and length-length relationships of four endemic fish species caught from Payra River, Southern Bangladesh, *J. Appl. Ichthy.*, 34 (3), pp. 785-787. doi:10.1111/jai.13601

[17] Siddik, M. A. B., Hanif, M. A., Chaklader, M. R., Nahar, A., and Mahmud, S., 2015, Fishery biology of gangetic whiting *Sillaginopsis panijus* (Hamilton, 1822) endemic to Ganges delta, Bangladesh, *Egypt. J. Aquat. Res.*, 41, pp. 307-331. doi:10.1016/j.ejar.2015.11.001

[18] Negi, R. K., and Negi, T., 2010, Analysis of morphometric characters of *Schizothorax richardsonii* (Gray, 1832) from the Uttarkashi district of Uttarakhand state, India, *Journal of Biological Science*, 10 (6), pp. 536-540.

[19] Pathak, N. B., Parikh, A. N., and Mankodi, P. C., 2013, Morphometric Analysis of Fish Population from two Different Ponds of Vadodara City, Gujarat, India, *Research Journal of Animal, Veterinary and Fisheries Science*, 1 (6), pp. 6-9.

[20] Soni, N., and Ujjania, N. C., 2017, Seasonal variation in food and feeding habit of Indian major carp (*Labeo rohita* Ham. 1822) in Vallabhsagar reservoir, *Gujarat. J. Appl. Nat. Sci.*, 9 (2), pp. 871–874. doi:10.31018/jans.v9i2.1289