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Morphological characters of *Botia lohachata*

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ABSTRACT

Objective: To provide complete and informative description on morphometric characters *i.e.*, relationships between length-weight (LWRs) and length-length and meristic characters of *Botia lohachata* from the Ganges River, Northwestern Bangladesh.

Methods: Samples were collected occasionally using different fishing gears from July 2015 to June 2016. For each individual, total 15 lengths were taken using digital slide calipers and body weight was measured using an electronic balance with 0.01 cm and 0.01 g accuracy, respectively. The LWRs was estimated using the formula: $W = a \times L^b$, where W was the body weight (g); L was the length (cm) and, a and b were LWRs parameter. The meristic data were counted using magnifying glass.

Results: A sum of 110 individuals of *Botia lohachata* were hardly collected. Total length was varied from 3.70–6.80 cm and body weight was ranged from 0.55 to 2.80 g. The LWRs were highly correlated ($P < 0.001$) with r^2 values greater than 0.961. The calculated overall allometric coefficient (b) indicated negative allometric growth pattern ($b < 3.00$, $P < 0.001$). In addition, all length-length relationships were highly significant ($P < 0.001$) and most of the r^2 values were greater than 0.950. The fin formula was- dorsal, D. 10–11 (2–3/8); pectoral, P_c. 8–10 (4–6/4); pelvic, P_v. 8 (2–3/5–6); anal, A_n. 6–7 (2/4–5); and caudal, C_a. 20–22 (6–8/14–16).

Conclusions: The findings of the present study will keep a crucial contribution to fisheries scientist in favor of identification of this fish, stock assessment and sustainable conservation in the Ganges River of Bangladesh and adjoining countries. Also, these results will impart valuable information for the FishBase, as well as provide an important baseline for further studies.

1. Introduction

The Reticulate loach *Botia lohachata* (Chaudhuri, 1912) (*B. lohachata*) is a freshwater fish of the family Cobitidae and distributed only in Asian countries *i.e.*, Bangladesh, India, Nepal and Pakistan[1,2]. This fish is locally known as Rani in Bangladesh, Y-loach in India, Baghe, Getu in Nepal and Reticulate loach, Pakistani loach in USA[2-5]. It mainly inhabits rivers and streams[6]. It is used as food fish in Bangladesh and also used as aquarium fish[2,7].

For identification and classifying of any fish species in laboratory or in wild habitats, morphometric and meristic characters are very helpful[8,9].

The wild populations of *B. lohachata* are waning due to indiscriminate fishing, habitat destruction, pollution and other biological changes to their territory and afterward categorized as endangered in Bangladeshi waters[10-14]. Morphometric and meristic characters of many endangered species from Bangladeshi waters are well documented, however there is no available literature on endangered species *B. lohachata*[15-17]. Details information on morphometric and meristic characters of *B. lohachata* is urgently needed for proper management and conservation in the Ganges River, Northwestern Bangladesh. As a result, this study reported the first complete and informative description on morphometric characters *i.e.*, length-weight

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relationships (LWRs), length-length relationships (LLRs) and meristic characters of *B. lohachata* using individuals with small to large body sizes from the Ganges River, Northwestern Bangladesh.

2. Materials and methods

This study was done in different parts of the Ganges River (Charghat: 24°15' N, 88°44' E; Godagari: 24°26' N, 88°19' E; Saheb Bazaar: 24°20' N, 88°34' E and Nazirgong, Pabna: 23° 50' N, 89° 31' E), Northwestern Bangladesh. Total 110 specimens of *B. lohachata* were caught using different fishing gears, including cast net, square lift net and gill net during July 2015 to June 2016. The fresh samples were instantly iced on site and after arrival in the laboratory preserved in 10% formalin for data collection. For each individual, total body weight was measured using an electronic balance with 0.01 g accuracy and different lengths (Table 1 and Figure 1) were taken to the nearest 0.01 cm using digital slide calipers. The LWRs was calculated using the equation: $W = a \times L^b$ where W was the body weight (g) and L was the length (cm). The parameters a and b were estimated by linear regression analyses based on natural logarithms: $\ln(W) = \ln(a) + b \ln(L)$. Additionally, 95% confidence intervals of a, b and the co-efficient of determination (r^2) were estimated. Extremes outliers were deleted from the regression analyses according to Froese[18]. A t-test was used to confirm whether b values obtained in the linear regressions were significantly different from the isometric value ($b = 3$)[19]. The LLRs (15 relationships) were estimated by linear regression analysis[15]. Furthermore, the number of fin rays from all the fins was also counted using magnifying glass. For statistical analysis, GraphPad Prism 6.5 Software was used. All statistical analyses were considered significant at 5% ($P < 0.05$).

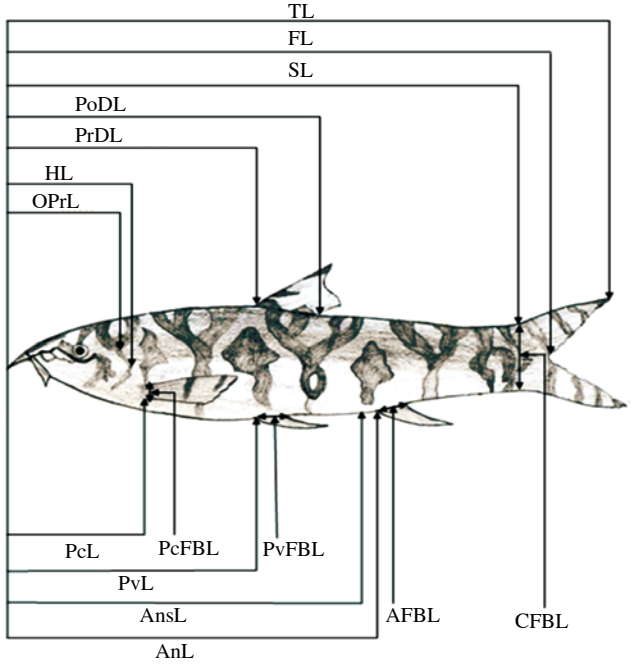

Figure 1. The morphometric measurements of *B. lohachata* from the Ganges River, Northwestern Bangladesh.

Table 1
Length (cm) and weight (g) measurements of *B. lohachata* (n = 110) from the Ganges River, Northwestern Bangladesh.

Measurement	Minimum	Maximum	Mean ± SD	95% CL	Mean TL (%)
TL	3.70	6.80	5.32 ± 0.62	5.21–5.44	
SL	2.80	5.10	4.06 ± 0.46	3.97–4.14	76.32
FL	3.30	5.90	4.70 ± 0.53	4.60–4.80	88.35
HL	0.80	1.10	0.96 ± 0.06	0.95–0.97	18.05
OPrL	0.50	0.84	0.68 ± 0.07	0.67–0.70	12.78
PrDL	1.60	2.75	2.19 ± 0.23	2.15–2.23	41.17
PoDL	1.80	3.50	2.62 ± 0.33	2.56–2.68	49.25
PcL	0.86	1.23	1.05 ± 0.07	1.04–1.06	19.74
PvL	1.60	2.70	2.17 ± 0.22	2.13–2.21	40.79
AnL	2.40	4.00	3.22 ± 0.33	3.15–3.28	60.53
AnsL	2.00	3.50	2.79 ± 0.30	2.73–2.84	52.44
BD	0.80	1.25	1.02 ± 0.09	1.00–1.03	19.17
CFBL	0.35	0.78	0.58 ± 0.09	0.56–0 .59	10.90
PcFBL	0.14	0.25	0.20 ± 0.02	0.19–0.20	3.76
PvFBL	0.12	0.21	0.16 ± 0.02	0.16–0.17	3.01
AnFBL	0.22	0.35	0.29 ± 0.03	0.28–0.29	5.45
W	0.55	2.88	1.59 ± 0.05	1.50–1.68	

CL: Confidence limit for mean values; TL: Total length; SL: Standard length; FL: Fork length; HL: Head length; OPrL: Opercular length; PrDL: Pre-dorsal length; PoDL: Post-dorsal length; PcL: Pectoral length; PvL: Pelvic length; AnL: Anal length; AnsL: Anus length; BD: Body depth; CFBL: Caudal fin base length; PcFBL: Pectoral fin base length; PvFBL: Pelvic fin base length; AnFBL: Anal fin base length; W: Body weight.

3. Results

A sum of 110 individuals of *B. lohachata* was collected from the Ganges River during the study period. Table 1 demonstrates the descriptive statistics for length and weight measurements of *B. lohachata*. Total sample (n), regression parameters and 95% confidence intervals for a and b of the LWRs, coefficients of determination (r^2) and growth type of *B. lohachata* were given in Table 2. The calculated allometric coefficient (b) indicated negative allometric growth ($b < 3.00$, $P < 0.001$). The LWRs were highly significant ($P < 0.01$), with all r^2 values exceeding 0.961. Moreover, the LLRs (15 relationships) along with the estimated parameters and the coefficient of determination (r^2) were presented in Table 3. Also, the calculated LLRs were highly significant ($P < 0.001$) with $r^2 \geqslant 0.951$. All the meristic characteristics were presented in Table 4.

Table 2
Length-weight relationships of *B. lohachata* (n = 110) with estimated parameters from the Ganges River, Northwestern Bangladesh.

Equations	Regression parameters		95% CL of a	95% CL of b	r^2	GT
	a	b				
$W = a \times TL^b$	0.0181	2.65	0.0157–0.0208	2.575–2.742	0.974	-A
$W = a \times FL^b$	0.0237	2.69	0.0204–0.0275	2.600–2.793	0.966	-A
$W = a \times SL^b$	0.0356	2.69	0.0308–0.0411	2.587–2.794	0.961	-A

a and b were LWRs parameters. r^2: Coefficient of determination; GT: Growth type; -A: Negative allometry.

Table 3

The estimated parameters of the length-length relationships ($Y = a + b \times X$) of *B. lohachata* ($n = 110$) from the Ganges River, Northwestern Bangladesh.

Equations	*a*	*b*	95% CL of *a*	95% CL of *b*	r^2
TL = *a* + *b* (SL)	–0.0582	1.327	–0.2234–0.1069	1.287–1.368	0.975
TL = *a* + *b* (FL)	–0.0873	1.151	–0.2033–0.0287	1.127–1.176	0.988
TL = *a* + *b* (HL)	–4.3440	10.082	–4.7468–3.9406	9.662–10.501	0.955
TL = *a* + *b* (OPrL)	–0.7520	8.885	–1.0052–0.4988	8.517–9.253	0.955
TL = *a* + *b* (PrDL)	–0.4505	2.636	–0.6945–0.2066	2.525–2.747	0.954
TL = *a* + *b* (PoDL)	0.5032	1.841	0.3241–0.6822	1.774–1.909	0.964
TL = *a* + *b* (PcL)	–3.4920	8.392	–3.8692–3.1148	8.034–8.751	0.952
TL = *a* + *b* (PvL)	–0.6323	2.741	–0.8602–0.4044	2.637–2.845	0.962
TL = *a* + *b* (AnL)	–0.5558	1.826	–0.7840–0.3276	1.755–1.896	0.961
TL = *a* + *b* (AnsL)	–0.2638	2.005	–0.4481–0.0792	1.939–2.071	0.971
TL = *a* + *b* (BD)	–1.4685	6.679	–1.7497–1.1872	6.404–6.955	0.955
TL = *a* + *b* (CFBL)	1.2826	7.008	1.1241–1.4410	6.737–7.280	0.960
TL = *a* + *b* (PcFBL)	–0.0410	26.909	–0.2674–0.1872	25.776–28.042	0.954
TL = *a* + *b* (PvFBL)	–0.2893	34.384	–0.5311–0.0476	32.911–35.856	0.952
TL = *a* + *b* (AnFBL)	–1.5664	24.064	–1.8666–1.2661	23.019–25.108	0.951

a: Intercept; b: Slope.

Table 4

Meristic counts of *B. lohachata* from the Ganges River, Northwestern Bangladesh.

Meristic data	Numbers	Unbranced	Branced
Dorsal fin rays	10–11	2–3	8
Pectoral fin rays	8–10	4–6	4
Pelvic fin rays	8	2–3	6–5
Anal fin rays	6–7	2	4–5
Caudal fin rays	20–22	6–8	14–16

4. Discussion

This study describes first complete information on morphometric (LWRs and LLRs) and meristic characteristics of *B. lohachata* from the Ganges River, Northwestern Bangladesh. Here, it was unable to sample *B. lohachata* (< 3.70 cm TL), which may be due to the absence of smaller fishes (< 3.70 cm TL) in the populations or selectivity of fishing nets. Similar causes for the absence of smaller another fishes were observed in earlier studies from the same habitat[20-22]. The maximum length of *B. lohachata* found in the present study was 6.80 cm in TL which is lower than 11.00 cm in SL[23]. The information on maximum length is helpful to estimate asymptotic length and growth coefficient of fishes, which are important for fisheries management[24,25]. The regression parameter *b* of LWRs was ranged from 2.65–2.69 indicating negative allometric growth pattern in the Ganges River, Northwestern Bangladesh. However, the *b* values may vary in the same species due to the combination of various factors including habitat, level of stomach fullness, seasonal effect, gonadal maturation, gender, physiology, preservation methods and differences in the observed length ranges of the specimens collected, which were excluded in the present study[20,26]. In addition, all the LLRs were highly correlated ($P < 0.001$). This is the first study on these aspects and there was no previous study on this issue that restrains to compare with our findings.

Furthermore, the fin formula for *B. lohachata* is: dorsal, D. 10-11 (2–3/8); pectoral, P_c. 8–10 (4–6/4); pelvic, P_v. 8 (2–3/5–6); anal, A_n. 6–7 (2/4–5); caudal, C_a. 20–22 (6–8/14–16), which is accordance with the fin formula[1]. However, these meristic characteristics would be very effective for species identification in the region and comparison on populations of different geographical regions.

Conflict of interest statement

We declare that we have no conflict of interest.

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References

[1] Talwar PK, Jhingran AG. *Inland fishes of India and adjacent countries*. Vol. 1. Rotterdam: A.A. Balkema; 1991, p. 541.

[2] Froese R, Pauly D. FishBase. 2016. World Wide Web electronic publication. [Online] Available from: http://www.fishbase.org [Accessed on 20 July 2016]

[3] Rahman AKA. *Freshwater fishes of Bangladesh*. Dhaka: University of Dhaka; 1989, p. 364.

[4] Shrestha J. *Fishes, fishing implements and methods of Nepal*. Gwalior: Smt. M.D. Gupta, Lalitpur Colony, Lashkar, India; 1994, p. 150.

[5] Robins CR, Bailey RM, Bond CE, Brooker JR, Lachner EA, Lea RN, et al. World fishes important to North Americans. Exclusive of species from the continental waters of the United States and Canada. *Am Fish Soc Spec Public* 1991; **21**: 243.

[6] Gopalakrishnan A, Ponniah AG. Cultivable, ornamental, sport and food fishes endemic to peninsular India with special reference to Western Ghats. In: Ponniah AG; Gopalakrishnan A, editors. *Endemic fish diversity of Western Ghats*. Lucknow: NBFGR-NATP Publication; 2000, p. 347.

[7] Bhuiyan AL. *Fishes of Dacca*. Dacca: Asiatic Society of Pakistan; 1964, p. 148.

[8] Bagenal JB, Tesch FW. *Methods for assessment of fish production in freshwaters*. Oxford: Blackwell Scientific Publication; 1978, p. 361.

[9] Jayaram KC. *The fresh water fishes of the Indian region*. New Delhi: Narendra Publishing House; 1999, p. 551.

[10] Hossain MY, Hossen MA, Pramanik MNU, Ahmed ZF, Yahya K, Rahman MM, et al. Threatened fishes of the world: *Anabas testudineus* (Bloch, 1792) (Perciformes: Anabantidae). *Croat J Fish* 2015; **73**: 128-31.

[11] Hossain MY, Hossen MA, Pramanik MNU, Nawer F, Ahmed ZF, Yahya K, et al. Threatened fishes of the world: *Labeo calbasu* (Hamilton, 1822) (Cypriniformes: Cyprinidae). *Croat J Fish* 2015; **73**: 134-6.

[12] Hossain MY, Hossen MA, Yahya K, Islam MM, Islam MA, Ahmed KKU, et al. Threatened fishes of the world: *Ompok pabda* (Hamilton, 1822) (Siluriformes: Siludidae). *Croat J Fish* 2015; **73**: 183-5.

[13] Hossen MA, Hossain MY, Yahya K, Pramanik MNU. Threatened fishes of the world: *Labeo bata* (Hamilton, 1822) (Cypriniformes: Cyprinidae). *Croat J Fish* 2015; **73**: 89-91.

[14] International Union for Conservation of Nature Bangladesh. *Red book of threatened fishes of Bangladesh*. Grande: the World Conservation Union; 2000.

[15] Hossain MY, Ahmed ZF, Leunda PM, Jasmine S, Oscoz J, Miranda R, et al. Condition, length-weight and length-length relationships of the Asian striped catfish *Mystus vittatus* (Bloch, 1794) (Siluriformes: Bagridae) in the Mathabhanga River, Southwestern Bangladesh. *J Appl Ichthyol* 2006; **22**(4): 304-7.

[16] Hossain MY, Rahman MM, Fulanda B, Jewel MAS, Ahamed F, Ohtomi J. Length-weight and length-length relationships of five threatened fishes from the Jamuna (Brahmaputra River tributary) River, Northern Bangladesh. *J Appl Ichthyol* 2012; **28**(2): 275-7.

[17] Hossain MY, Ohtomi J, Jaman A, Jasmine S, Vadas RL Jr. Life-history traits of the Monsoon River prawn *Macrobrachium malcolmsonii* (Milne-Edwards, 1844) (Palaemonidae) in the Ganges (Padma) River, Northwestern Bangladesh. *J Freshw Ecol* 2012; **27**(1): 131-42.

[18] Froese R. Cube law, condition factor and weight-length relationships: history, meta-analysis and recommendations. *J Appl Ichthyol* 2006; **22**: 241-53.

[19] Sokal RR, Rohlf FJ. *Introduction to biostatistics*. 2nd ed. New York: Freeman Publication; 1987.

[20] Hossain MY, Jewel MAS, Nahar L, Rahman MM, Naif A, Ohtomi J. Gonadosomatic index-based size at first sexual maturity of the catfish *Eutropiichthys vacha* (Hamilton, 1822) in the Ganges River (NW Bangladesh). *J Appl Ichthyol* 2012; **28**: 601-5.

[21] Hossain MY, Sayed SRM, Rahman MM, Ali MM, Hossen MA, Elgorban AM, et al. Length-weight relationships of nine fish species from the Tetulia River, Southern Bangladesh. *J Appl Ichthyol* 2015; **31**(5): 967-9.

[22] Hossain MY, Hossen MA,Pramanik MNU, Yahya K, Bahkali AH, Elgorban AM. Length-weight relationships of *Dermogenys pusilla* Kuhl & van Hasselt, 1823 (Zenarchopteridae) and *Labeo bata* (Hamilton, 1822) (Cyprinidae) from the Ganges River (NW Bangladesh). *J Appl Ichthyol* 2016; **32**(4):744-6.

[23] Shrestha TK. *Resource ecology of the Himalayan waters*. Kathmandu: Tribhuvan University; 1990, p. 645.

[24] Hossain MY, Naser SMA, Bahkali AH, Yahya K, Hossen MA, Elgorban AM, et al. Life history traits of the flying barb *Esomus danricus* (Hamilton, 1822) (Cyprinidae) in the Ganges River, Northwestern Bangladesh. *Pak J Zool* 2016; **48**(2): 399-408.

[25] Hossain MY, Rahman MM, Bahkali AH, Yahya K, Arefin MS, Hossain MI, et al. Temporal variations of sex ratio, length-weight relationships and condition factor of *Cabdio morar* (Cyprinidae) in the Jamuna (Brahmaputra River distributary) River, Northern Bangladesh. *Pak J Zool* 2016; **48**(4): 1099-107.

[26] Tesch FW. Age and growth. In: Ricker WE. *Methods for assessment of fish production in fresh waters*. Oxford: Blackwell Scientific Publications; 1971, p. 99-130.