

Length–weight relationships of four small indigenous fish species from an inland artisanal fishery, Bangladesh

M. A. Islam¹ | M. A. B. Siddik² | M. A. Hanif² | M. R. Chaklader² | A. Nahar¹ | I. Ilham³

¹Department of Marine Fisheries and Oceanography, Patuakhali Science and Technology University, Patuakhali, Bangladesh

²Department of Fisheries Biology and Genetics, Patuakhali Science and Technology University, Patuakhali, Bangladesh

³Department of Aquatic Resources and Management, Jakarta Fisheries University, Jakarta Selatan, Indonesia

Correspondence

Muhammad Abu Bakar Siddik, Department of Fisheries Biology and Genetics, Patuakhali Science and Technology University, Patuakhali, Bangladesh.
Email: siddik@pstu.ac.bd

Summary

This study reports the length–weight relationships (LWRs) of four small indigenous species, *Trichogaster lalius* (Hamilton, 1822), *Nandus meni* (Hossain & Sarker, 2013), *Lepidocephalichthys annandalei* (Chaudhuri, 1912) and *Botia dario* (Hamilton, 1822) collected between July 2015 and August 2016 from fishermen's catches landed in an inland fish landing center, northeastern Bangladesh. In the study, a new maximum total length (TL) is given for *L. annandalei* and LWRs of three species *T. lalius*, *N. meni* and *L. annandalei* for the first time in FishBase. Estimated LWRs were $W = .014 \text{ TL}^{3.17}$, ($r^2 = .982$) for *T. lalius*, $W = .006 \text{ TL}^{3.38}$, ($r^2 = .961$) for *N. meni*, $W = .004 \text{ TL}^{3.27}$, ($r^2 = .965$) for *L. annandalei* and $W = .020 \text{ TL}^{2.87}$, ($r^2 = .978$) for *B. dario*.

1 | INTRODUCTION

Bangladesh is endowed with vast fishery resources where inland water contributes 42% of the total fish production in the country (Chaklader, Siddik, Hanif, & Nahar, 2016; FAO, 2016). There are circa 260 native freshwater fish species dwelling in the inland waters of Bangladesh, of which 143 are categorized as small indigenous species (SIS) (Rahman, 2005), preferred by all classes of people because of their taste, ample nutrition and lower prices. However, in the vast areas of inland resources, the length–weight relationships (LWRs) data for many species have not been documented in FishBase (Froese & Pauly, 2015). The understanding of LWRs is essential for the assessment of fish stocks, yield and biomass (Duan & Tan, 2016; Froese, 1998; Siddik, Chaklader, Hanif, Islam, & Fotedar, 2016). Therefore, the present study aim was to estimate the LWRs of *Trichogaster lalius*, *Nandus meni*, *Lepidocephalichthys annandalei* and *Botia dario* collected from fishermen's catches landed in the Pultakanda inland fish landing center, northeastern Bangladesh.

2 | MATERIALS AND METHODS

Specimens were collected monthly between July 2015 and August 2016 from fishermen's catches landed in Pultakanda fish Market, Kishoreganj, an inland fish landing site located in Bhairab upazila at 22°22'N; 90°20'E, northeastern Bangladesh. Fishermen usually used

lift nets (mesh size <0.5 cm) for *T. lalius*, push nets (mesh size <0.5 cm) for *N. meni* and cast nets (mesh size <0.5 cm) for *L. annandalei* and *B. dario*. All specimens were identified at the species level and the validities of all scientific names were checked in FishBase. Total length (TL) and wet body weight (W) of each individual were measured at a precision of 0.1 cm and 0.01 g, respectively.

The regression parameters of the growth model, $W = a\text{TL}^b$, were calculated from the log-transformed formula: $\ln W = \ln a + b \times \ln \text{TL}$ (King, 2007), where W is the total wet weight of fish (g), TL is the total length (cm), a is the intercept that is interrelated to the fish body structure, and b is the slope of regression coefficient which could indicate the pattern of growth. Plotting log data of the length–weight pairs were performed to eliminate extreme outliers. The 95% confidence interval (CI) was determined for the regression parameters a and b (Froese, 2006).

3 | RESULTS

Descriptive statistics and estimated parameters for LWRs including sample size (n), range of total body length (TL) and body weight (W), regression parameters (a and b) with their 95% confidence limits and coefficients of determinations (r^2) are given in Table 1. In the present study, the b value of LWRs ranged from 2.87 to 3.38 and the coefficients of determination (r^2) ranged from .961 to .982.

TABLE 1 Length–weight relationships (LWRs) and estimated parameters for four small indigenous species (SIS) of fish from an inland artisanal fishery, northeastern Bangladesh

Species	n	Total length (cm) Min–Max	Weight (g) Min–Max	Parameters				
				a	b	95% CI of a	95% CI of b	r ²
<i>Trichogaster lalius</i> (Hamilton, 1822)	434	4.80–9.50	1.98–15.54	.014	3.17	.010–.018	3.01–3.32	.982
<i>Nandus meni</i> (Hossain & Sarker, 2013)	235	7.90–13.50	5.25–34.52	.006	3.38	.003–.011	3.14–3.63	.961
<i>Lepidocephalichthys annandalei</i> (Chaudhuri, 1912)	359	4.60–7.80 ^a	0.64–3.39	.004	3.27	.003–.006	3.06–3.47	.965
<i>Botia dario</i> (Hamilton, 1822)	119	5.80–13.90	2.97–35.24	.020	2.87	.014–.027	2.73–3.02	.978

n, sample size; min, minimum; max, maximum; CL, confidence limits; r², coefficient of determination.

^aNewly recorded maximum total length.

4 | DISCUSSION

Sufficient numbers of samples for each species between juvenile and adult stages were examined to attain a better species-specific estimate, resulting in higher r² values for the regressions (Rastgoo, Fatemi, Valinassab, & Mortazavi, 2016; Siddik, Hanif, Chaklader, Nahar, & Mahmud, 2016). The regression parameter *b* of LWRs for each reported species was found within the expected normal range of 2.5 < *b* < 3.5, as compared to the Bayesian LWRs predictions approach in FishBase (Froese, 2006). For *T. lalius* (*b* = 3.17), *N. meni* (*b* = 3.38) and *L. annandalei* (*b* = 3.27), *b* > 3 indicates that these three species grow more in weight than in length; whereas for *B. Dario* (*b* = 2.87), *b* < 3 indicates that this species shared more energy to axial growth than to biomass, and helps them to escape predators and to search for food (Liu, Ye, & Li, 2016; Vicentin, dos S Costa, & Suárez, 2012). However, scientific findings revealed that the *b* value of the same species may vary by a number of factors, including seasonality, selectivity of the gear, habitat, gonadal maturity, sex, stomach fullness, diet, health and environmental conditions (Chaklader, Siddik, & Nahar, 2015; Froese, 2006; Siddik, Hanif, Chaklader, Nahar, & Fotedar, 2016).

The LWRs of these four fish species will provide valuable information for the online FishBase database as well as assist in their sustainable management and conservation in Bangladesh.

REFERENCES

- Chaklader, M. R., Siddik, M. A. B., Hanif, M. A., & Nahar, A. (2016). Size structure of finescale razorbelly minnow, *Salmostoma phulo* (Cyprinidae) inhabiting a coastal river of Bangladesh. *Iranian Journal of Fisheries Sciences*, 15(4), 1348–1361.
- Chaklader, M. R., Siddik, M. A. B., & Nahar, A. (2015). Taxonomic diversity of paradise threadfin *Polynemus paradiseus* (Linnaeus, 1758) inhabiting southern coastal rivers in Bangladesh. *Sains Malaysiana*, 44, 1241–1248.
- Duan, Y. J., & Tan, D. Q. (2016). Length–weight relationships of two fish species from Yalong River, southwestern China. *Journal of Applied Ichthyology*, 32, 1259–1260.
- FAO (2016). *Fishery and aquaculture country profiles, Bangladesh*. Country Profile Fact Sheets. Rome: FAO Fisheries and Aquaculture Department [online].
- Froese, R. (1998). Length–weight relationships for 18 less-studied fish species. *Journal of Applied Ichthyology*, 14, 117–118.
- Froese, R. (2006). Cube law, condition factor and weight–length relationship: History, meta-analysis and recommendations. *Journal of Applied Ichthyology*, 22, 241–253.
- Froese, R., & Pauly, D. Eds. (2015). *FishBase 2015: World Wide Web electronic publication*. Retrieved from <http://www.fishbase.org> (Accessed on 22 February 2015).
- King, M. (2007). *Fisheries biology, assessment, and management*, 2nd ed. Oxford: Blackwell Publishing Ltd.
- Liu, H. P., Ye, S. W., & Li, Z. J. (2016). Length–weight relationships of three schizothoracinae fish species from the Niyang River, a branch of the Yarlung Zangbo River, Tibet, China. *Journal of Applied Ichthyology*, 32, 982–985.
- Rahman, A. K. A. (2005). *Freshwater fishes of Bangladesh*, 2nd edn. Dhaka, Bangladesh: Zoological Society of Bangladesh, Department of Zoology, University of Dhaka.
- Rastgoo, A. R., Fatemi, M. R., Valinassab, T., & Mortazavi, M. S. (2016). Length–weight relationships for 10 elasmobranch species from the Oman Sea. *Journal of Applied Ichthyology*, 32, 734–736.
- Siddik, M. A. B., Chaklader, M. R., Hanif, M. A., Islam, M. A., & Fotedar, R. (2016). Length–weight relationships of four fish species from a coastal artisanal fishery, southern Bangladesh. *Journal of Applied Ichthyology*, 32, 1300–1302.
- Siddik, M. A. B., Hanif, M. A., Chaklader, M. R., Nahar, A., & Fotedar, R. (2016). A multivariate morphometric investigation to delineate stock structure of gangetic whiting, *Sillaginopsis panijus* (Teleostei: Sillaginidae). *SpringerPlus*, 5, 520.
- Siddik, M. A. B., Hanif, M. A., Chaklader, M. R., Nahar, A., & Mahmud, S. (2016). Fishery biology of gangetic whiting *Sillaginopsis panijus* (Hamilton, 1822) endemic to Ganges delta, Bangladesh. *The Egyptian Journal of Aquatic Research*, 4, 307–313.
- Vicentin, W., dos S Costa, F. E., & Suárez, Y. R. (2012). Length–weight relationships and length at first maturity for fish species in the upper Miranda River, southern Pantanal wetland, Brazil. *Journal of Applied Ichthyology*, 28, 143–145.

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