



# Length-weight relationship and relative condition factor of five indigenous fish species from Torsa River, West Bengal, India

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## Summary

Length-weight relationships (LWRs) for five indigenous fish species under five genera and two families, namely *Cyprinion semiplotum* (McClelland, 1839), *Barilius barna* (Hamilton, 1822), *Barilius barila* (Hamilton, 1822), *Gagata sexualis* Tilak, 1970 and *Pseudolaguvia shawi* (Hora, 1921) were studied from Torsa River in West Bengal, India. Sampling was done at quarterly intervals from November, 2015 to December, 2016 and a total of 701 fish specimens were collected using cast nets (mesh size of 15–20 mm), gill nets (mesh size 20–35 mm) and bamboo traps. In the present study, *b* value ranges from 2.686 to 3.268. LWRs for these fish species (except *P. shawi*) have not been reported in FishBase. A new maximum length has been recorded for *P. shawi* and *G. sexualis*. The relative condition factor (*Kn*) values was found to range from 1.004 to 1.028.

## 1 | INTRODUCTION

Estimating length-weight relationship (LWR) is considered to be a regular research work of fisheries scientists (Froese, 2006) and has a wide range of application in the field of fish population dynamics. It helps to describe some of the basic biological characteristics and provide information on growth status of fishes (Tesch, 1968). The mathematical relationship between length and weight of fishes (LWR) besides a host of other parameters is one of the practical index suitable for understanding their survival, growth, maturity, reproduction, and general well-being (Le Cren, 1951). The study on the relative condition factor (*Kn*) can be used to compare the plumpness of fish and helps to compare the weight of fish against a standard calculated weight to determine if the fishes are in better or poorer condition than the standard. The present study was aimed at evaluating the LWRs and *Kn* of five indigenous fish species namely *Cyprinion semiplotum* (McClelland, 1839), *Barilius barna* (Hamilton, 1822), *Barilius barila* (Hamilton, 1822) belonging to the family Cyprinidae; *Gagata sexualis* (Tilak, 1970) and *Pseudolaguvia shawi* (Hora, 1921) belonging to the family Sisoridae from river Torsa in West Bengal. All the studied fish species are of least concern as per IUCN except for *C. semiplotum* which is categorized as Vulnerable. LWR of these fish species (except *P. shawi*) has

not been reported in FishBase ver. 02/2017 (Froese & Pauly, 2017) previously.

## 2 | MATERIALS AND METHODS

Torsa River has its origin in Chumbi Valley, Tibet, China, where it is known as Machu. Then it flows through Bhutan as the Amo Chu. Afterwards flowing into Alipurduar district and then into Cooch Behar district in the northern part of West Bengal, India. The river meets Kaljani River at Toofanganj, Cooch Behar and flows into Bangladesh where it finally meets the mighty Brahmaputra. Altogether 701 specimens were collected from the river stretch of Torsa at Hasimara (N 26°42'41.5" and E 89°19'57.5") in Alipurduar district and Haripur (N 26°21'5.36" and E 89°22'1.29") in Cooch Behar district of West Bengal, India from November 2015 to December, 2016. Fish specimens were caught using three types of fishing gear viz., cast nets (mesh size of 15–20 mm), gill nets (mesh size 20–35 mm), and bamboo traps. Freshly caught fish specimens were preserved in ice and brought to the laboratory. Fish specimens were identified to species level using standard manuals (Jayaram, 1999; Talwar & Jhingran, 1991; Vishwanath, Lakra, & Sarkar, 2007). Total length of specimens

**TABLE 1** Descriptive statistics and estimated length-weight relationship parameters for five indigenous fish species collected during November, 2015 to December, 2016 from Torsa River, West Bengal, India

Family	Fish species	n	Total length (cm)		Body weight (g)		Regression parameters			Relative condition factor (Kn)		
			Min	Max	Min	Max	a <sup>#</sup>	95% CI of a	b		95% CI of b	r <sup>2</sup>
Cyprinidae	<i>Cyprinion semiplotum</i> (McClelland, 1839)	436	3.0	15.3	0.47	40.01	0.0137	0.0120–0.0160	2.897*	2.827–2.966	.939	1.028 ± 0.013
	<i>Barilius barna</i> (Hamilton, 1822)	39	5.6	10.7	1.41	10.38	0.0064	0.0031–0.0132	3.112*	2.745–3.480	.924	1.008 ± 0.025
	<i>Barilius barila</i> (Hamilton, 1822)	52	3.9	8.2	0.60	5.53	0.0174	0.0109–0.0246	2.686*	2.465–2.908	.974	1.015 ± 0.032
Sisoridae	<i>Gagata sexualis</i> (Tilak, 1970)	133	3.9	8.8	0.56	5.70	0.0048	0.0031–0.0072	3.268*	3.049–3.487	.869	1.005 ± 0.009
	<i>Pseudolaguvia shawi</i> (Hora, 1921)	41	3.1	4.1	0.37	0.82	0.0142	0.0085–0.0235	2.906*	2.504–3.309	.928	1.004 ± 0.0207

n, sample size; Min, minimum; Max, maximum; a and b, parameters of LWR; CL, confidence limits; r<sup>2</sup>, coefficient of determination.

<sup>#</sup>Anti-log a.

\*Significant at p < .05.

was measured upto nearest millimeter and total body weight was measured using a digital monopan balance (accuracy 0.01 g).

Length-weight relationship of the selected species were determined using the cube law proposed by Le Cren (1951),  $W = aL^b$  where W = live weight (g) of the fish specimens, L = total length (cm), a = intercept and b = slope of the regression line. Prior to regression analysis length and weight data of individual specimen were log transformed using MS Excel 2010. LWR of each fish species was arrived at by using the logarithmic transformation of cube law ( $\text{Log } W = \text{Log } a + b \text{ Log } L$ ) with a view to establishing a linear relationship. Outliers were removed following Froese (2006).

Relative condition factor (Kn) of the studied fish species were determined as per Le Cren (1951),  $Kn = w/W$ , where w = observed weight (g) of fish specimens and W = estimated weight calculated from the length-weight relationship.

### 3 | RESULTS

Table 1 shows the descriptive statistics and estimated parameters of LWRs a and b, 95% confidence limits for a and b, coefficient of determination (r<sup>2</sup>) and relative condition factor (Kn) values for the five indigenous fish species from Torsa River, West Bengal. In the present study, b value ranged from 2.686 to 3.268. *G. sexualis* (8.8 cm) and *P. shawi* (4.1 cm) have new maximum length records as per Fishbase. The Kn value of the five species ranged from 1.004 to 1.028.

### 4 | DISCUSSION

Length-weight relationship of fishes are used to estimate biomass when the length-frequency distribution is known (Anderson & Gutreuter, 1983; Froese, 2006); determine possible differences between/among separate stocks of the same species (King, 2007); estimate mean weight of fish based on known length (Beyer, 1987). A number of intrinsic (e.g., gonadal development, age, sex, genetic makeup, etc.) and extrinsic factors (e.g., food availability, season, habitat characteristics, etc.) are known to affect the b value of fishes. In the present study b value for the five selected indigenous fish species were found to be consistent with the expected range of 2.5 to 3.5 (Froese, 2006) and was significant at 1% level of significance ( $p \leq .01$ ) which indicates that their present growth status is quite well. A number of studies on LWRs of indigenous fish species has been carried out in Indian water bodies (Sandhya et al., 2016; Borah et al., 2017). The length range covered in case of *B. barna* in our study is quite limited including specimens up to 71% of the known maximum recorded size. Narrow size range of fish specimens can result in less accurate LWRs (Froese, 2006). Better estimates on LWR of *B. barna* can possibly be obtained with wider size range of collected specimens. The relative condition factor can also be used to compare the general well-being, fatness or the state of development of gonad in fishes (Thomas, 1969). Study on relative condition factor (Kn) in preference to the ponderal index (K) is

recommended as the latter is generally influenced by many environmental and biological factors (Le Cren, 1951). All the studied fish species have a  $K_n$  value  $>1$  which indicates good general condition of fish (Le Cren, 1951). Multitude of factors either individually or in combination such as over-exploitation, siltation, loss of habitat, pollution, destructive fishing practices, etc. poses serious threat to ichthyofaunal resources of Torsa River. Record of LWRs for these fish species (except *P. shawi*) has not been found in FishBase ver. 02/2017. Considering the importance of the studied fish species both in terms of food value, ornamental value and biodiversity, basic information on LWRs and relative condition factor ( $K_n$ ) of these species can be of great help to fishery biologists of the region to study their population dynamics and formulate suitable management measures for sustainable management, conservation and judicious utilization of such resources.

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