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Technical contribution

Length-weight relationships of nine fish species from the Tetulia River, southern Bangladesh

By M. Y. Hossain¹, S. R. M. Sayed², M. Mosaddequr Rahman³, M. M. Ali⁴, M. A. Hossen¹, A. M. Elgorban⁵, Z. F. Ahmed⁶ and J. Ohtomi³

¹Department of Fisheries, Faculty of Agriculture, University of Rajshahi, Rajshahi, Bangladesh; ²Department of Zoology, College of Science, King Saud University, Riyadh, Saudi Arabia; ³Faculty of Fisheries, Kagoshima University, Kagoshima, Japan;

⁴Department of Aquaculture, Faculty of Fisheries, Patuakhali Science and Technology University, Patuakhali, Bangladesh;

⁵Department of Botany and Microbiology, College of Science, King Saud University, Saudi Arabia; ⁶Department of Fisheries Management, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh, Bangladesh

Summary

The present study describes the length-weight relationships (LWRs) for nine fish species from the Tetulia River, southern Bangladesh, namely *Anabas testudineus*, *Coilia dussumieri*, *Otolithoides biauritus*, *Otolithoides pama*, *Pethia conchoni*, *Polynemus paradiseus*, *Puntius lateristriga*, *Setipinna taty* and *Sillaginopsis panijus*. A total of 1380 specimens were caught using traditional fishing gear from March 2012 to February 2013. Individual total length (TL) and body weight (BW) were measured by digital slide calipers and digital balance, respectively. The LWR was calculated as $W = aL^b$, where the W is the BW in g and L the TL in cm, a and b are regression parameters. This study presents the very first references on LWRs for seven of the species. The results are valuable for the application of sustainable management and conservation of these fishes in the Tetulia River and surrounding ecosystems.

Introduction

Anabas testudineus (Bloch, 1792), *Coilia dussumieri* Valenciennes, 1848, *Otolithoides biauritus* (Cantor, 1849), *Otolithoides pama* (Hamilton, 1822), *Pethia conchoni* (Hamilton, 1822), *Polynemus paradiseus* Linnaeus, 1758, *Puntius lateristriga* (Valenciennes, 1842), *Setipinna taty* (Valenciennes, 1848) and *Sillaginopsis panijus* (Hamilton, 1822) comprise an important component of coastal riverine fisheries in Bangladesh and are target species for commercial fishers, who use a variety of traditional means of fishing with small and large fishing gear.

Length-weight relationships (LWRs) are of high importance for comparing life histories of fishes between different areas of a species distribution (Hossain et al., 2012a, 2013a; Froese and Pauly, 2015) and hence important for fisheries management (Froese et al., 2011). The establishment of length-weight relationships is considered to be basic and continuing work in fisheries research (Hossain et al., 2006a, 2009, 2014, 2015). The LWRs of fish species are essential parameters for conservation and fisheries management pro-

grams (Hossain et al., 2012b,c), as well as for the prevention in exploitation of young individuals and the consequent reduction in the spawning stock (Froese, 2006).

In the present study we report LWRs for nine fish species from the Tetulia River, southern Bangladesh, to expand the biological knowledge of these species. In addition, with the exception of *A. testudineus* and *S. taty*, there are no LWRs reported in FishBase for the remaining species (Froese and Pauly, 2015).

Materials and methods

This study was conducted in the Tetulia River, southern Bangladesh. It is also one of the largest riverine ecosystems of southern Bangladesh near the Bay of Bengal and supports diverse fisheries communities. Samples were collected on a seasonal basis from fishermen's catches landed at the Kalia fish landing centre of the Barisal region, March 2012 to February 2013. The main gear used by the commercial fishers included seine net, cast net, square lift net, conical trap and monofilament fixed gill net. The fresh samples were immediately chilled on site in ice and fixed with 10% buffered formalin upon arrival at the laboratory. Species identifications were made based on morphometric and meristic characteristics according to Froese and Pauly (2015).

Total length (TL) of each fish was measured to the nearest 0.1 cm with a slide caliper (Mitutoyo; CD-15PS; Mitutoyo Corporation, Tokyo, Japan), and the individual body weight (BW) was recorded to the nearest 0.01 g using a digital balance (Shimadzu, EB-430DW; Shimadzu Seisakusho, Tokyo, Japan). All LWRs were estimated using the allometric model as $W = aL^b$, where W is the total body weight (BW, g), L the total length (TL, cm), and a and b are the regression parameters. Parameters a and b of the LWR were estimated by linear regression analysis based on natural logarithms: $\ln(W) = \ln(a) + b \ln(L)$. Prior to regression analysis \ln - \ln plots of BW and TL were used to detect and exclude outliers (Froese, 2006).

Table 1

Descriptive statistics and estimated length-weight relationship ($W = a \cdot L^b$, W in g and L in cm) parameters for nine fish species captured in Tetulia River, southern Bangladesh

Species	n	TL (cm)			BW (g)		Regression parameters		95% CL of a	95% CL of b	r^2
		Min	Max	Max*	Min	Max	a	b			
<i>Anabas testudineus</i>	176	7.3	16.1	25.0	7.1	68.4	0.0220	2.90	0.0143–0.0339	2.72–3.07	0.981
<i>Coilia dussumieri</i>	115	13.1	21.0	[†] 20.0	9.2	29.2	0.0091	2.64	0.0038–0.0218	2.34–2.95	0.970
<i>Otolithoides biauritus</i>	168	10.6	22.1	[†] 160.0	14.2	90.1	0.0347	2.55	0.0300–0.0402	2.50–2.60	0.974
<i>Otolithoides pama</i>	135	17.4	23.5	160.0	40.3	95.6	0.0075	3.02	0.0024–0.0235	2.64–3.40	0.954
<i>Pethia conchoni</i>	175	7.0	11.1	14.0	2.9	15.1	0.0051	3.33	0.0026–0.0099	3.03–3.63	0.969
<i>Polynemus paradiseus</i>	158	9.1	17.1	23.0	4.4	30.2	0.0034	3.23	0.0015–0.0080	2.91–3.55	0.954
<i>Puntius lateristriga</i>	118	8.5	[‡] 18.6	18.0	8.9	77.5	0.0152	2.93	0.0127–0.0183	2.86–2.99	0.998
<i>Setipinna taty</i>	180	10.8	19.5	[†] 22.1	14.2	47.3	0.0276	2.51	0.0166–0.0456	2.32–2.69	0.952
<i>Sillaginopsis panijus</i>	155	17.4	34.0	44.0	27.5	248.3	0.0021	3.30	0.0011–0.0041	3.07–3.51	0.981

Species identified according to FishBase and listed in alphabetic order. No LWR references for seven of the species in FishBase except *A. testudineus* and *S. taty*.

n, sample size; TL, total length; BW, body weight; a, intercept; b, slope; CL, confidence limit; r, coefficient of determination; Min, minimum; Max, maximum.

*Maximum length in the FishBase and [†]maximum standard length (Froese and Pauly, 2015).

[‡]New maximum length record for the species (bold).

Statistical analyses were performed using GraphPad Prism 5 software (GraphPad Software, Inc., San Diego, CA). A t-test was applied to determine significant differences from the isometric value of $b = 3$ for LWR. All statistical analyses were considered significant at 5% ($P < 0.05$).

Results

A total of 1380 specimens belonging to nine fish species were collected from the Tetulia River, southern Bangladesh, during the present study. Results of the LWR analyses along with the descriptive statistics are shown in Table 1. Minimum and maximum TL were observed at 7.0 cm for *P. conchoni* (2.9 g BW) and 34.0 cm for *S. panijus* (248.3 g BW), respectively. All LWRs were highly significant ($P < 0.001$), with r^2 values greater than 0.952.

Discussion

Information is deficient on LWRs from the coastal areas of Bangladesh; nevertheless, there are several studies of freshwater species (Hossain et al., 2006a,b, 2009, 2012b, 2014). In the present study the collection of a large number of specimens from this coastal river was possible using traditional fishing gear. However, it was not possible to catch fishes smaller than 7.0 cm TL during the sampling period, which may be indicative of the selectivity of the fishing gear (Hossain et al., 2012d) rather than their absence in the fishing grounds. Hossain (2010a,b) made a similar hypothesis while studying the LWRs of some small indigenous species from the Ganges River (northwestern Bangladesh). However, this lack of smaller fishes might be overcome if specimens smaller than smallest specimens (<7.0 cm) could be collected by larval survey net and by later adjusting the length-frequency data for gear selectivity (Ahmed et al., 2012).

In the present study, b values were within the limits (2.5–3.5) reported by Froese (2006) for most fishes. Earlier studies

from Bangladesh, Thailand and the Philippines revealed negative allometric growths in *A. testudineus* (b values ranged from 2.51 to 2.84), in accordance with the findings in our study in terms of growth type, although some of these studies found much lower b values (Froese and Pauly, 2015). However, the differences in b values can be attributed to the combination of one or more factors including habitat, area, seasonal effect, degree of stomach fullness, gonad maturity, sex, health, preservation techniques and differences in the observed length ranges of the captured specimens (Gonzalez-Acosta et al., 2004; Hossain et al., 2006a,b, 2013b, 2014; Ruiz-Campos et al., 2006), all of which were not similar among those studies. On the other hand, there are no references on LWRs for the remainder of the species in the present study.

Although LWRs are easily obtained, they remain absent for many species in Bangladesh, including those species mentioned earlier. Therefore, our study provides a significant baseline study on the LWRs of nine fish species from Bangladesh. These results are useful for further studies or for other key parameters needed for fisheries management in the Tetulia River, southern Bangladesh. Additionally, this study provides basic information for the FishBase database.

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Author's address: Md. Yeamin Hossain, Department of Fisheries, Faculty of Agriculture, University of Rajshahi, Rajshahi, Bangladesh.
E-mails: yeamin.fish@ru.ac.bd; yeamin2222@yahoo.com