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Length–weight and length–length relationships of eight fish species from river Ganga, India

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Summary

Present study provides length–weight relationships (LWRs) and length–length relationships (LLRs) of eight fish species from river Ganga, India. Specimens were sampled from gill nets (mesh, 22–120 mm), cast nets (mesh, 12–14 mm), and seine nets (mesh, 12 mm) on quarterly basis from September 2016 to September 2017 within the river stretch from Buxar (25°33'43.90"N and 83°56'3.10"E) to Freserganj (21°35'40.58"N and 88°15'28.92"E). The *b* value ranged from 2.86 (*Otolithoides pama*) to 3.08 (*Polynemus paradiseus*), whereas *a* value ranged from 0.004 (*P. paradiseus*) to 0.016 (*Rita rita*). Both relationships (LWRs and LLRs) were found to be highly correlated ($p < .001$). This study provides first report on LWR for *Amblyceps mangois* and *Osteobrama cotio*, whereas new maximum length recorded for *Macrognathus pancalus*. Furthermore, the estimate of *R. rita* should be considered as tentative because of the limited size range in the study.

1 | INTRODUCTION

In fisheries biology, estimation of length–weight relationships (LWRs) and length–length relationships (LLRs) are important parameters commonly used to convert length measures into weight and vice-versa. Because, in field condition, weight measurements are less accurate and time consuming as compared to length measurements (Karna, 2017). LWR is also partly an important parameter for fish stock and population assessments (Chu, Hou, Tsong-Ueng, & Wang, 2012; Ruiz-Campos, Gonzalez-Acosta, & Cruz-Aguero, 2006). Recently, numerous attempts are made to study LWRs as well as LLRs of indigenous freshwater fish species from Indian waters (Baitha et al., 2017; Borah et al., 2017; Koushlesh et al., 2017; Nath et al., 2017; Sandhya et al., 2016). However, there is a lack of studies on LWRs for fishes of the River Ganga (largest river in India and fifth longest in the world), hence, this study contributes such estimates for eight species.

2 | MATERIALS AND METHODS

Under a systematic quarterly fisheries survey in the lower stretch of river Ganga from Buxar (25°33'43.90"N and 83°56'3.10"E),

Patna (25°36'51.66"N and 85°12'7.02"E), Bhagalpur (25°15'28.338"N and 86°58'53.890"E), Farakka (24°47'38.478"N and 87°55'26.413"E), Rejinagar (23°50'10.64"N and 88°13'55.60"E), Balagarh (23°07'44.05"N and 88°27'58.04"E), Godakhali (22°23'57.37"N and 88°08'03.47"E), Diamond Harbour (22°09'53.85"N and 88°12'19.21"E) and Freserganj (21°35'40.58"N and 88°15'28.92"E), fresh fish specimens were sampled from gill nets (mesh 22–120 mm), cast nets (12–14 mm) and seine nets (12 mm) from September 2016 to September 2017. Fishes were identified following standard literatures of Talwar and Jhingran (1991), Jayaram (1999). Total length (TL), standard length (SL) and fork length (FL) were measured to the nearest 1 mm with a digital caliper and weighed (W) to the nearest 0.01 g on an electronic balance. The parameters for the equation $W = a L^b$ (Ricker, 1973) were estimated by linear regression analysis, after a logarithmic transformation of the variables (weight and length data). Extreme outliers were removed before linear regression analysis. The statistical significance, 95% confidence intervals (CIs) of the parameters *a*, *b* and coefficient of determination (r^2) were also estimated. The LLRs between TL, FL and SL were also established using linear regression analysis of $TL = a + b \times FL$ and $TL = a + b \times SL$.

TABLE 1 Estimated parameters from length–weight relationship of fishes collected on quarterly basis from river Ganga during 2016–17 (N: sample size; TL: total length; W: body weight; *a*: intercept; *b*: slope of the linear regression; CI: confidence limits; *r*²: coefficient of determination; values in bold: new TL_{max})

Species	Family	N	TL (cm)	W (g)	<i>a</i>	95% CI of <i>a</i>	<i>b</i>	95% CI of <i>b</i>	<i>r</i> ²
<i>Rita rita</i> (Hamilton, 1822)	Bagridae	104	5.5– 64.9	2.49–3480.20	0.016	0.012–0.020	2.94	2.85–3.03	0.98
<i>Amblyceps mangois</i> (Hamilton, 1822)	Amblycipitidae	21	3.3–6.3	0.18–1.62	0.005	0.004–0.007	3.05	2.84–3.27	0.98
<i>Osteobrama cotio</i> (Hamilton, 1822)	Cyprinidae	66	2.6–10.8	0.22–13.31	0.010	0.008–0.012	3.05	2.97–3.13	0.99
<i>Cabdio morar</i> (Hamilton, 1822)	Cyprinidae	128	3.4– 13.6	0.31–22.89	0.007	0.006–0.009	3.06	2.99–3.13	0.98
<i>Salmostoma bacaila</i> (Hamilton, 1822)	Cyprinidae	130	2.0– 13.4	0.06–18.30	0.006	0.005–0.008	2.99	2.86–3.13	0.94
<i>Otolithoides pama</i> (Hamilton, 1822)	Sciaenidae	92	1.8– 36.7	0.06–568.00	0.012	0.010–0.014	2.86	2.77–2.94	0.98
<i>Polynemus paradiseus</i> Linnaeus, 1758	Polynemidae	129	3.4– 19.7	0.25–47.85	0.004	0.003–0.005	3.08	2.95–3.21	0.94
<i>Macrognathus pancalus</i> Hamilton, 1822	Mastacembelidae	66	5.0– 18.9	0.41–34.52	0.005	0.003–0.007	2.96	2.75–3.16	0.93

TABLE 2 Estimated parameters from relationship between total length (TL), standard length (SL) and fork length (FL) of fishes collected from river Ganga during 2016–17 (species in bold: new length–length relationships reports)

Species	Length type	N	TL (min–max)	SL or FL (min–max)	Equation	<i>r</i> ²
<i>Rita rita</i> (Hamilton, 1822)	TL-FL	21	7.1–20.5	6.4–16.4	TL = 1.7818 + 0.7013 FL	0.9666
	TL-SL	21	7.1–20.5	5.8–15.7	TL = 1.0958 + 0.7077 SL	0.9843
<i>Amblyceps mangois</i> (Hamilton, 1822)	TL-SL	21	3.3–6.3	2.6–4.7	TL = 0.2093 + 0.6905 SL	0.9726
	TL-FL	21	3.3–6.3	2.8–5.2	TL = 0.0608 + 0.7755 FL	0.9594
<i>Osteobrama cotio</i> (Hamilton, 1822)	TL-FL	35	6.7–10.8	6.1–9.5	TL = 0.5119 + 0.8256 FL	0.9708
	TL-SL	35	6.7–10.8	5.6–8.9	TL = 0.3535 + 0.7640 SL	0.9607
<i>Cabdio morar</i> (Hamilton, 1822)	TL-FL	78	3.4–12.2	3.2–11.5	TL = -0.0045 + 0.9015 FL	0.9909
	TL-SL	78	3.4–12.2	2.8–9.9	TL = -0.1866 + 0.8452 SL	0.9901
<i>Salmostoma bacaila</i> (Hamilton, 1822)	TL-FL	29	5.1–13.4	4.6–11.6	TL = 0.4595 + 0.8366 FL	0.9899
	TL-SL	29	5.1–13.4	4.3–10.2	TL = 0.4317 + 0.7685 SL	0.9815
<i>Otolithoides pama</i> (Hamilton, 1822)	TL-SL	36	3.2–25.0	2.2–20.0	TL = -0.0650 + 0.7942 SL	0.997
	TL-FL	95	3.4–19.7	2.8–15.3	TL = -0.5286 + 0.8137 FL	0.9837
<i>Polynemus paradiseus</i> Linnaeus, 1758	TL-SL	95	3.4–19.7	2.6–13.8	TL = -0.4933 + 0.7428 SL	0.9836
	TL-FL	95	3.4–19.7	2.6–13.8	TL = -0.4933 + 0.7428 FL	0.9836
<i>Macrognathus pancalus</i> Hamilton, 1822	TL-SL	53	5.0–15.9	4.5–14.9	TL = -0.0792 + 0.9432 SL	0.9977

3 | RESULTS

Estimated parameters of LLRs, i.e., sample size, length range, weight range, values of *a*, values of *b* and *r*² of the eight studied fishes are described in Table 1. Estimated growth coefficients (*b*) from LWR ranged from 2.86 (*O. pama*) to 3.08 (*P. paradiseus*). All regression values were highly significant (*p* < .001). The estimated equations of LLR between TL, FL and SL are described in Table 2. The LLR values were also found to be highly correlated (*p* < .001).

4 | DISCUSSION

The estimated *b* values for LWRs of all studied species were within the range 2.5–3.5 as per Carlander (1969) and Froese (1998). Furthermore, the observed confidence limits of values *a* and *b* for all species were found well within the recommended Bayesian confidence limits described in FishBase (Froese & Pauly, 2017). Here, maximum TL covered in LWR estimation for *R. rita* (64.9 cm), *Cabdio morar* (13.6 cm), *Salmostoma bacaila* (13.4 cm), *Otolithoides*

pama (36.7 cm), *Polynemus paradiseus* (19.7 cm) constitutes higher length range than the previous estimates. But, TL_{max} covered for *Macrogathus pancalus* (18.9 cm) constitutes new maximum known length as per FishBase (Froese & Pauly, 2017). Although, the species *R. rita* can reach a maximum size of 150 cm (Talwar & Jhingran, 1991), the current maximum lengths covered for LWR estimation is only 64.9 cm, which is the natural size that occurred in Ganga river system. Therefore, the estimate of *R. rita* should be considered as tentative because of the limited size range in the study. However, all the presented values can be useful for management and conservation of these eight fish species in future.

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REFERENCES

- Baitha, R., Sinha, A., Koushlesh, S. K., Chanu, T. N., Kumari, K., Gogoi, P., ... Das, B. K. (2017). Length-weight relationship of ten indigenous freshwater fish species from Gandak River, Bihar, India. *Journal of Applied Ichthyology*, 34, 233–236.
- Borah, S., Bhattacharjya, B. K., Saud, B. J., Yadav, A. K., Debnath, D., Yengkokpam, S., ... Sarma, K. K. (2017). Length-weight relationship of six indigenous fish species from Deepor beel, a Ramsar site in Assam, India. *Journal of Applied Ichthyology*, 33, 655–657.

- Carlander, K. D. (1969). *Handbook of freshwater fishery biology*, Vol. 1. Ames: The Iowa State University Press.
- Chu, W. S., Hou, Y., Tsong-Ueng, Y., & Wang, J. P. (2012). Length weight relationship of large scale mullet, *Liza macrolepis* (Smith, 1846), off the southwestern coast of Taiwan. *African Journal of Biotechnology*, 11, 1948–1952.
- Froese, R. (1998). Length-weight relationships for 18 less studied fish species. *Journal of Applied Ichthyology*, 14, 117–118. <https://doi.org/10.1111/j.1439-0426.1998.tb00626.x>
- R. Froese, & D. Pauly (Eds.). (2017). FishBase. World Wide Web electronic publication. <http://www.fishbase.org>
- Jayaram, K. C. (1999). *The freshwater fishes of Indian region*. Delhi: Narendra Publishing House.
- Karna, S. K. (2017). Length-weight and length-length relationship of *Thryssa purava* (Hamilton, 1822), *Thryssa polybranchialis* Wongratana, 1983 and *Thryssa mystax* (Bloch & Schneider, 1801) from Chilika lagoon, India. *Journal of Applied Ichthyology*, 33, 1284–1286.
- Koushlesh, S. K., Sinha, A., Kumari, K., Borah, S., Chanu, T. N., Baitha, R., ... Das, B. K. (2017). Length-weight relationship and relative condition factor of five indigenous fish species from Torsa River, West Bengal, India. *Journal of Applied Ichthyology*, 34, 169–171.
- Nath, K. D., Borah, S., Yadav, A. K., Bhattacharjya, B. K., Das, P., Deka, P. M., ... Nath, D. J. D. (2017). Length-weight and length-length relationship of four native fish species from Barak river, Assam, India. *Journal of Experimental Zoology, India*, 20, 977–979.
- Ricker, W. E. (1973). Linear regressions in fishery research. *Journal of Fisheries Research Board of Canada*, 30, 409–434. <https://doi.org/10.1139/f73-072>
- Ruiz-Campos, G., Gonzalez-Acosta, A. F., & De La Cruz-Aguero, J. (2006). Length-weight and length-length relationships for some continental fishes of northwestern Baja California, Mexico. *Journal of Applied Ichthyology*, 22, 314–315.
- Sandhya, K. M., Hassan, M. A., Kumari, S., Mishal, P., Lianthuamlaia, L., Kumar, V., ... Meena, D. K. (2016). Length-weight relationships of four indigenous freshwater fish species from Khalsi wetland in lower Ganga basin, West Bengal, India. *Journal of Applied Ichthyology*, 32, 505–506.
- Talwar, P. K., & Jhingran, A. G. (1991). *Inland fishes of India and adjacent countries (Vols 1 & 2)*. New Delhi: Oxford and IBH Publishing Co., Pvt. Ltd; p. 1158.

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