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Length–weight and length–length relationships of 16 fish species from Amapá, Brazilian Amazon

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Summary

The present study provides length-weight (LWR) and total length-standard length (LLR) relationships for 16 freshwater fish species collected in coastal rivers of the northern Brazilian, state of Amapá in 2015. Fishes were caught in heterogenic environments like ponds, stream and river channel with sieve and trawl. As result, we present novel information of LWR and LLR for 11 and 15 species, respectively. Maximum values (first values or new maximum values) of TL, SL and WT are presented for 14, 12 and 15 species, respectively.

1 | INTRODUCTION

Despite of easily obtained, LWR and LLR parameters of most fish species stay unavailable (Froese, 1998), including those from remote regions. The Amazon ichthyofauna from the coastal rivers of the state of Amapá, northern Brazil, was recently extensively inventoried and 120 freshwater fish species were reported (Melo, Benine, Britzke, Gama, & Oliveira, 2016). In order to further investigate their ecology, we provide LWR and LLR for 16 fish species from coastal rivers of Amapá.

2 | MATERIALS AND METHODS

Fishes were caught with sieve and trawl net in several heterogenic habitats, such as small streams, river channels and lagoons covering two ecoregions of northern Brazil (*sensu* Abell et al., 2008): the Guianas (lower Oyapock river) and Amazonas Estuary and Coastal Drainages (see Melo et al., 2016). Field expedition was realized during dry season of late November/early December 2015. Specimens were fixed in alcohol 96%, identified and deposited in the Laboratório de Biologia e Genética de Peixes, Universidade Estadual Paulista, Botucatu, São Paulo, Brazil (LBP). Additional voucher information is available in Melo et al. (2016).

After eight months of preservation, the weight (Wt) in grams (0.1 precision) and total and standard length (Tl/Sl) in centimeters (0.1 precision) were obtained for each specimen. LWRs were determined using the linear regression: log TW − log a + b log TL, where TW is the total weight (in grams), TL is the total length (in cm), "a" is the intercept and "b" is the slope of the linear regression (Froese, 2006; Nobile et al., 2015). For TL − SL relationships (LLRs), the determination was made using the linear regression SL = a + b TL (Marques, Nobile, Dias, & Ramos, 2016). Outliers were removed in both analyses using a log TW − log SL or log TL − log SL plot (Nobile et al., 2015). The SL and TW data were compared with those available in FishBase (Froese & Pauly, 2016; http://www.fishbase.org), and LWRs were compared with Bayesian LWR predictions (Froese, Thorson, & Reyes, 2014).

TABLE 1 Descriptive statistics and estimated parameters of the length-weight relationships (LWRs) and length-length relationships (LLRs) for freshwater fishes from the Amapá in northern Brazil. Data were collected during November/December 2015: *n* = sample size; TL = total length (cm); SL = standard length (cm); TW = total weight (g). R^2 = coefficient of correlation; *a* = intercept, *b* = slope of the regression parameters; CI (*a* or *b*) = confidence interval

		Biological parameters			log TW log *a* + *b* log TL			SL *a* + *b* TL		
Taxa	*n*	TL	SL	TW	R^2	*a* (CI *a*)	*b* (CI *b*)	R^2	*a* (CI *a*)	*b* (CI *b*)
Characiformes/Characidae										
Hemigrammus levis Durbin, 1908*†	64	**3.9–5.9**	**3.3–5.0**	**0.17–0.89**	.890	0.0062 (0.0043–0.0080)	3.110 (2.832–3.388)	.949	0.8001 (0.7419–0.8582)	1.0109 (0.9514–1.0705)
Hemigrammus ocellifer (Steindachner, 1882)*	23	**3.6–4.9**	**3.0–4.0**	**0.15–0.53**	.903	0.0114 (0.0072–0.0157)	2.728 (2.322–3.134)	.937	0.8122 (0.7142–0.9102)	0.9539 (0.8420–1.0657)
Hemigrammus schmardae (Steindachner, 1882)*†	88	**3.2–5.4**	**2.8–4.6**	**0.10–0.70**	.921	0.0109 (0.0090–0.0128)	2.820 (2.643–2.996)	.946	0.7823 (0.7383–0.8263)	1.0340 (0.9810–1.0870)
Hyphessobrycon copelandi Durbin, 1908*†	57	**2.9–5.0**	**2.6–4.2**	**0.06–0.42**	.948	0.0073 (0.0061–0.0086)	2.960 (2.772–3.147)	.975	0.8717 (9.8373–9.9061)	0.9253 (9.8851–0.9654)
Moenkhausia collettii (Steindachner, 1882)*†	81	**3.8–6.4**	**3.4–5.5**	**0.20–1.29**	.918	0.0100 (0.0078–0.0122)	2.881 (2.689–3.074)	.942	0.8330 (0.7758–0.8901)	0.9907 (0.9354–1.0460)
Poptella brevispina Reis, 1989†	37	**3.4–7.0**	2.9–5.9	**0.13–2.81**	.975	0.0053 (0.0040–0.0067)	3.462 (3.273–3.650)	.984	0.7558 (0.7041–0.8075)	1.0413 (0.9955–1.0870)
Characiformes/Curimatidae										
Curimatopsis crypticus Vari, 1982*†	43	**4.1–6.5**	**3.4–5.5**	**0.38–1.64**	.899	0.0078 (0.0050–0.0107)	2.774 (2.493–3.055)	.916	0.8690 (0.7685–0.9696)	0.9376 (0.8482–1.0270)
Characiformes/Iguanodectidae										
Bryconops caudomaculatus (Günther, 1864)†	67	4.5–10.8	**3.9–9.1**	**0.3–6.54**	.987	0.0064 (0.0054–0.0073)	3.051 (2.963–3.139)	.991	0.8391 (0.8038–0.8744)	0.9931 (0.9701–1.0160)
Bryconops melanurus (Bloch, 1794)†	47	**3.3–13.2**	**3.0–10.9**	**0.06–14.36**	.996	0.0057 (0.0051–0.0062)	3.109 (3.048–3.171)	.997	0.8485 (9.8267–9.8704)	0.9827 (9.9677–0.9978)
Characiformes/Lebiasinidae										
Copella carsevennensis (Regan, 1912)*†	22	**2.7–5.7**	**2.5–4.8**	**0.03–0.76**	.957	0.0053 (0.0039–0.0067)	3.113 (2.806–3.419)	.951	0.8517 (0.7674–0.9359)	0.9677 (0.8654–1.0699)
Nannostomus beckfordi Günther, 1872*†	71	**2.5–4.5**	2.3–4.0	**0.03–0.33**	.961	0.0088 (0.0076–0.0101)	2.842 (2.704–2.980)	.977	0.8772 (0.8424–0.9121)	0.9744 (0.9383–1.0106)
Pyrrhulina filamentosa Valenciennes, 1847†	21	3.1–5.2	**2.7–4.5**	0.05–0.74	.910	0.0036 (0.0018–0.0053)	3.604 (3.059–4.149)	.948	0.8377 (0.7324–0.9430)	0.9878 (0.8762–1.0993)
Cyprinodontiformes/Poeciliadae										
Fluviphylax palikur Costa & Le Bail, 1999*†	20	**1.1–2.4**	**0.9–1.8**	**0.01–0.05**	.937	0.0064 (0.0056–0.0072)	2.521 (2.198–2.845)	.939	1.0138 (0.7221–0.3055)	0.9071 (0.7759–1.0383)

continues

TABLE 1 (Continued)

Taxa	n	Biological parameters			log TW log *a* + *b* log TL			SL *a* + *b* TL		
		TL	SL	TW	R^2	*a* (CI *a*)	*b* (CI *b*)	R^2	*a* (CI *a*)	*b* (CI *b*)
Perciformes/Cichlidae										
Guianacara geayi (Pellegrin, 1902)†	35	**3.1–12.4**	**2.7–9.8**	**0.16–23.88**	.957	0.0134 (0.0095–0.0174)	3.075 (2.845–3.305)	.989	0.7981 (0.7550–0.8412)	0.9950 (0.9586–1.0314)
Krobia guianensis (Regan, 1905)*†	32	**3.1–12.3**	2.4–10.2	**0.25–30.69**	.977	0.0049 (0.0034–0.0065)	3.392 (3.198–3.586)	.989	0.7913 (0.7318–0.8509)	1.0033 (0.9638–1.0428)
Mesonauta guyanae Schindler, 1998*†	39	**2.2–11.2**	1.8–8.7	**0.05–15.64**	.9796	0.0221 (0.0178–0.0264)	2.822 (2.687–2.958)	.954	0.7460 (0.6637–0.8283)	0.9937 (0.9209–1.0665)

*New LWR; †New LLR; New maximum values for total length, standard length, and total weight are in bold.

3 | RESULTS

We analyzed 681 specimens included in 16 species, six families and three orders (Table 1). All the regressions were highly significant ($p < .001$), and the coefficient of determination ranged from .943 to .997. For LWR, except for *Pyrrhulina filamentosa* ($b = 3.604$) all "*b*" values felt between 2.521 and 3.462, staying inside the interval of 2.5 and 3.5, suggested by Froese (2006) as expected. For "*a*", values ranged from 0.0053 and 0.0221, felt between the interval of 0.001 and 0.05, also suggested by Froese (2006) as expected. Only *Poptella brevispina* and *Guianacara geayi* had values of "*a*" and "*b*" in discordance of Bayesian parameters. New records of LWR and LLR are presented for 11 and 15 species, respectively. Maximum values of TL, SL and WT (first values or new maximum values) are presented for 14, 12 and 15 species, respectively.

4 | DISCUSSION

Our results yielded novel information on LWR and LLR of fish from coastal rivers of Amapá, north to Amazon estuary, a species-rich and remote area demanding further biological research (Melo et al., 2016). Some ecological parameters reported here represent exclusive data for most, if not all, analyzed species. A few species had values in discordance of Bayesian paramenters, that can be caused by several factors, such as fixation process in alcohol, body shape, sample size, number of analyzed specimens, narrow length and fatness (Carlender, 1977; Bagenal & Tesch, 1978; Froese, 2006; Nobile et al., 2015). In this sense, due to the fixation process in alcohol, it's possible that some values can be distort, however, most of our results are in line of those presented in Fish Base. Even so, as recommendation, future research can be addressed to calculate the differences between fresh and alcohol-fixed specimens, in different periods of fixation, to propose a correction factor, if necessary. Concluding, data presented here will contribute to further increase basic information for these species, most of them endemic from that region in northern South America.

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CONFLICT OF INTEREST

The authors declare no conflict of interest at work.

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