TECHNICAL CONTRIBUTION

Length–weight relationship for freshwater fish species from Brazilian Cerrado

J. L. S. Nunes[1] | M. Sousa Costa[1] | M. F. Rêgo Ribeiro[1] | M. S. Costa[1] | M. Bonfim[2]

[1]Laboratório de Organismos Aquáticos, Departamento de Oceanografia e Limnologia, Universidade Federal do Maranhão, Cidade Universitária, São Luís, Maranhão, Brazil

[2]Departamento de Biologia, Universidade Federal do Maranhão, Cidade Universitária, São Luís, Brazil

Correspondence
Jorge Luiz Silva Nunes, Departamento de Oceanografia e Limnologia, Universidade Federal do Maranhão, Cidade Universitária, São Luís, Brazil
Email: silvanunes@yahoo.com

Summary

Presented are length–weight relationship (LWR) estimates for 15 native fish species captured between 2010 and 2011, in the Munim River, Brazilian Cerrado basin. Samples were collected using gillnets of four different mesh sizes (3.0, 4.0, 5.0 and 6.0 cm), hand nets and a *covo*-fish trap. Additionally provided are the first LWRs for eight species, specially the recently described species *Charax awa* Guimarães, Brito, Ferreira & Ottoni, 2018.

1 | INTRODUCTION

The length–weight relationship (LWR) of fish species is a valuable and useful parameter to infer and describe important aspects of their life cycles (Froese, 2006), and to develop management approaches (Nascimento et al., 2012), fisheries assessment (Zuluaga-Gómez, Giarrizzo, Andrade, & Arango-Rojas, 2014), and environmental monitoring programmes (Giarrizzo et al., 2015).

Reported here are the LWRs of dominant fish species captured in Munim River, part of the Brazilian Cerrado basin, northeastern Brazil. This particular area has undergone many anthropogenic impacts mainly through the establishment of fishing villages (Ribeiro, Piorski, Almeida, & Nunes, 2014), increasing deposition of sediments as the result of siltation, as well as direct contamination by pollutants from local agribusinesses. Altogether, these factors could be leading to natural landscape degradation and affecting local biota. Data we report here is foundational to inform future efforts, and could be used to deepen an understanding of how these disturbances are affecting fish populations in this area on the long term and local scale.

2 | MATERIALS AND METHODS

Sites were surveyed on a bimonthly basis between June 2010 and July 2011 in the middle stream of Munim River (03°51''34''

S/43°19'33'' W), in Maranhão state, northeastern Brazil. This basin is described as blackwater river and soft sand influenced by the Itapecuru geological formation (Cretaceous) (GEPLAN-LABGEO/UEMA, 2002). Maranhão state is highly influenced by Amazon ecosystems, resulting in typical warm and wet tropical weather, with a mean atmospheric temperature of 29°C, and annual precipitation index between 1,600–2,000 mm^3. Thus, two seasons are well defined: rainy (January–June) and dry (July–December) (SRH/MMA, 2006).

Samples were collected using gillnets of four different mesh sizes (3.0, 4.0, 5.0 and 6.0 cm), hand nets, and a *covo*-fish trap. Specimens were identified to species level based on specialized literature (Froese & Pauly, 2019; Piorski, Castro, Pereira, & Muniz, 1998; Santos, Mérona, Juras, & Jégu, 2004; Soares, 2005).

LWRs were estimated from the equation, $W = aTL^b$ (Pauly, 1984), and logarithmically transformed into $\log W = \log a + b \log L$, where W is total body weight (g), TL is total length (cm), a is a constant (or the intercept) and b is an allometric coefficient (or slope of linear regression) (Giarrizzo et al., 2015; Nascimento et al., 2012). We used Pearson coefficient r-squared (r^2) to measure data fit. Outliers identified from log–log plots of length and weight data were excluded from regression analyses. We followed recommendations by Giarrizzo et al. (2015), and employed 95% confidence limits for b, in order to be able to look at hypothetical values of isometry.

TABLE 1 Length–weight relationship parameters and descriptive statistics for freshwater fishes, Brazilian Cerrado, Maranhão, sampled June 2010–July 2011

Species	N	TL (cm) Min	TL (cm) Max	WT (g) Min	WT (g) Max	LW Regression parameters a	95% CL of a	b	95% CL of b	r^2
Hemiodus parnaguae Eigenmann & Henn, 1916	16	9.01	15.04	10.00	40	0.0245	0.008–0.0751	2.7033	2.2582–3.1484	0.9238[a]
Psectrogaster rhomboides Eigenmann & Eigenmann, 1889[b]	19	9.72	15.69	10.00	70	0.0088	0.0013–0.0608	3.2422	2.4580–4.0264	0.8174
Curimatella dorsalis Eigenmann & Eigenmann, 1889	165	2.25	12.76	0.13	35	0.0085	0.0078–0.0093	3.2389	3.1869–3.291	0.9893[a]
Prochilodus lacustris Steindachner, 1907	27	10.04	19.29	15.00	120	0.0122	0.0058–0.0256	3.1250	2.8457–3.4042	0.9551[a]
Schizodon dissimilis Garman, 1890	16	10.90	32.50	20.00	535	0.0137	0.0054–0.0346	3.0076	2.7003–3.3148	0.9692[a]
Hoplias malabaricus Bloch, 1794	38	8.02	38.43	5.27	615	0.0104	0.0072–0.0150	3.0227	2.9–3.1454	0.9858
Astyanax cf. *bimaculatus* Linnaeus, 1758	28	0.78	10.52	0.06	25	0.0160	0.0098–0.0262	2.8414	2.4890–3.1937	0.9135
Charax awa Guimarães, Brito, Ferreira & Ottoni, 2018	12	9.19	15.13	10.00	45	0.0154	0.0036–0.0657	2.8522	2.2532–3.4513	0.9184[a]
Metynnis lippincottianus (Cope 1870)[b]	59	4.58	9.00	1.75	25	0.0270	0.0108–0.0677	2.9354	2.4585–3.4124	0.7271[a]
Hassar affinis Steindachner, 1881	18	7.24	17.35	5.00	65	0.0108	0.006–0.0192	3.0746	2.8398–3.3093	0.9797[a]
Platydoras brachylecis Piorski, Garavello, Arce H. & Sabaj Pérez, 2008	11	6.88	14.46	5.03	45	0.0145	0.0049–0.0426	3.0360	2.5673–3.5046	0.9598[a]
Ancistrus sp.	26	5.76	10.93	2.30	15.37	0.0242	0.0098–0.0595	2.7116	2.2562–3.1671	0.8629
Crenicichla brasiliensis (Bloch, 1792)	20	5.25	18.78	1.46	80	0.0076	0.0039–0.0149	3.2025	2.9297–3.4754	0.9713[a]
Geophagus parnaibae Staeck & Schindler, 2006	18	9.07	18.78	10.00	80	0.0079	0.0031–0.0199	3.1859	2.8152–3.5566	0.9540[a]
Satanoperca jurupari Heckel, 1840	29	5.84	13.99	3.74	61.95	0.0124	0.0045–0.0340	3.2163	2.7778–3.6548	0.8935

Note: N, sample size; TL (Min–Max), total length (minimum–maximum); WT (Min–Max), total weight (minimum–maximum); a and b, parameters of relationship among TL and WT; CL, confidence limits; r^2, Pearson r-squared for log–log regression (all relationships significant at $p < 0.0001$)
Bold: highest number recorded in specific literature.
[a]species without length–weight relationship estimates included in FishBase (Froese & Pauly, 2019).
[b]species with LWR obtained from Garcia-Ayala et al. 2014.
[c]species with LWR from Giarrizzo et al. (2011).

3 | RESULTS

A total of 479 fishes from 15 species belonging to 10 families and three orders were analyzed (Table 1). Cichlidae was the most represented family (three species), followed by Curimatidae, Characidae and Doradidae (two species). Individuals showed a size range between 0.78–38.43 cm (mean 10.63 cm), and weight variation between 0.06–615 g (Table 1). In addition, allometric coefficient (*b*) ranged from 2.7033 for *Hemiodus parnaguae* Eigenmann & Henn, 1916 to 3.2422 for *Psectrogaster rhomboides* Eigenmann & Eigenmann, 1889.

4 | DISCUSSION

Considering growth type, six species (40%) showed positive allometry (*b* > 3), five species (33.33%) presented negative allometry (*b* < 3), and four species (26.66%) isometric growth (*b* = 3).

Fishbase database (Froese & Pauly, 2019) provides LWR information for only six species of those described in Table 1; two others were previously described (Giarrizzo et al., 2015; Nascimento et al., 2012). Our study provides LWR estimates for 14 species, as well as new records of maximum TL for the recently described species *Charax awa* Guimarães, Brito, Ferreira & Ottoni, 2018.

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