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Technical contribution

Length–weight relationship for seven freshwater fish species from Brazil

By W. S. Nascimento[1], A. S. Araújo[1], N. H. C. Barros[1], L. L. Gurgel[2], E. F. S. Costa[3] and S. Chellappa[1]

[1]*Department of Oceanography and Limnology, Universidade Federal do Rio Grande do Norte, Praia de Mãe Luiza, s/n, Natal, RN, Brazil;* [2]*Instituto Federal de Educação, Ciência e Tecnologia do Rio Grande do Norte (IFRN), Campus Macau, RN, Brazil;* [3]*Programa de Pós-graduação em Oceanografia Biológica, Universidade de São Paulo, Praça do Oceanográfico, São Paulo-SP, Brazil*

Summary

The present study reports length-weight relationships for seven native freshwater fish species (*Triportheus angulatus*, *Psectrogaster rhomboides*, *Prochilodus brevis*, *Leporinus piau*, *Cichlasoma orientale*, *Crenicichla menezesi*, and *Pimelodella gracilis*) captured in a semiarid Brazilian reservoir located in the state of Rio Grande do Norte.

Introduction

Information on the relationship between length and weight of fish is useful for fisheries management (Kolher et al., 1995; Jennings et al., 2000; Froese, 2006). Despite the fact that they are not difficult to obtain, data on the length-weight relationship are still unavailable for many fish species (Froese, 1998).

Thus, the aim of the present study was to estimate the parameters of the L-W relationships for seven important fish species from a semi-arid reservoir in the State of Rio Grande do Norte, Brazil.

Material and methods

The study was carried out in the Marechal Dutra reservoir (popularly known as the Acari reservoir), located on Piranhas-Assu hydrographic basin in the state of Rio Grande do Norte in the semiarid region of Brazil (6°26′24″S; 36°38′00″W).

Fish samples were captured on a monthly basis from September 2008 to June 2009. Fishing gear consisted of stationary nets of 20 m length and mesh sizes from 4 to 19 cm, as well as 10 m long gillnets with mesh sizes from 1 to 3 cm. All captured fish samples were transported on ice to the laboratory for identification (Britski et al., 1984; Chellappa et al., 2009). Detailed morphometric measurements and meristic counts were carried out to verify the taxonomical status of each fish species. Total length of each fish was measured to the nearest centimeter (cm), and body weight measured to the nearest gram (g). Secondary sexual dimorphism characteristics were not exhibited by all species, as such, each fish was dissected and the sex identified based on the gonadal characteristics (Mackie and Lewis, 2001). However, maturation stages of the gonads were not estimated in this study; consequently, juveniles and adults of each sex were grouped together as either males or as females.

The length-weight relationships were estimated from the equation, $\log W = \log a + b \log L$, where W is the total body weight, L the total length, a the intercept and b the slope of the linear regression (Ricker, 1973; Jobling, 2008). Log-log plots were generated to remove outliers (Froese, 2006), and 95% confidence limits for anti-log a and b were calculated for males, females and the grouped sex. The t-test was performed to confirm whether the b departed from the isometric value 3 (Sokal and Rohlf, 1987).

Results and discussion

During the study period a total of 1090 individuals were analyzed. All LW regressions were significant ($P < 0.01$), with the coefficient of determination (r^2) ranging from 0.62 to 0.99. In general, b values ranged from 2.1717 to 3.4231, showing significant differences between sexes of *T. angulatus* and *C. orientale*. This study is the first report of LWR for six of seven native fish species from a Brazilian reservoir (Table 1).

The b values vary between 2 and 4, however, values ranging from 2.5 to 3.5 are more common (Carlander, 1969; Froese, 2006). Low b values registered for *T. angulatus* and *P. rhomboides* along with $r^2 < 90\%$ could be attributed to the small difference in length range of the sample size. The LWR where b-values fall within the expected range can be used safely; b-values outside this range require more attention (Froese, 1998).

The slope b provides valuable information on fish growth, being isometric when $b = 3$, positive allometry when $b > 3$ and negative allometry when $b < 3$ (Morey et al., 2003). This study indicates isometric growth for both sexes of *C. menezesi* and males of *C. orientale*, negative allometry for females of *C. orientale*, both sexes of *T. angulatus*, *P. rhomboides* and *P. gracilis* and positive allometry for both sexes of *P. brevis* and *L. piau*. Isometric growth indicates that the body increases in all dimensions in the same proportion to growth, whereas negative allometry indicates that the body becomes more rotound as it increases in length, and negative allometry indicates a slimmer body (Jobling, 2008). The results of this study could contribute to the management of these fish species and also awaken an interest in the study of native fish species that play an important role in the reservoir ecosystems.

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Table 1
Descriptive statistics and estimate parameters of length-weight relationship for seven species of native fishes from semi-arid Brazilian reservoir (n, sample size; Min, minimum; Max, maximum; SD, standard deviation; *a*, intercept; *b*, slope; CI, Confidence interval; r^2, determination coefficient)

			Length (cm)		Weight (g)		Equation parameters				
Order / family / species	Sex	*n*	Mean ± SD	Min–Max	Mean ± SD	Min–Max	log *a*	CI of log a	log *b*	CI of log *b*	r^2
Characiformes											
Characidae											
Triportheus angulatus[b]	M	38	14.8 ± 1.2	12.5–17.0	34.9 ± 6.5	23.0–50.0	−1.0128	−1.500 to −0.526	**2.1717**[a]	1.756 to 2.588	0.76
Spix & Agassiz, 1829	F	89	14.9 ± 0.9	13.2–17.2	31.3 ± 6.8	22.0–45.5	−1.5542	−2.083 to −0.125	**2.5839**[a]	2.133 to 3.035	0.63
	Grouped sex	127	14.9 ± 1.7	12.5–17.2	32.6 ± 7.1	22.0–50.0	−1.2891	−1.689 to −0.899	**2.3745**	2.033 to 3.716	0.62
Curimatidae											
Psectrogaster rhomboides[b]	M	126	14.5 ± 1.0	13.0–17.0	41.4 ± 8.6	29.5–65.5	−0.9977	−1.301 to−0.694	**2.2433**	1.982 to 2.504	0.72
Eigenmann &	F	168	14.6 ± 1.0	12.3–17.0	43.2 ± 8.5	27.5–60.5	−1.1876	−1.485 to −0.890	**2.4136**	2.158 to 2.669	0.70
Eigenmann, 1889	Grouped sex	294	14.3 ± 2.0	12.3–17.0	42.3 ± 8.4	27.5–65.5	−1.0948	−1.302 to−0.888	**2.3312**	2.153 to 2.509	0.70
Prochilodontidae											
Prochilodus brevis	M	136	20.0 ± 5.3	7.3–28.7	139.3 ± 76.6	5.0–385	−1.9783	−2.052 to −1.904	**3.1069**	3.049 to 3.164	0.99
Steindachner[b], 1875	F	114	19.2 ± 6.4	7.2–32.8	139.1 ± 102.5	4.6–416.5	−1.9713	−2.086 to −1.857	**3.1025**	3.012 to 3.193	0.98
	Grouped sex	250	19.7 ± 5.9	7.2–32.8	139.1 ± 89.1	4.6–416.5	−1.9742	−2.041 to −1.907	**3.1042**	3.052 to 3.156	0.98
Anostomidae											
Leporinus piau Fowler, 1941	M	106	18.4 ± 4.0	11.0–28.5	99.3 ± 71	15.0–364.5	−2.0309	−2.201 to −1.861	**3.1248**	2.990 to 3.260	0.95
	F	87	20.8 ± 4.9	11.0–32.9	162.5 ± 127.3	15.0–601.5	−2.3976	−2.531 to −2.264	**3.4231**	3.321 to 3 525	0.98
	Grouped sex	193	19.5 ± 4.7	11.0–32.9	128.3 ± 105.4	15.0–601.5	−2.1992	−2.301 to −2.098	**3.2614**	3.182 to 3.341	0.97
Perciformes											
Cichlidae											
Cichlasoma orientale[b]	M	64	11.5 ± 1.0	9.7–14.7	35.9 ± 10.6	20.9–90.5	−1.0864	−1.414 to −0.759	**2.4776**[a]	2.168 to 2.787	0.80
Kullander, 1983	F	46	11.3 ± 1.2	8.2–13.7	37.1 ± 14.4	12.0–73.5	−1.8966	−2.301 to −1.524	3.2632[a]	2.927 to 3.599	0.90
	Grouped sex	110	11.4 ± 1.1	8.2–14.7	36.6 ± 12.2	12.0–90.5	−1.4282	−1.683 to −1.174	2.8066	2.566 to 3.047	0.83
Crenicichla menezesi[b]	M	14	14.0 ± 1.8	12.0–18.5	32.9 ± 14.0	17.5–69.5	−1.9028	−2.379 to −1.427	2.9588	2.544 to 3.374	0.95
Ploeg, 1991	F	10	14.3 ± 1.5	12.5–17.0	35.8 ± 13.2	21.5–62.5	−2.1325	−2.993 to −1.272	3.1728	2.427 to 3.918	0.92
	Grouped sex	24	14.1 ± 1.8	12.0–18.5	34.1 ± 13.5	17.5–69.5	−1.9937	−2.388 to −1.599	3.0442	2.701 to 3.387	0.94
Siluriformes											
Heptapteridae											
Pimelodella gracilis[b]	M	42	9.5 ± 4.3	4.6–17.3	8.9 ± 9.6	0.67–32.0	−2.0269	−2.111 to −1.942	**2.8346**	2.746 to 2.923	0.99
Valenciennes, 1835	F	50	9.7 ± 3.8	4.5–16.5	8.7 ± 7.7	0.76–23.5	−2.0581	−2.183 to −1.934	**2.8735**	2.745 to 3 002	0.98
	Grouped sex	92	9.7 ± 4.1	4.5–17.3	8.8 ± 8.5	0.67–32.0	−2.0429	−2.118 to −1.968	**2.8549**	2.777 to 2.933	0.98

[a]Significant differences between sexes; bold, significant differences from 3 ($P < 0.05$).
[b]No previous data on LWR in Fishbase.

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Author's address: S. Chellappa, Department of Oceanography and Limnology, Universidade Federal do Rio Grande do Norte, Praia de Mãe Luiza, s/n, Natal, RN, CEP: 59014-100, Brazil.
E-mail: chellappa.sathyabama63@gmail.com