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Technical contribution

Length–weight relationships of 23 fish species from Southeastern Brazil

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Summary

Length–weight relationships of 23 fish species from the Guaratiba mangrove area in southeastern Brazil were estimated. The value of the parameter *b* ranged from 2.63 to 3.39 (median = 2.97). This study presents the first estimation of LWR for two species (*Ctenogobius stomatus* and *Ctenogobius boleosoma*). New maximum length records were obtained for two species (*Poecilla vivipara* and *Ctenogobius stomatus*).

Introduction

Data on length–weight relationships are still unavailable for most fish species (Froese, 1998, 2006). In the present study the length–weight relationships parameters of 23 fish species are given for the Guaratiba Mangrove, a marine protection area in Southeastern Brazil.

Materials and methods

Monthly biological surveys were undertaken in the Guaratiba Mangrove (23°02′– 23°05′S; 43°33′– 43°34′W) between August 2002 and July 2003. Fishes were collected by beach seine (30 m long × 2.5 m high × 7 mm mesh size) in shallow areas (<1.5 m depth). Hauls were performed perpendicular to the shoreline at a standardized distance of 30 m. Collected specimens were preserved in 10% formaldehyde solution. The total length of each fish was measured to the nearest millimeter (mm) and body weight to the nearest 0.01 g. Length–weight ($W = a\ TL^b$) relationships of 23 species were estimated by linear regression on the transformed equation: log (W) = log (a) + b log (TL) (Le-Cren, 1951), where W is body weight (g), TL is total length (cm), a is the y-intercept and b is the slope (Beverton and Holt, 1996). Specimens that were too small in size to positively identify were eliminated.

The plot of log a vs b was used to detect and exclude outliers (Vega-Cendejas et al., 2012). Stages of development and comparison of maximum sizes recorded in previous studies were performed considering the FishBase website (Froese and Pauly, 2012) and available current literature. Scientific names were checked against Eschmeyer and Fricke (2011). The results for individual species are arranged in systematic order, as given by Nelson (2006).

Results

A total of 24 609 specimens belonging to 14 families, 15 genera and 23 species was included in this LWR study. For two species (*Ctenogobius boleosoma* and *Ctenogobiuss stomatus*) no length–weight relationships were available in FishBase (Froese and Pauly, 2012), and the maximum length recorded for *Poecilia vivipara* (7.8 cm *TL*) and *G. stomatus* (13.9 cm *TL*) were greater than previously recorded. The estimated parameters and length characteristics of the length–weight relationship are given in Table 1.

Discussion

Three of the 23 analysed species had b values significantly lower compared with the available information. These are: *S. foetens* (n = 96; b = 3.10; length range, Lr = 2.7–23.0 cm; CI = 3.01–3.20); *E. argenteus* (n = 2676; b = 2.90; Lr = 1.1–12.0 cm; CI = 2.87 – 2.92); and *S. testudineus* (n = 306; b = 2.90; Lr = 1.7 – 26.4 cm; CI = 2.84 – 2.96) that had lower b and respectives confidence intervals compared with those recorded by Vega-Cendejas et al. (2012) for the Yucatan peninsula, Mexico, i.e. *S. foetens* (n = 87; b = 3.51; Lr = 3.1 – 23.5 cm; CI = 3.43–3.59); *E. argenteus* (n = 2877; b = 3.30; Lr = 2.0–16.0 cm; CI = 3.27 – 3.33); and *S. testudineus* (n = 474; b = 2.68; Lr = 1.8–28.0 cm; CI = 2.63–2.74). These species had similar sample sizes and length ranges that gave robustness to such comparisons.

Three species (*M. curema, E. melanopterus* and *D. rhombeus*) also had lower b values compared with those recorded by Vega-Cendejas et al. (2012), with our data having a comparatively larger sample size and wider length range. The lower b values found in the present study for these six species in comparison with the available information may be due to other uncontrolled factors such as season or extreme environments. For instance, there were small numbers of some specimens, or the length-size range was narrow (e.g. *M. ciliatus*), which may have led to the differences.

The estimated parameters should be applied only within the specified length ranges. Our results can enable estuarine fishery biologists to derive weight estimates for fish that are measured but not weighed, and assist in estimating the biomass of captured fish species.

Table 1
Descriptive statistics and estimated parameters of length–weight relationship ($W = a\ L^b$) for 23 fish species, Guaratiba Mangrove, Rio de Janeiro State, Southeastern Brazil

Family	Species	n	Length range (cm)	Weight range (g)	*a*	95% CI *a*	*b*	95% CI *b*	r^2	Life stage
Clupeidae	*Harengula clupeola*	1376	2.1–8.4	0.06–4.82	0.0049	0.0046–0.0051	3.24	3.20–3.27	0.96	J[1]
Ariidae	*Genidens genidens*	30	10.5–26.9	7.65–110.00	0.0137	0.0082–0.0227	2.73	2.54–2.91	0.96	J, A[2]
Synodontidae	*Synodus foetens*	96	2.7–23.0	0.13–57.98	0.0030	0.0024–0.0036	3.10	3.01–3.20	0.97	J, A[3]
Mugilidae	*Mugil liza*	1103	2.0–10.5	0.1–11.71	0.0097	0.0092–0.0102	2.99	2.99–3.02	0.97	J[4]
Mugilidae	*Mugil curema*	164	3.3–16.8	0.36–33.86	0.0122	0.0107–0.0139	2.84	2.79–2.90	0.98	J[5]
Mugilidae	*Mugil platanus*	82	2.6–10.9	0.11–10.02	0.0079	0.0069–0.0091	3.05	2.97–3.14	0.99	J[6]
Mugilidae	*Mugil gaimardianus*	22	3.8–13.0	0.45–17.17	0.0081	0.0060–0.0110	2.96	2.78–3.14	0.98	J
Atherinopsidae	*Atherinella brasiliensis*	15909	1.0–16.0	0.01–29.04	0.0060	0.0060–0.0061	2.97	2.96–2.98	0.96	J, A[7]
Poeciliidae	*Poecilla vivipara*	555	1.8–**7.8**	0.07–6.48	0.0078	0.0072–0.0084	3.28	3.23–3.33	0.97	J, A[8]
Carangidae	*Oligoplites saurus*	33	2.1–11.6	0.10–11.23	0.0118	0.0088–0.0158	2.63	2.44–2.82	0.96	J[9]
Gerreidae	*Eucinostomus argenteus*	2676	1.1–12.0	0.01–18.21	0.0112	0.0108–0.0115	2.90	2.87–2.92	0.96	J, A[10]
Gerreidae	*Eucinostomus melanopterus*	899	1.5–10.1	0.02–8.51	0.0097	0.0093–0.0102	2.84	2.80–2.88	0.96	J, A[11]
Gerreidae	*Diapterus rhombeus*	646	1.5–9.0	0.03–5.88	0.0098	0.0092–0.0104	2.92	2.88–2.97	0.96	J, A[12]
Gerreidae	*Eucinostomus gula*	21	5.4–10.0	1.43–10.30	0.0069	0.0036–0.0132	3.16	2.85–3.48	0.96	J, A[13]
Gobiidae	*Ctenogobius boleosoma*[a]	385	2.3–5.8	0.09–0.93	0.0078	0.0072–0.0085	2.87	2.81–2.93	0.96	
Gobiidae	*Ctenogobius stomatus*[a]	17	3.4–**13.9**	0.15–6.69	0.0027	0.0015–0.0047	3.05	2.80–3.30	0.98	
Paralichthyidae	*Citharychthys arenaceus*	95	1.2–11.1	0.02–9.54	0.0075	0.0062–0.0090	2.87	2.77–2.98	0.97	J, ?
Paralichthyidae	*Citharychthys spilopterus*	74	2.7–15.4	0.09–24.47	0.0061	0.0051–0.0073	3.00	2.92–3.09	0.99	J, A[14]
Achiriidae	*Achirus lineatus*	36	2.1–7.7	0.05–7.55	0.0063	0.0044–0.0090	3.39	3.13–3.65	0.95	J
Cynoglossidae	*Symphurus tesselatus*	37	3.6–15.5	0.10–19.34	0.0025	0.0018–0.0035	3.25	3.08–3.42	0.98	J, A[15]
Tetraodontidae	*Sphoeroides testudineus*	306	1.7–26.4	0.12–366.0	0.0223	0.0202–0.0246	2.90	2.84–2.96	0.97	J, A[16]
Tetraodontidae	*Sphoeroides greeleyi*	33	1.5–8.4	0.06–11.86	0.0218	0.0158–0.0301	2.85	2.62–3.08	0.95	J, A[17]
Monacanthidae	*Monacanthus ciliatus*	14	3.0–5.7	0.43–3.38	0.0168	0.0114–0.0249	2.97	2.71–3.24	0.98	J[18]

New maximum size data in bold.
[a]Data represent first length–weight relationship for the species. Life stage: J, juvenile, A, adult, ?, undetermined.
Life stage reference: [1]Peña-Alvaro et al. (2009); [2]Rocha and Freire (2009); [3]Kagiwara and Abilhôa (2000); [4]Esper et al. (2000); [5]Oliveria (2010); [6]Esper et al. (2000); [7]Favaro et al. (2003); [8]Mendonça and Andreata (2001); [9]Duque-Nivia et al. (1995); [10]Araujo et al. (1999); [11]Albert and Desfossez (1988); [12]Araujo et al. (1999); [13]Araujo et al. (1999); [14]Dias et al. (2005); [15]Terwilliger and Munroe (1999); [16]Pauly (1991); [17]Schultz et al. (2002); [18]Powell et al. (2007).

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