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Length-weight relationships for reef fishes in a southwestern Atlantic tropical oceanic island

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Abstract: Length-weight relationships (LWR) were estimated from 978 specimens belonging to nine different species captured during recreational activities at Trindade Island. LWR of one species is new to science and other two are new for the Brazilian province.

Keywords: Trindade island, recreational fisheries, Vitória-Trindade Seamount Chain.

Resumo. Relações peso-comprimento de peixes recifais de uma ilha oceânica no Atlantico ocidental. Relações peso-comprimento (LWR) foram estabelecidas para nove espécies a partir de 978 espécimes capturados pela pesca recreativa na Ilha da Trindade. A relação de uma espécie é nova para a ciência e outras duas são novas para a província brasileira.

Palavras-Chaves: Ilha da Trindade, pesca recreativa, cadeia de montes submarinos Vitória-Trindade.

Isolated oceanic islands are known to hold high fish biomass and to show good status of conservation (Friedlander and DeMartini 2002, DeMartini *et al*. 2008, Pinheiro *et al*. 2011). These environments also are considered hotspots for speciation (*e.g.*, Macieira *et al*. 2014) and therefore need to be well understood to be better preserved. Length-weight relationships (LWR), for their part, are an essential tool for studies in population dynamics, fisheries and community structure (Froese 2006). The LWR parameters (the constant *a* and the allometric coefficient *b*), however, vary greatly among populations and often need to be collected locally (Froese 2006). In the present paper, the length-weight relationships for several reef fish species captured by recreational activities at Trindade Island were established.

Trindade is an isolated Brazilian oceanic island that, together with Martin-Vaz Archipelago, lies on the eastern end of the Vitória-Trindade Chain (VTC), about 1,200 km off the central coast of Brazil (see Gasparini and Floeter 2001). Two scientific expeditions were carried out in 2012 and 2013, totaling 68 days of fieldwork during which all fishes caught by recreational fisheries (spear fishing and angling) by personnel of the Brazilian Navy were assessed. Fishes were identified at the lowest taxonomic level according to Humann and DeLoach (1994) and Carvalho-Filho (1999). Total length (*TL*) and weight (*W*) were measured to the nearest millimeter and on a 5 g precision scale, respectively. A 0.01 g precision scale was used for juveniles of the coney *Cephalopholis fulva* smaller than 10 cm *TL*. Parameters *a* and *b* of the growth model $W=aTL^b$, in which *W* and *TL* are expressed in grams and centimeters, respectively, were obtained through linear regression done on Neperian log-transformed data. [*i.e.*, $\ln(W) = \ln(a)+b\ln(TL)$] (see Froese 2006). Differences between estimated and real (*i.e*. measured) weight were computed and individuals showing value beyond three standard deviations of the mean were considered outliers and excluded from further analyses. In order to investigate the hypothesis that *Epinephelus adscensionis* specimens can reach bigger sizes in Trindade than on the Brazilian coast and in the Caribbean, LWR parameters established for these regions (Frota *et al*. 2004, González-Gándara *et al*. 2003) were applied for Trindade's specimens.

A residual model was constructed based on the difference between real and estimated weight. This approach was employed for Trindade's fishes within the same size range of those used in literature.

Regression parameters were calculated using 978 fishes of nine species belonging to seven families (Table I). Linear regressions were significant ($p < 0.001$) for all taxa. The coefficient of determination (R^2) varied between 0.83 and 0.99, with low values associated to a small variation in *TL* of captured individuals. New maximum total length and weight are reported for *Epinephelus adscensionis* (Table I).

LWR parameters estimates for *Melichthys niger* are furnished for the first time. Parameters estimates for *Anisotremus surinamensis* and *Canthidermis sufflamen* are new for the Brazilian province and therefore represent the best estimates to be used in reef fish studies in this region.

The maximum total length (up to 65 cm *TL* and 5,300 g) for Trindade´s *Epinephelus adscensionis* suggests that this species may be able to grow larger on this tropical isolated island than elsewhere (up to 61 cm *TL* and 4,100 g; available in Froese and Pauly 2015). To test this hypothesis, LWRs established for the Brazilian coast (Frota *et al*. 2004) and for Mexico (González-Gándara *et al*. 2003) were used to estimate the weight-at-length of Trindade's specimens. Using Brazilian coastal and Mexican LWR parameters leads to weights of Trindade's fish being underestimated by 17 and 18,5%, respectively (Fig. 1).

Table I. Length-weigth relationships and descriptive statistics for reef fishes captured by recreational activities at Trindade Island.

		***TL* (cm)**		***W* (g)**		**Regression parameters**		
Family/Species	n	Min	Max	Min	Max	a (95% C.I.)	B (95% C.I.)	R^2
Holocentridae								
Holocentrus adscensionis (Osbeck, 1765)	11	23.0	35.6	210	570	0.19 (0.01-2.37)	2.25 (1.51-2.99)	0.84
Epinephelidae								
Cephalopholis fulva (Linnaeus, 1758)	452	6.4	38.5	3.2	1125	0.0098 (0.0089-0.0107)	3.18 (3.15-3.205)	0.99
Epinephelus adscensionis (Osbeck, 1765)	70	28.0	65.0	370	5300	0.0070 (0.0048-0.0101)	3.24 (3.15-3.34)	0.98
Carangidae								
Caranx lugubris Poey, 1860	326	26.0	66.5	335	4665	0.0211 (0.0149-0.0299)	2.92 (2.83-3.01)	0.92
Haemulidae								
Anisotremus surinamensis (Bloch, 1791)	25	29.2	51.6	540	2915	0.067 (0.024-0.184)	2.69 (2.42-2.97)	0.95
Kyphosidae								
Kyphosus cf. *sectatrix*.(Linnaeus 1758),	14	30.5	42.0	520	1800	0.0022 (0.0001-0.0346)	3.62 (2.84-4.39)	0.90
Labridae								
Sparisoma amplum (Ranzani, 1841)	11	45.5	67.0	1590	4015	0.81 (0.08-8.09)	2.01 (1.44-2.57)	0.88
Balistidae								
Canthidermis sufflamen (Mitchill, 1815)	23	37.5	57.0	995	4370	0.088 (0.011-0.702)	2.62 (2.08-3.15)	0.83
Melichthys niger (Bloch, 1786)	57	19.5	29.5	180	730	0.0439 (0.0211-0.0914)	2.80 (2.57-3.04)	0.91

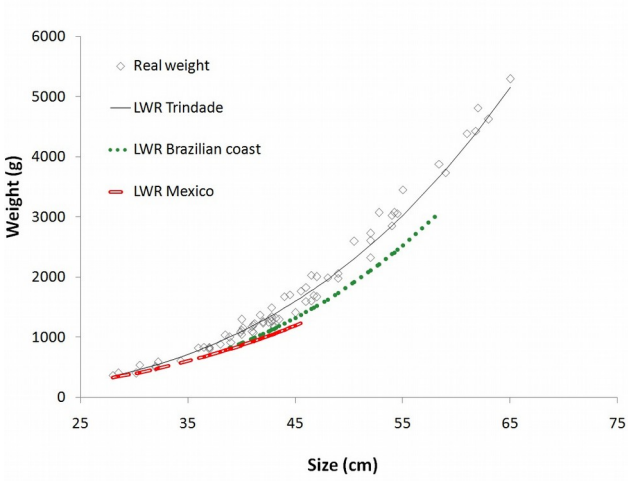

Figure 1.- Length-weight relationships for *Epinephelus adscensionis* at Trindade Island (black line), the Brazilian central coast (blue line; size range 31,5 – 46,0 cm SL) and Mexico (red line; size range 11,0 – 36,0 cm SL). Black squares (♦) show real data (length and weight) for Trindade specimens.

This species shows a disjunctive distribution along the VTC since the species is absent from the seamounts and is only present at Trindade and on the continental shelf (Pinheiro *et al*. 2015). We suggest that LWRs reported for Trindade fishes could be used in studies conducted at other Brazilian islands as they may provide better models for isolated oceanic populations.

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