

Length–weight relationships for three small reef-fishes from the Argentine coast: *Helcogrammoides cunninghami* (Smitt, 1898), *Ribeiroclinus eigenmanni* (Jordan, 1888), and *Hyleurochilus fissicornis* (Quoy and Gaimard, 1824)

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Summary

In this study the first length–weight relationships are provided for *Helcogrammoides cunninghami* and *Ribeiroclinus eigenmanni* inhabiting subtidal rocky areas in northern Patagonia, and for *Hyleurochilus fissicornis* inhabiting intertidal rocky areas in Buenos Aires Province. Specimens were collected between 2009 and 2016, from seven different locations in northern Patagonia and Buenos Aires Province (Southwest Atlantic Coast; 37°–42°S), using a trawling dredge or a small hand net. New maximum lengths were recorded for *R. eigenmanni* and *H. fissicornis*.

1 | INTRODUCTION

The small sized fish species in the rocky areas of the Northern and Central coast of Argentina are comprised mainly of the Clinidae, Tripterygiidae, Batrachoididae, Singnathidae, Zoarcidae and Nototheniidae families, having species of reduced size (<15 cm in total length) and generally a cryptic behavior (Gosztonyi & Lopez-Arbarello, 2000). Most of these fishes represent a main source of food for sea birds, for example, the imperial cormorant *Phalacrocorax atriceps* and the rock shag *Phalacrocorax magellanicus* have *Helcogrammoides cunninghami* (Smitt, 1898) and *Ribeiroclinus eigenmanni* (Jordan, 1888) as important prey (Bulgarella et al., 2008; Gosztonyi & Kuba, 1998). No length–weight relationships was yet estimated for *H. cunninghami*, *R. eigenmanni* and *Hyleurochilus fissicornis* (Quoy and Gaimard, 1824) from the Argentine coast, although there is a known relationship for *H. cunninghami* on the Chilean coast (Pérez-Matus, Carrasco, & Ospina-Alvarez, 2014).

2 | MATERIALS AND METHODS

Helcogrammoides cunninghami and *Ribeiroclinus eigenmanni* were captured at three sites in northern Patagonia: Golfo Nuevo, Punta

Pardelas and Playa Fracasso. Fishes were collected in 2009 and between May 2016 and June 2016 with a 0.8 m wide trawling dredge. *Hyleurochilus fissicornis* was captured at four sites in Buenos Aires Province: Santa Clara, Mar de Cobo, Los Acantilados and Waikiki, between 2010 and 2011 using a small hand net (length: 30 cm, height: 20 cm, mesh size: 2 mm bar length). In total, the 461 collected specimens were measured (total length = TL) to the nearest 0.1 cm with an ichthyometer. Wet weights (*W*) were determined to the nearest 0.01 g using an electronic balance.

Before fitting the models, a *x*–*y* plot was used to detect outliers in length–weight relationships, as suggested by Froese (2006). In order to decide which was the more appropriate fitting algorithm (a linear regression on log-transformed data or a non-linear regression on raw data), we first evaluated the error distribution (additive vs. multiplicative) of the whole data set for each species by likelihood analysis (see Xiao, White, Hooten, & Durham, 2011 for details). As the assumption of multiplicative log-normal error was better supported for the three data sets (results not shown), the parameters of the length–weight relationship ($W = a TL^b$, where *a* and *b* are the parameters of the regression) were estimated by fitting linear regressions to the log transformed data ($\log [W] = \log [a] + b \log [TL]$) following Venerus, Villanueva Gomila, Sueiro, and

TABLE 1 Total length–weight relationships for three small reef-fishes from inter and subtidal rocky areas of North Patagonia and Buenos Aires Province, Argentina. Samples collected between 2009 and 2016

Species	N	Total length range (cm)	Weight range (g)	Parameters [CI 95% _{inf} ; CI 95% _{sup}]		R ²
				a	b	
<i>Helcogrammoides cunninghami</i> (Smitt, 1898)	56	3–5	0.32–1.75	0.022 [0.014–0.035]	2.54 [2.21–2.87]	.81
<i>Riberoclinus eigenmanni</i> (Jordan, 1888)	91	2.7–9.2	0.28–5.47	0.013 [0.094–0.018]	2.67 [2.48–2.86]	.90
<i>Hypleurochilus fissicornis</i> (Quoy and Gaimard, 1824)	310	2.8–8.9	0.27–1.76	0.018 [0.015–0.02]	2.94 [2.86–3.03]	.93

Bovcon (2016). All analyses were made using the R software (R Core Team, 2014).

3 | RESULTS

A total of 56 *H. cunninghami* ranging between 3 and 5 cm TL, 91 *R. eigenmanni* ranging between 2.7 and 9.2 cm TL, and 310 *H. fissicornis* ranging between 2.8 and 8.9 cm TL were used (Table 1).

4 | DISCUSSION

In the present study we provide the length–weight relationships for three small reef-fishes from inter and subtidal rocky areas of the Argentine coast. The maximum size for *R. eigenmanni* and *H. fissicornis* reported here (9.2 and 8.9 cm TL, respectively) exceeded the FishBase records (4.4 and 8.7 cm, respectively (Froese & Pauly, 2016)). However, the maximum size for *H. cunninghami* was 6.2 cm TL (Pérez-Matus et al., 2014), but for the Argentine coast no fish larger than 5 cm was found. The exponent *b* for fish of the Chilean coast ranged from 3.356 to 3.840, which was higher than for the Argentine coast.

These results contribute to the necessary input for biomass estimations in diet reconstruction of marine predators and/or monitoring programs in marine protected areas.

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