



Range extension of *Rhinosardinia bahiensis* (Steindachner, 1879) in the southwestern Atlantic: The role of shallow estuarine waters in seasonal recruitment

MICHELLE S. BOLZAN¹, RYAN ANDRADES², HENRY L. SPACH³ & MAURÍCIO HOSTIM-SILVA¹

¹ Universidade Federal do Espírito Santo, Departamento de Ciências Agrárias e Biológicas, Centro Universitário Norte do Espírito Santo, Rodovia BR 101 Norte, km 60, Bairro Litorâneo, 29932-540, São Mateus, ES, Brasil; ² Universidade Federal do Espírito Santo, Departamento de Oceanografia e Ecologia, Av. Fernando Ferrari, 514, 29075-910, Vitória, ES, Brasil; ³ Universidade Federal do Paraná, Centro de Estudos do Mar, Pontal do Sul, Pontal do Paraná, Paraná 83255-976, Brasil.

Abstract: This study provides the concise first record and range extension of *Rhinosardinia bahiensis* (Steindachner, 1879) in the Espírito Santo waters. The recruitment of *R. bahiensis* in the São Mateus river estuary probably occurs in the upper areas covered by dense macrophyte vegetation during the winter months.

Key-words: nursery habitat, estuary, São Mateus river, Espírito Santo

Resumo: Extensão de ocorrência de *Rhinosardinia bahiensis* (Steindachner, 1879) no Atlântico Sul-Occidental: o papel das águas rasas estuarinas no recrutamento sazonal. O presente estudo fornece o primeiro registro conciso e a extensão da distribuição geográfica de *Rhinosardinia bahiensis* (Steindachner, 1879) no Espírito Santo. O recrutamento de *R. bahiensis* no estuário do rio São Mateus provavelmente ocorre no setor superior durante os meses de inverno em áreas cobertas por uma densa vegetação de macrófitas.

Palavras-chave: ambiente berçário, estuário, rio São Mateus, Espírito Santo

Worldwide, shallow estuarine habitats serve as nurseries for juvenile fish (Beck *et al.* 2001), including species of the *Rhinosardinia* genus (Barletta & Barletta-Bergan 2009; Giarrizzo & Krumme 2009). However, *R. bahiensis* remains poorly understood in freshwater and estuarine habitats in comparison to the congeneric species *R. amazonica*, which has been recorded in many previous studies (Barletta *et al.* 2005; Giarrizzo & Krumme 2009; Barletta & Barletta-Bergan 2009). Previous reports have assumed that the species had a southern geographical distribution restricted to the Bahia state in northeastern Brazil (Carpenter 2002). One record of *R. bahiensis* was reported in 1997 (MZUSP 51758) from Espírito Santo, also in the São Mateus river basin (northern Espírito Santo), but it is comprised of one specimen that was purchased from a fisherman

and does not provide the specific coordinates of the fishing location (SIBIP/NEODAT III 2014). Here, we provide the first concise record and range extension of *R. bahiensis* in the state of Espírito Santo and highlight the importance of shallow estuarine habitats for the species.

The study area was the São Mateus River estuary (39°43'56.3" W; 18°35'59.8"S), which is located in the northern region of the state of Espírito Santo in southeastern Brazil. Based on the salinity gradient, eight shallow areas covering the entire estuarine area (lower, middle, and upper) were chosen to record and investigate the spatial and temporal patterns of *R. bahiensis*. Furthermore, the sampled sites represented different habitat mosaics as follows: Sites 1 and 2 consisted of sandy beaches (SB) located in the lower estuary area; sites 4 and 5

were located in the middle estuarine area and were comprised of mangrove shoreline habitats (MSH), primarily covered by *R. mangle*; and sites 7 and 8 were shallow habitats located in the upper estuary and covered by dense macrophyte vegetation (MV), primarily *Typha domingensis*. Sites 3 and 6 were the intermediary habitat types of SB-MSH and MSH-MV, respectively. A sampling program was instituted at the eight sites over the course of one year (July 2012 to June 2013) that performed three replicate collections per month with a beach seine net 10-m long and 2.5-m height with a 5-mm mesh size. The seine hauls were always pulled during neap tides and diurnal periods. Captured individuals were counted, measured in relation to the standard length (SL; mm), and weighed (g). All individuals were identified according to Carpenter (2002) and Carvalho-Filho (1999). The seasons were defined as Winter (Jun 21 to Sep 20), Spring (Sep 21 to Dec 20), Summer (Dec 21 to Mar 20), and Autumn (Mar 21 to Jun 20). We tested separately the spatial (sites) and temporal (seasons) effect on fish abundance (number of fish) using non-parametric Kruskal-Wallis tests. To assess the seasonal recruitment patterns, histograms of fish size classes were constructed from the abundance data. Size classes were defined using the Sturges method (Sturges 1926), which grouped the individuals into 11 SL (mm) classes.

Altogether, 975 *R. bahiensis* individuals (1525 g total biomass) were caught in the São Mateus River estuary from a total sampling area of 43,200 m² (4.3

ha), confirming the first occurrence and range extension of the species (Figure 1). Voucher specimens were deposited in the Coleção Zoológica Norte Capixaba (CZNC 578). The *R. bahiensis* density was 225.6 individuals·ha⁻¹ (353 g·ha⁻¹) and their size ranged from 24 to 80 mm SL. Regarding the estuarine areas, Kruskal-Wallis tests showed that *R. bahiensis* were most abundant during the winter months ($p < 0.05$), and they were more abundant in the upper estuarine area (sites 7 and 8) than in the middle and lower areas of the São Mateus River estuary ($p < 0.05$; Figure 2). The size histograms clearly showed a seasonal peak of small recruits (< 40 mm SL) during the winter months (Figure 3). Recruitment peaks in the winter months (primarily September) were also observed for the congeneric species *R. amazonica* in shallow mangrove creeks in the Curuçá estuary in northern Brazil (Giarrizzo & Krumme 2009). In our study, the presence of dense patches of macrophytes (*T. domingensis*) in shallow habitats seemed to provide more potential nursery habitat for *R. bahiensis* recruitment than did the mangrove shoreline habitats or sandy beaches. Indeed, aquatic macrophytes have been described as providing a refuge from predators for juvenile estuarine and coastal fishes (Adams *et al.* 2004; Sheppard *et al.* 2011; Andrades *et al.* 2014). One of the main challenges of fishes during the early stages of their lives is predation avoidance, which entails seeking refuge in a variety of habitats, including shallow estuarine waters (Hammerschlag *et al.* 2010).



Figure 1: *Rhinostardina bahiensis*, 69,0 mm SL, São Mateus river estuary, Conceição da Barra, Espírito Santo, Brazil. Photo by Ryan Andrades.

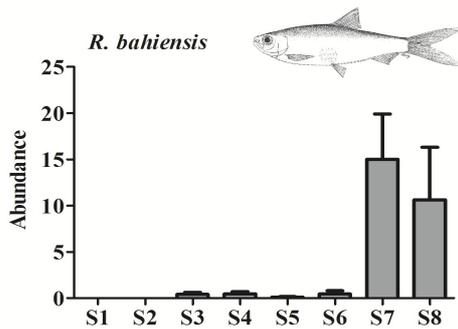


Figure 2: Abundance (+SE) of *Rhinosardinia bahiensis* in sampled sites of São Mateus River estuary. Picture by Carpenter 2002.

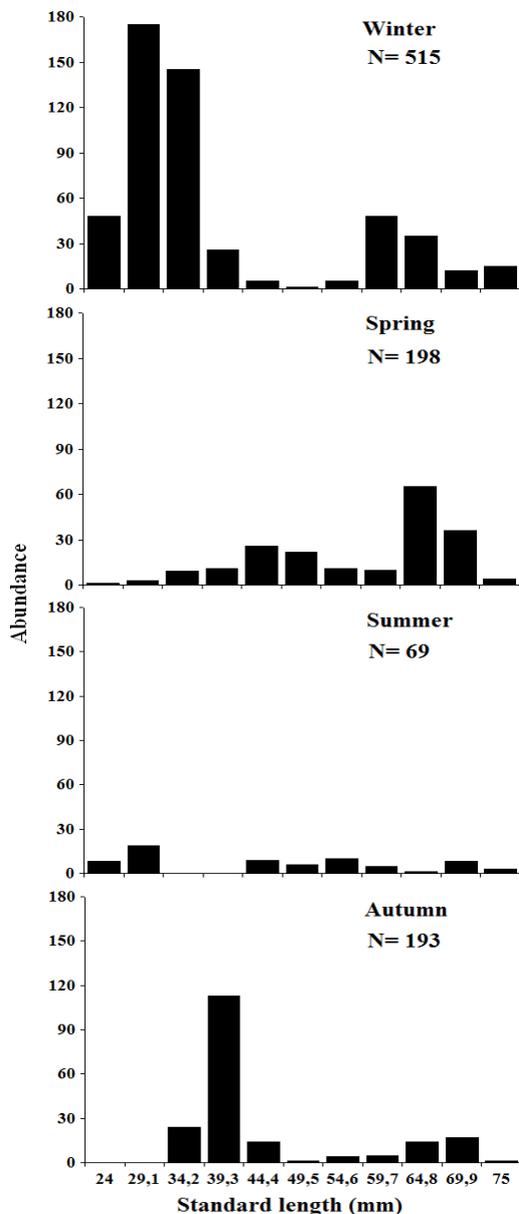


Figure 3: Length abundance histograms (SL mm) of *Rhinosardinia bahiensis* caught in shallow areas of São Mateus River estuary.

The first concise record of extension of *R. bahiensis* into Espírito Santo waters will allow inclusion of the species in future management and conservation plans under the environmental laws of Espírito Santo state, mainly in relation to the Environmental Protected Area of Conceição da Barra (APA de Conceição da Barra), which includes the São Mateus River estuary. This report draws attention to current anthropic impacts in the present estuarine area such as removal of natural vegetation (Silva *et al.* 2005; Vale & Ross 2011) and its influence in *R. bahiensis* recruitment in vegetated estuarine areas. Further studies will assess feeding ecology and short-term variations in recruitment process along estuarine vegetated areas in order to clarify the population ecology of *R. bahiensis* face to human-induced disturbances in São Mateus River estuary.

References

- Adams, A. J., Locascio, J. V. & Robbins, B. D. 2004. Microhabitat use by a post-settlement stage estuarine fish: evidence from relative abundance and predation among habitats. **Journal of Experimental Marine Biology and Ecology**, 299: 17-33.
- Andrades, R., Gomes, M. P., Pereira-Filho, G. H., Souza-Filho, J. F., Albuquerque, C. Q., & Martins, A. S. 2014. The influence of allochthonous macroalgae on the fish communities of tropical sandy beaches. **Estuarine, Coastal and Shelf Science**, 144: 75-81.
- Barletta, M., Barletta-Bergan, A., Saint-Paul, U. & Hubold, G. 2005. The role of salinity in structuring the fish assemblages in a tropical estuary. **Journal of Fish Biology**, 64: 5-17.
- Barletta, M. & Barletta-Bergan, A. 2009. Endogenous Activity Rhythms of Larval Fish Assemblages in a Mangrove-fringed Estuary in North Brazil. **The Open Fish Science Journal**, 2: 15-24.
- Beck, M. W., Heck, K. L., Able, K. W., Childers, D. L., Eggleston, D. B., Gillanders, B. M., Halpern, B., Hays, C. G., Hoshino K., Minello, T. J., Orth, R. J., Sheridan, P. F. & Weinstein, M. P. 2001. The identification, conservation, and management of estuarine and marine nurseries for fish and invertebrates. **BioScience**, 51: 633-641.
- Carpenter, K. E. 2002. **The living marine resources of the Western Central Atlantic. Vol. 2 Bony fishes part 1 (Acipenseridae to Grammatidae)**. FAO.
- Carvalho-Filho, A. 1999. **Peixes: Costa Brasileira**.

- Melro, São Paulo, 320 p.
- Giarrizzo, T. & Krumme, U. 2009. Temporal patterns in the occurrence of selected tropical fishes in mangrove creeks: implications for the fisheries management in north Brazil. **Brazilian Archives of Biology and Technology**, 52: 679-688.
- Hammerschlag, N., Morgan, A. B. & Serafy, J. E. 2010. Relative predation risk for fishes along a subtropical mangrove-seagrass ecotone. **Marine Ecology Progress Series**, 401: 259-267.
- Sheppard, J. N., James, N. C., Whitfield, A. K. & Cowley, P. D. 2011. What role do beds of submerged macrophytes play in structuring estuarine fish assemblages? Lessons from a warm-temperate South African estuary. **Estuarine, Coastal and Shelf Science**, 95: 145-155.
- SIBIP/NEODAT III. 2014. **Sistema Brasileiro de Informações sobre Biodiversidade de Peixes-Sistema Nacional de Informações sobre Coleções Ictiológicas**, accessible at <http://www.mnrj.ufrj.br/pronex>. (Accessed 01/09/2014).
- Silva, M. A. B., Bernini, E. & Carmo, T. M. S. 2005. Características estruturais de bosques de mangue do estuário do rio São Mateus, ES, Brasil. **Acta Botanica Brasílica**, 19: 465-471.
- Sturges, H. A. 1926. The choice of a class interval. **Journal of the American Statistical Association**, 21: 65-66.
- Vale, C. C. & Ross, J. L. S. 2011. As transformações morfológicas e fitogeográficas do estuário do rio São Mateus, litoral Norte do Estado do Espírito Santo, entre 1970 e 2008. **Revista do Departamento de Geografia – USP**, 21: 03-23.

Received July 2014

Accepted December 2014

Published on-line December 2014