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PENSOFT

First records of the Redfin Brotula, *Petrotyx sanguineus* (Meek & Hildebrand, 1928) (Ophidiiformes, Bythitidae), in the western South Atlantic

Arthur de B. Bauer[1], Alfredo Carvalho-Filho[2], Rodrigo A. Caires[3], Michael M. Mincarone[4]

1 Universidade Federal do Rio de Janeiro, Programa de Pós-Graduação em Ciências Ambientais e Conservação, Macaé, RJ, Brazil. **2** Fish Bizz Ltda, São Paulo, SP, Brazil. **3** Museu de Zoologia da Universidade de São Paulo, Seção de Peixes, São Paulo, SP, Brazil. **4** Universidade Federal do Rio de Janeiro, Núcleo em Ecologia e Desenvolvimento Socioambiental de Macaé, Caixa Postal 119331, Macaé, RJ, 27910-970, Brazil.
Corresponding author: Michael M. Mincarone, mincarone@macae.ufrj.br

Abstract
The present study reports on the first records of the bythitid Redfin Brotula, *Petrotyx sanguineus* (Meek & Hildebrand, 1928), in the western South Atlantic, based on 7 specimens (50.8–152.8 mm SL) from 5 localities along the northeastern coast of Brazil: (1) Praia de Maracaípe, Ipojuca and (2) Praia de Tamandaré, Tamandaré, in Pernambuco state; and (3) Praia do Forte, Mata de São João, (4) Praia de Busca Vida, Camaçari, and (5) Barra do Pote, Vera Cruz, in Bahia state. This species was previously known only in the western Central Atlantic, from Bahamas to Trinidad and Tobago, including the Caribbean Sea. In addition to the new distributional information, morphological data are provided based on the specimens examined.

Key words
Reef fish; distribution; Brazil.

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Introduction

According to Nelson et al. (2016), the order Ophidiiformes includes 5 families (Aphyonidae, Bythitidae, Carapidae, Parabrotulidae, and Ophidiidae), 119 genera and about 530 species. Recently, Møller et al. (2016) introduced a new classification for the viviparous clade, merging Bythitinae, Brosmophysini and Aphyonidae into Bythitidae, and elevating Dinematichthyidae (formerly tribe Dinematichthyini) to family status. Recent studies on the diversity of ophidiiforms from Brazil reported the occurrence of 45 species from 33 genera and 3 families from both coastal and deep-sea waters (Franco et al. 2007, Mincarone et al. 2008, Nielsen 2009, Nielsen et al. 2009, 2015). In this study, the Redfin Brotula, *Petrotyx sanguineus* (Meek & Hildebrand, 1928), a reef species previously known from the western Central Atlantic (Nielsen et al. 1999), is reported for the first time in the western South Atlantic, based on 7 specimens obtained from 5 localities along the northeastern coast of Brazil.

Methods

Measurements and counts were taking according to Nielsen et al. (1999). Counts of vertebrae and unpaired fin-rays were taken from x-rayed specimens. The specimens

were identified following the descriptions and diagnoses provided by Meek and Hildebrand (1928), Böhlke (1955), Cohen and Nielsen (1978), and Nielsen et al. (1999). An updated distribution map of *P. sanguineus* based on the literature, photographic material, and museum specimens is also provided. Institutional abbreviations: ANSP – Academy of Natural Sciences, Philadelphia; MZUSP – Museu de Zoologia da Universidade de São Paulo, São Paulo; NPM – Fish Collection of the Núcleo em Ecologia e Desenvolvimento Socioambiental de Macaé, Universidade Federal do Rio de Janeiro, Macaé; USNM – National Museum of Natural History, Washington, DC.

Comparative material examined: ANSP 191638, 7 (82.0–111.1 mm SL), Bahamas, Great Bahama Bank, New Providence Island, Green Cay, 25°06′34.0″ N, 077°11′41.8″ W, 15.8 m depth, 15 November 2010; ANSP 191639, 1 (133.8 mm SL), Bahamas, Great Bahama Bank, New Providence Island, 25°05′31.2″ N, 077°23′30.0″ W, 5.5 m depth, 17 November 2010; ANSP 191640, 4 (55.1–112.0 mm SL), Bahamas, Great Bahama Bank, New Providence Island, Delaporte Point, 25°04′52.0″ N, 077°25′52.2″ W, 4.3 m depth, 17 November 2010.

Results

New records (based on specimens examined). MZUSP 61270, 2 (50.8–99.6 mm SL), Brazil, Bahia, Vera Cruz, Ilha de Itaparica, Barra do Pote, collected by M. Custódia, 17 July 1973; NPM 1638, 1 (152.8 mm SL), Brazil, Pernambuco, Ipojuca, Praia de Maracaípe, found dead on the beach near to a reef formation, collected by G. Camargo, 4 November 2011, ca 08:00 am; NPM 3817, 1 (165.0 mm SL), Brazil, Pernambuco, Tamandaré, Praia de Tamandaré, found dead on the beach near to a reef formation, collected by S. Marques, 30 January 2017.

New records (based on photographs). Fig. 1A: 1 specimen (ca 150 mm SL), Brazil, Bahia, Camaçari, Praia de Busca Vida, found dead on a reef formation, collected by J. Castro, 4 November 2010, ca 09:00 am; Fig. 1B: 1 specimen (82 mm SL), Brazil, Pernambuco, Ipojuca, Praia de Maracaípe, 24 September 2011; Fig. 1C: 1 specimen (ca 70 mm SL), Brazil, Bahia, Mata de São João, Praia do Forte, collected by M. Paiva, 27 November 2009.

Identification. The genus *Petrotyx* is diagnosed by the following combination of characters: lips with series of dermal fringes; snout with numerous small and fleshy papillae; snout and chin without barbels; eyes relatively small; posterior margin of preopercle covered by skin; opercle and preopercle without spines; presence of sheath in the upper margin of maxilla; apparently no pores on head; 3 developed gill rakers on the first branchial arch; 8 branchiostegal rays; teeth presented in bands on jaws, vomer, and palatines; 1 median basibranchial tooth patch; single lateral line restricted to the anterior half of the body; pelvic fins inserted posterior to the tip of humeral symphysis; pelvic fins with 2 rays; lower pectoral-fin rays not separated; dorsal, anal, and caudal fins confluent posteriorly; 12 precaudal vertebrae; head and body scaled (Bölhke 1955, Nielsen et al. 1999).

Petrotyx sanguineus can be distinguished from its single congener, *Petrotyx hopkinsi* Heller & Snodgrass, 1903, by its head length (4.0–4.6 vs 4.9–5.9 × in TL), pelvic-fin length (5.0–5.5 vs 6.1–7.1 × in TL), number of dorsal-fin rays (86–91 vs 105), and number of anal-fin rays (68–72 vs 82) (Bölhke 1955). In addition, *P. sanguineus* has a tropical western Atlantic distribution, whereas *P. hopkinsi* occurs in the tropical eastern Pacific, from Colombia to Ecuador, including Galapagos Islands (Nielsen et al. 1999).

The juveniles of *P. sanguineus* have a uniform reddish-orange coloration. The adult specimens are reddish-brown, with fins bright red, and margins of dorsal, caudal and anal fins dark. The specimens recorded in Brazil have a darker coloration, probably because they were collected after death.

Discussion

Petrotyx sanguineus is a reef dwelling species with secretive habit, known in the western Central Atlantic, from Bahamas to Trinidad and Tobago, including USA (Florida), Mexico (Quintana Roo), Belize, Turks and Caicos Islands, Cayman Islands, Haiti, Puerto Rico, Virgin Islands, Dominica, Panama, Colombia (Santa Marta and Isla de Providencia), Venezuela, and Curaçao (Böhlke and Chaplin 1968, Robins and Ray 1986, Cervigón 1991, Nielsen and Robins 2003, Smith et al. 2003, museum records). The present study provides the southernmost records of *P. sanguineus* in the western Atlantic, on the coasts of Pernambuco and Bahia states, Brazil (Fig. 2). The species can be found in reefs, from 3 to 21 m depth (Böhlke and Chaplin 1968, Nielsen et al. 1999).

With a few exceptions, the measurements and counts of specimens from Brazil are within the morphological variations observed among the specimens from the Caribbean Sea (Table 1). However, we found that some diagnostic characters proposed by Bölhke (1955) are different from those observed for the specimens currently examined (dorsal-fin rays 86–91 vs 81–96; anal-fin rays 68–72 vs 63–74, respectively). In general, the specimens examined in this study have a wider range (both minimum and maximum values) when compared with those proposed by Bölhke (1955). This could be an effect of the sample size, as we have examined more specimens (n = 16) than Bölhke (1955; n = 5). The examination of additional specimens from other western Atlantic localities could clarify our understanding on such morphological variations.

Recent studies on the diversity of ophidiiforms from Brazil include those of Mincarone et al. (2008), who reported the occurrence of 45 species (of which 44 are currently valid). Subsequently, Nielsen et al. (2009) reviewed the ocellus-bearing species of *Neobythites* from the western Atlantic, which resulted in the description of *Neobythites multiocellatus* Nielsen, Uiblein & Mincarone,

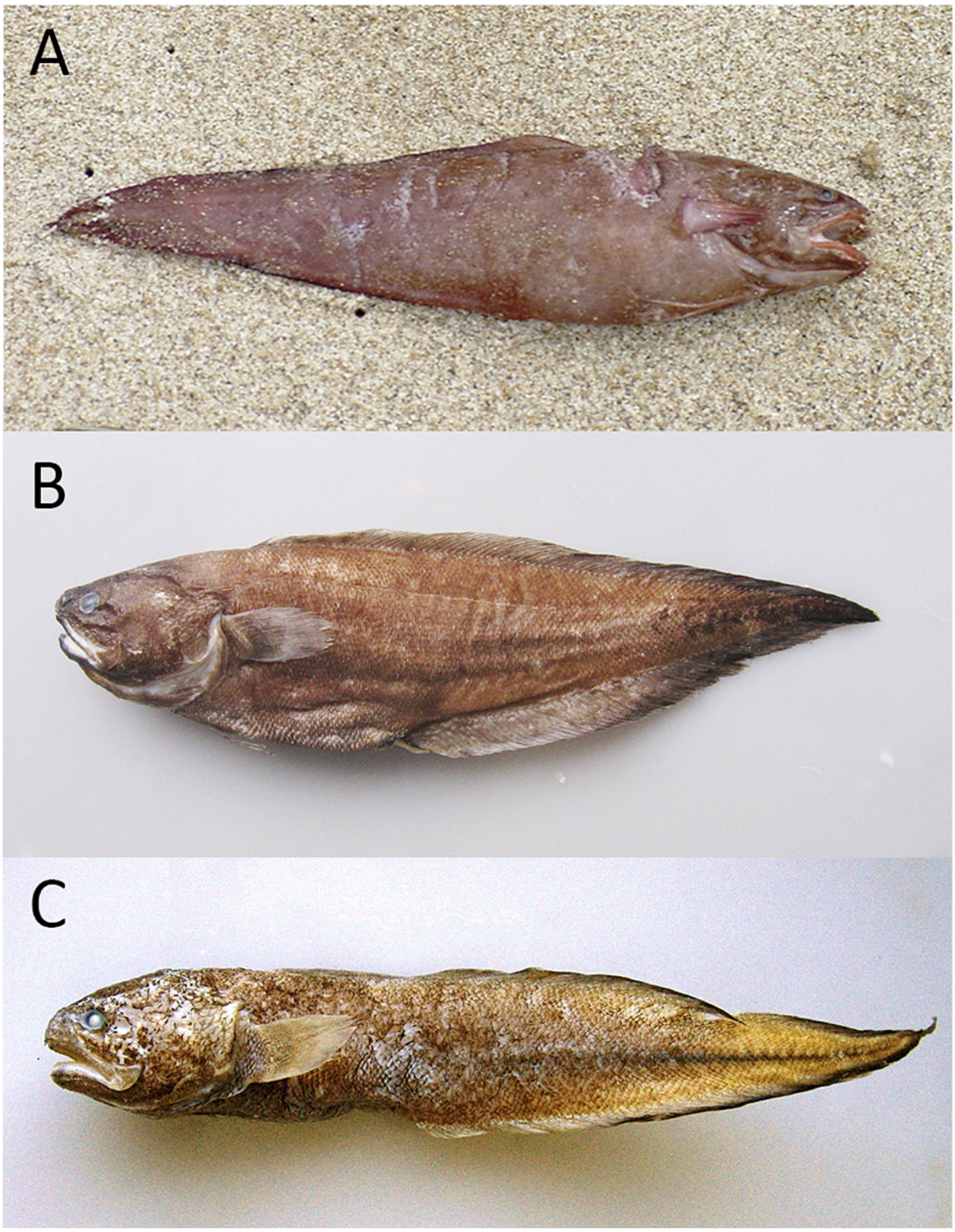

Figure 1. Photographic records of *Petrotyx sanguineus* along the northeast Brazilian coast. **A.** Specimen (*c.* 150 mm SL) found dead on a reef formation on the Praia de Busca Vida, Camaçari, Bahia. **B.** Specimen (82 mm SL) found dead on the Praia de Maracaípe, Porto de Galinhas, Pernambuco. **C.** Dried specimen (*c.* 70 mm SL) found dead on Praia do Forte, Mata de São João, Bahia.

2009 from the Caribbean Sea and the taxonomic re-evaluation of the *Neobythites* species from Brazil. In addition, one of the deep-sea ophidiids provisionally named as *Luciobrotula* sp. by Mincarone et al. (2008) was found to be a new species, which was described as *Luciobrotula brasiliensis* Nielsen, 2009. More recently, a new aphyonid species from off northeastern Brazil was described as *Barathronus linsi* Nielsen, Mincarone & Di

Table 1. Measurements and counts for the Redfin brotula *Petrotyx sanguineus* from northeastern Brazil and Caribbean Sea.

Location	Northeastern Brazil				Panama	Bahamas	
Collection number	**NPM 1638**	**NPM 3817**	**MZUSP 61270 (1)**	**MZUSP 61270 (2)**	**USNM 81793***	**ANSP 191638–191640**	
Number of specimens	**1**	**1**	**1**	**1**	**Holotype**	**12 specimens**	
						range	**mean ± SD**
Total length (mm)	157.7	171.9	100.6	51.9	60.5	58.6–145.5	—
Standard length (mm)	152.8	165.0	93.4	47.9	56.2	55.1–133.8	—
Measurements (in % SL):							
Preanal length	42.9	39.1	35.5	34.4	38.3	39.0–47.5	42.2 ± 2.3
Predorsal length	24.3	25.9	21.2	20.7	25.3	23.0–26.9	25.5 ± 1.1
Pelvic-fin length	**	18.8	20.0	**	20.3	18.7–22.3	20.1 ± 1.2
Head length	22.4	22.7	22.4	21.9	23.7	22.5–25.2	24.0 ± 0.8
Eye diameter	3.0	3.2	3.2	2.5	2.7	2.9–3.7	3.3 ± 0.2
Snout length	5.2	5.5	4.4	3.5	6.8	5.3–6.7	5.7 ± 0.4
Upper-jaw length	11.1	11.2	10.7	8.6	12.5	10.2–12.8	11.2 ± 0.7
Counts:							
Pectoral-fin rays	26	25	26	24	27	22–26	23.6 ± 1.7
Dorsal-fin rays	96	93	95	94	91	81–95	87.3 ± 3.6
Anal-fin rays	74	72	73	71	71	63–73	68.4 ± 2.6
Caudal-fin rays	9	9	10	10	10	8–12	9.6 ± 1.2
Developed gill-rakers	3	3	3	3	3	3–3	3.0 ± 0.0
Branchiostegal rays	8	8	—	—	—	8–8	8.0 ± 0.0
Precaudal vertebrae	11	11	—	—	—	10–11	10.3 ± 0.5
Caudal vertebrae	37	38	—	—	—	31–38	35.9 ± 2.4
Total vertebrae	48	49	—	—	—	42–49	46.3 ± 2.2

* from Böhlke (1955).
** broken.

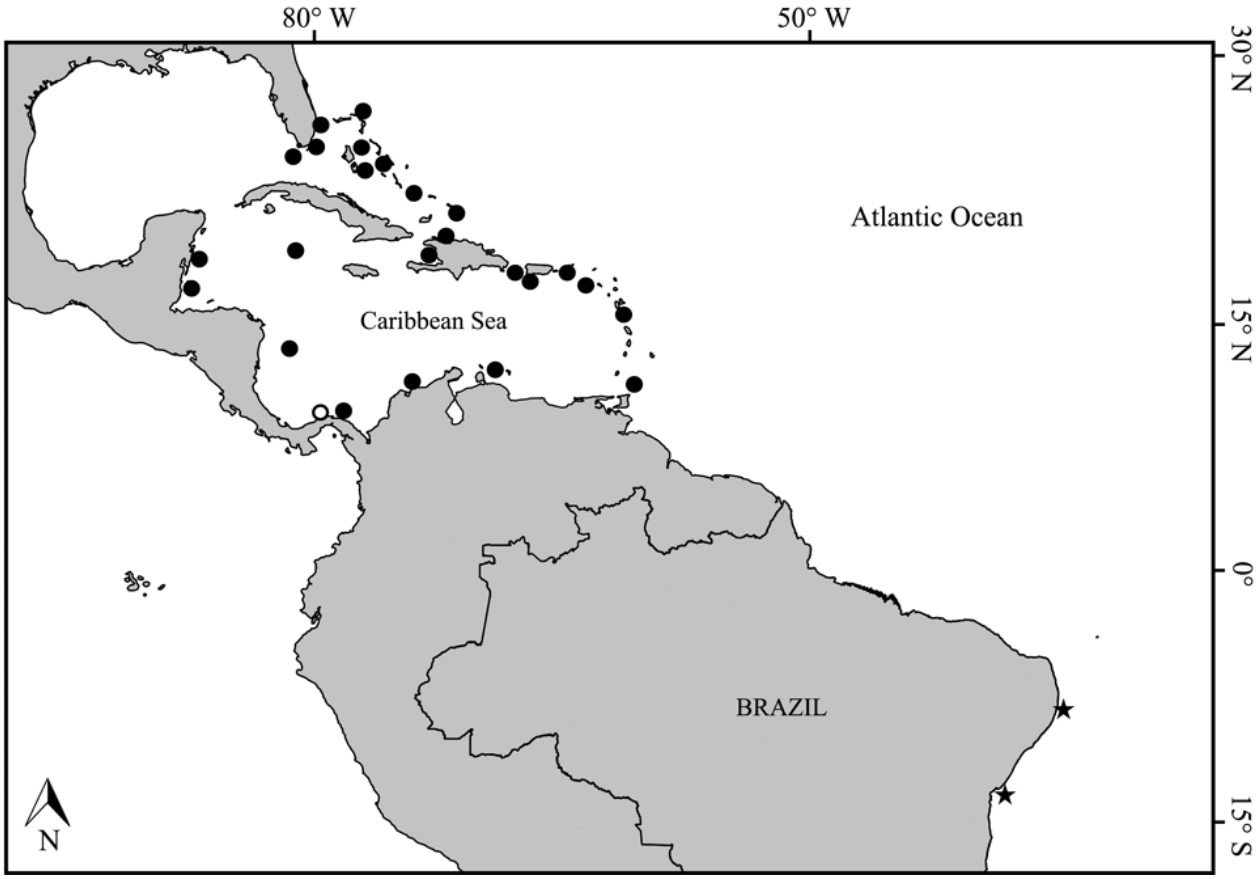

Figure 2. Distribution of *Petrotyx sanguineus* in the Atlantic Ocean, including: type locality (open circle), literature and museum records in the western Central Atlantic (black circles), and new records along northeast Brazilian coast (stars).

Dario, 2015. Summing up, the current list of ophidiiform fishes recorded in Brazilian waters, following Møller's et al. (2016) classification, includes 34 genera and 46 species: 9 species of Bythitidae (including *P. sanguineus*), 4 Carapidae, and 33 Ophidiidae. In a recent study, Pinheiro et al. (2018) reported the presence of 405 resident reef fish species in the western South Atlantic, of which 186 species (46%) are widely distributed in the western Atlantic. The occurrence of *P. sanguineus* in the northeastern Brazil represents another example of species shared by central and southwestern Atlantic reefs.

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Authors' Contributions

ACF collected specimens and photos; MMM and ACF identified the species; ABB, RAC and MMM collected morphological data; ABB, ACF, RAC and MMM wrote, revised and corrected the manuscript.

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