

Taxonomy and Distribution of Deep-Sea Bigscales and Whalefishes (Teleostei: Stephanoberycoidei) Collected off Northeastern Brazil, Including Seamounts and Oceanic Islands

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Despite the increasing number of studies on the systematics of the Stephanoberycoidei (bigscales, pricklefishes, gibberfishes, hispidoberycids, and whalefishes) globally, knowledge about the diversity and distribution of the group in the western South Atlantic still remains fragmentary. In this study, we present new anatomical (meristic and morphometric) and distributional data for 18 species of the Stephanoberycoidei based on the examination of 150 specimens recently collected during the ABRACOS (Acoustics along the BRAZilian COaSt) expeditions off northeastern Brazil, including the Rocas Atoll, Fernando de Noronha Archipelago, and the seamounts off Rio Grande do Norte State, and additional museum specimens. In the Melamphaidae, remarks on the taxonomy of *Melamphaes polylepis* and of the *Poromitra crassiceps* and *P. megalops* species groups are made based on specimens examined. In addition, *Scopeloberyx opercularis*, currently considered as a junior synonym of *Scopeloberyx robustus*, is recognized as a valid species. Among the species identified, nine have their distributions extended in the western South Atlantic based on confirmed records: *Melamphaes polylepis*, *M. typhlops*, *Poromitra megalops*, *Poromitra* sp., *Scopeloberyx opercularis*, *Scopeloberyx opisthopterus*, *Scopelogadus mizolepis*, *Cetostoma regani*, and *Rondeletia loricata*. Eight further species are reported for the first time in Brazilian waters: *Cetomimus* sp. 1, *Cetomimus* sp. 2, *Ditropichthys storeri*, *Gyrinomimus bruuni*, *Melamphaes eulepis*, *M. leprus*, *M. longivelis*, and *Melamphaes* sp. Additional remarks on the taxonomy and distribution of the Stephanoberycoidei in the western South Atlantic are also provided.

THE Stephanoberycoidei comprises 23 genera and about 94 species of mostly meso- and bathypelagic teleosts commonly known as bigscales, pricklefishes, gibberfishes, hispidoberycids, and whalefishes (Nelson et al., 2016; Fricke et al., 2020a). Fishes of this suborder usually have a short to moderately long and somewhat compressed body, the subocular shelf and orbitosphenoid are absent, basibranchial tooth plates are also absent, with the exception of the copular tooth plate in the Cetomimidae, ossification is reduced to thin laminar bones on the surface of an extensively cartilaginous neurocranium, the supramaxillae are absent or reduced, and the extrascapular, when present, is greatly enlarged, partially or entirely covering the parietal bone (Johnson and Patterson, 1993; Moore, 1993; Wiley and Johnson, 2010; Nelson et al., 2016).

Until recently, the Stephanoberycoidei was recognized as an order (Stephanoberyciformes), distinct from the Beryciformes (e.g., Johnson and Patterson, 1993; Nelson, 2006; Wiley and Johnson, 2010), but there is growing evidence indicating that the former is a subgroup of the latter based on both morphological (Stiassny and Moore, 1992; Moore, 1993) and molecular data (Miya et al., 2005; Near et al., 2012; Betancur-R. et al., 2013; Dornburg et al., 2017). Relationships within the Stephanoberycoidei are also contentious: the Melamphaidae, traditionally recognized as a family of the Stephanoberycoidei or Stephanoberyciformes (e.g., Johnson and Patterson, 1993; Moore, 1993; Wiley and Johnson, 2010), has been proposed as the sister group of the Berycidae in the Berycoidei (Miya et al., 2005; Near et al., 2012; Betancur-R. et al., 2013; Dornburg et al.,

2017). However, for purposes of this study, we follow Moore's (1993) traditional arrangement of the Stephanoberycoidei, including the families Melamphaidae, Stephanoberycidae, Hispidoberycidae, Gibberichthyidae, Rondeletiidae, Barbourisiidae, and Cetomimidae. The Mirapinnidae and Megalomycteridae, also traditionally included in the Stephanoberycoidei (e.g., Moore, 1993; Nelson, 2006), are no longer recognized as valid since members of those families are now regarded as larvae and males, respectively, of the Cetomimidae (Johnson et al., 2009; Nelson et al., 2016).

Several contributions have been made on the systematics and biogeography of the Stephanoberycoidei in the last decades (e.g., Ebeling, 1962; Ebeling and Weed, 1973; Keene, 1973, 1987; Keene et al., 1987; Paxton, 1989; Kotlyar, 1996, 1999, 2004a, 2004b, 2008a, 2011a, 2013, 2014, 2019; Merrett and Moore, 2005; Bartow, 2010; Mincarone et al., 2014). However, knowledge of the diversity and distribution of the group in the western South Atlantic remains fragmentary, despite the apparent relative abundance of some stephanoberycoids in deep-sea environments (Günther, 1887; Keene, 1987; Campos et al., 2008; Costa and Mincarone, 2010; Mincarone et al., 2014; Judkins and Haedrich, 2018). This study reports on new anatomical and taxonomic data of mostly rare species of the Stephanoberycoidei recently collected off northeastern Brazil. The extensively long Brazilian coastline (c. 7,500 km; e.g., Reis et al., 2016) and associated Exclusive Economic Zone (EEZ) encompasses a substantial portion of the Tropical western South Atlantic. Therefore, a review of the distribution of the species recorded

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Submitted: 7 May 2020. Accepted: 11 November 2020. Associate Editor: M. P. Davis.

© 2021 by the American Society of Ichthyologists and Herpetologists DOI: 10.1643/i2020069 Published online: 9 June 2021

in this study in the Brazilian EEZ is also provided, with references to additional records in the western South Atlantic.

MATERIALS AND METHODS

Most specimens examined in this study are part of a large collection of mesopelagic invertebrates and fishes sampled during the ABRACOS expeditions (Acoustics along the Brazilian Coast), carried out between 30 September and 20 October 2015 (ABRACOS 1–AB1; Bertrand, 2015), and between 9 April and 6 May 2017 (ABRACOS 2–AB2; Bertrand, 2017). Both expeditions were conducted by the French RV *Antea* off northeastern Brazil and included collections along the Fernando de Noronha Ridge (Rocas Atoll, Fernando de Noronha Archipelago, and seamounts off Rio Grande do Norte State). The survey comprised 82 fishing stations, between the surface and 1,113 m depth, and resulted in the collection of more than 9,000 fish specimens. Sampling was conducted using micronekton (body mesh 40–80 mm, cod-end mesh: 10 mm) and mesopelagic (body mesh: 30 mm, cod-end mesh: 4 mm) nets. Trawl depth was continuously recorded using a Scanmar depth sensor fitted on the upper part of the trawl mouth. An open-mouth net was employed, but pre-established target (maximum) depths were defined for each trawl according to the presence of an acoustic scattering layer or patches detected with a Simrad EK60 split-beam scientific echo sounder. At the target depths, trawling activity lasted for about 30 minutes. Therefore, collection of specimens most likely occurred at target depths, which are indicated as capture depths in the species accounts.

Measurements and counts followed Hubbs and Lagler (1947) with adjustments by Ebeling (1962) for the Melamphaidae and Paxton (1989) for the Cetomimidae. Cranial bone nomenclature followed Kotlyar (1991). Vertebrae and dorsal- and anal-fin ray counts were obtained through a Faxitron LX-60 Cabinet X-ray System. Unless stated otherwise, gill raker number refers to the total number of rakers in the first gill arch. Species identifications were based on descriptions and taxonomic keys provided by Goode and Bean (1895), Parr (1934, 1946), Harry (1952), Rofen (1959), Bigelow (1961), Ebeling (1962), Abe and Hotta (1963), Richardson and Garrick (1964), Abe et al. (1965), Maul (1969), Ebeling and Weed (1973), Fedorov et al. (1987), Paxton (1989), McEachran and Feckhelm (1998), Moore (2003), Paxton and Trnski (2003), Kotlyar (2004b, 2004c, 2005, 2008a, 2008b, 2009a, 2009b, 2009c, 2010, 2011a, 2011b, 2012a, 2012b, 2013, 2014, 2015a, 2015b, 2015c, 2016a, 2016b, 2016c, 2019, 2020), Iwasaki (2009), and Mincarone et al. (2014). Institutional abbreviations follow Sabaj (2020).

RESULTS

Melamphaidae

The Melamphaidae (big scales) is the largest family in the Stephanoberycoidei, comprising five genera and about 72 species of meso- and bathypelagic fishes (Ebeling and Weed, 1973; Kotlyar, 2004a, 2005, 2010, 2012b, 2013, 2016c). Species of the group are reported from all oceans except the Arctic and the Mediterranean Sea (Ebeling, 1962; Kotlyar, 2004b, 2004c, 2005, 2008a, 2008b, 2009b, 2009c, 2010,

2011a, 2011b, 2012a, 2012b, 2013, 2019; Moore, 2016; Sutton et al., 2020). Juveniles occur in shallow oceanic waters, whereas adults occur below 100–200 m to depths greater than 3,000 m (Ebeling, 1962; Keene, 1987; Kotlyar, 2004a; Mincarone et al., 2014). In the Brazilian EEZ, ten species of the Melamphaidae were previously recorded: *Melamphaes hubbsi*, *M. polylepis*, *M. typhlops*, *Poromitra crassiceps*, *P. megalops*, *Poromitra* sp., *Scopeloberyx opisthopterus*, *Scopeloberyx robustus*, *Scopelogadus beanii*, and *Scopelogadus mizolepis* (Günther, 1887; Keene, 1987; Campos et al., 2008; Costa and Mincarone, 2010; Mincarone et al., 2014; Judkins and Haedrich, 2018). Records of 11 species of the Melamphaidae in the western South Atlantic are provided, four of them new in the Brazilian EEZ.

Melamphaes eulepis Ebeling, 1962

Figure 1A, Table 1

Melamphaes eulepis Ebeling, 1962: 70 (type locality: off Ghana, 00°31'S, 11°02'W, about 200 m depth; holotype: ZMUC P41141).

Specimens examined.—NPM 5007, 3, 35.2–45.6 mm, RV *Antea*, sta. AB2/41A, 03°19'59.1"S, 32°24'42.1"W to 03°19'31.8"S, 32°25'04.6"W, 430 m, 26 April 2017, 2144–2206 h; NPM 5008, 3, 42.0–45.0 mm, sta. AB2/49A, 04°10'38.1"S, 33°16'07.4"W to 04°10'58.0"S, 33°15'03.8"W, 770–1020 m, 30 April 2017, 2117–2152 h; NPM 5009, 2, 41.5–45.1 mm (Fig. 1A), sta. AB2/53A, 03°48'58.7"S, 33°59'17.1"W to 03°50'05.8"S, 33°58'46.5"W, 610 m, 2 May 2017, 2208–2240 h; NPM 5224, 2, 45.5–46.8 mm, sta. AB2/54B, 03°45'17.2"S, 34°41'04.0"W to 03°44'39.2"S, 34°40'04.5"W, 830–1030 m, 3 May 2017, 1311–1347 h.

Diagnosis.—*Melamphaes eulepis* differs from all congeners by the presence of bone expansions on the head ridges. It also differs from all congeners, except *M. spinifer*, by having almost all body scales intact in preserved specimens. *Melamphaes eulepis* differs from *M. spinifer* by the number of pores in the angular portion of the cheek (3–4, usually 3 vs. 4–5, usually 5) and total number of vertebrae (28–30 vs. 26–29, usually 27; Kotlyar, 2016c).

Distribution.—*Melamphaes eulepis* has a circumtropical distribution, except for the eastern Pacific (Kotlyar, 2014). In the Atlantic Ocean, the species is reported between 27°N and 7°S, including the Gulf of Mexico and the Caribbean Sea (Ebeling, 1962; Keene, 1987; Kotlyar, 2014; Moore, 2016; Sutton et al., 2020). In the western South Atlantic, the species was previously known based on a single record made southeast of São Pedro e São Paulo Archipelago (ISH 606/66—01°24'S, 26°W; Keene, 1987). The ten specimens reported herein therefore represent further confirmation of the occurrence of the species in the western South Atlantic and the first records in Brazilian waters. They were collected off the Fernando de Noronha Archipelago, Rocas Atoll, and near the seamounts off Rio Grande do Norte State, at depths ranging between 430 and 1,030 m (Fig. 2).

Habitat.—*Melamphaes eulepis* is a mesopelagic species, with adults and juveniles occurring at a minimum depth of 150 and 200 m, whereas adults probably occur below 700 m at night (Ebeling, 1962; Keene, 1987).

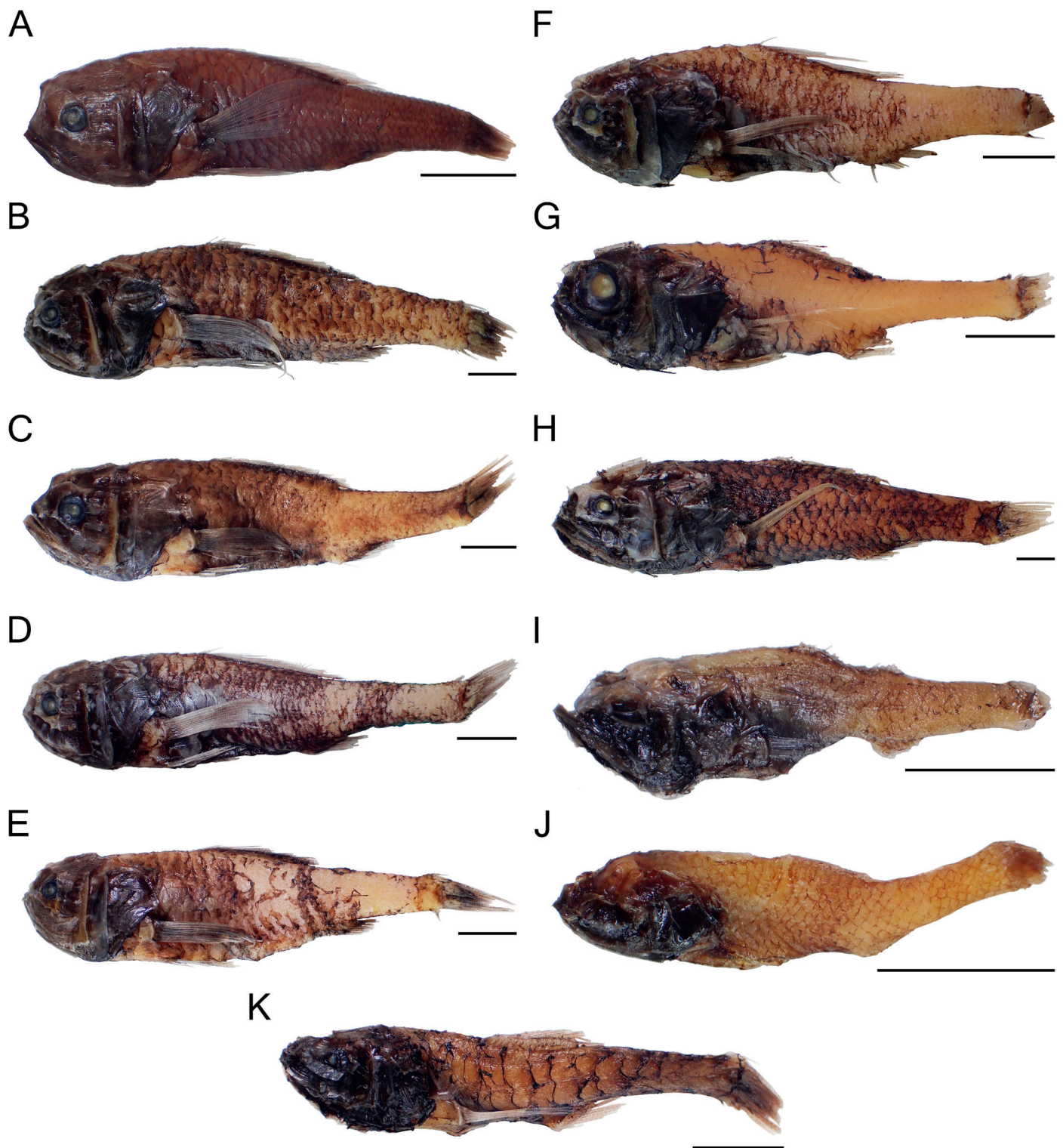


Fig. 1. Species of Melamphidae reported in this study: (A) *Melamphaes eulepis*, NPM 5009, 45.1 mm SL; (B) *Melamphaes leprus*, NPM 5227, 90 mm SL; (C) *Melamphaes longivelis*, NPM 5229, 75.2 mm SL; (D) *Melamphaes polylepis*, NPM 5228, 49.0 mm SL; (E) *Melamphaes typhlops*, NPM 5225, 60.3 mm SL; (F) *Melamphaes* sp., NPM 5826, 61.9 mm SL; (G) *Poromitra megalops*, NPM 5632, 57.0 mm SL; (H) *Poromitra* sp., NPM 5331, 120.0 mm SL; (I) *Scopeloberyx opercularis*, NPM 5987, 32.0 mm SL; (J) *Scopeloberyx opisthopterus*, NPM 5985, 25.0 mm SL; (K) *Scopelogadus mizolepis*, NPM 5990, 49.0 mm SL. Scale bar = 1 cm.

Table 1. Morphometric and meristic data of species of *Melamphaes* reported in this study.

Species	<i>M. eulepis</i>	<i>M. leprus</i>	<i>M. longivelis</i>	<i>M. polylepis</i>	<i>M. typhlops</i>	<i>Melamphaes</i> sp.
<i>n</i>	10	1	2	37	7	1
Standard length (SL, mm)	35.2–46.8	90.0	73.8–75.2	36–70.2	37.3–71.0	61.9
Measurements in % SL						
Head length	36.9–40.0	35.6	36.0–36.7	31.6–39.9	33.7–35.1	34.9
Head width	18.3–21.1	17.1	16.9	14.5–17.5	15.3–17.5	16.2
Eye diameter	5.3–6.0	4.8	6.2–6.3	3.9–5.6	4.1–5.5	4.8
Postorbital length	23.2–26.7	22.3	23.5–24.7	20.0–25.1	22.4–22.8	22.9
Snout length	9.1–10.3	8.6	8.4–9.4	6.9–9.3	7.5–8.6	8.1
Upper jaw length	17.2–18.8	17.0	18.0–18.1	14.5–17.6	16.6–18.2	16.5
Body depth	27.7–31.5	24.4	25.9	21.3–27.6	23.0–26.1	25.8
Prepectoral length	34.7–40.7	36.8	37.2–38.3	32.0–36.9	33.6–35.7	35.1
Prepelvic length	34.4–43.1	37.7	38.6–39.9	34.7–39.7	36.6–39.5	–
Predorsal length	43.7–49.9	43.1	41.3–42.8	40.6–45.4	39.9–42.6	43.3
Preal length	62.5–73.8	63.9	71.8–74.8	60.6–71.1	70.0–72.6	67.9
Dorsal-fin base length	25.6–31.6	30.6	29.4–30.6	22.9–29.0	23.5–28.7	26.2
Anal-fin base length	7.7–11.1	11.1	8.9–10.2	8.0–11.4	7.3–10.0	9.7
Caudal peduncle length	22.7–25.5	23.1	21.4–23.0	21.3–30.6	17.9–24.1	26.3
Caudal peduncle depth	9.3–10.5	9.6	9.3–9.5	7.8–10.1	7.9–9.7	9.7
Counts						
Gill rakers (upper + angle and lower)	4+13–14	6+16	4+14	5–6+15–17	4+11–13	5+15
Gill rakers (total)	17–18	22	18	20–23	16–17	20
Dorsal-fin rays	III, 14–16	III, 15	III, 17–18	III, 13–15	III, 15	III, 14
Anal-fin rays	1, 8	1, 8	1, 8	1, 7–8	1, 8	1, 8
Pectoral-fin rays	15	15	15	14–15	15	15
Pelvic-fin rays	1, 7	1, 7	1, 7	1, 7	1, 7	1, 8
Principal caudal rays (upper/lower)	8–10/8–9	10/9	9/8–9	8–11/7–10	8–10/8–9	10/9
Procurent caudal rays (upper/lower)	3–4/3	4/4	5/3	–	–	–
Vertebrae (precaudal + caudal)	12–13+16–18	11+16	12+17	11+17–19	12–13+14–16	11+18
Vertebrae (total)	28–30	27	29	28–30	26–28	29

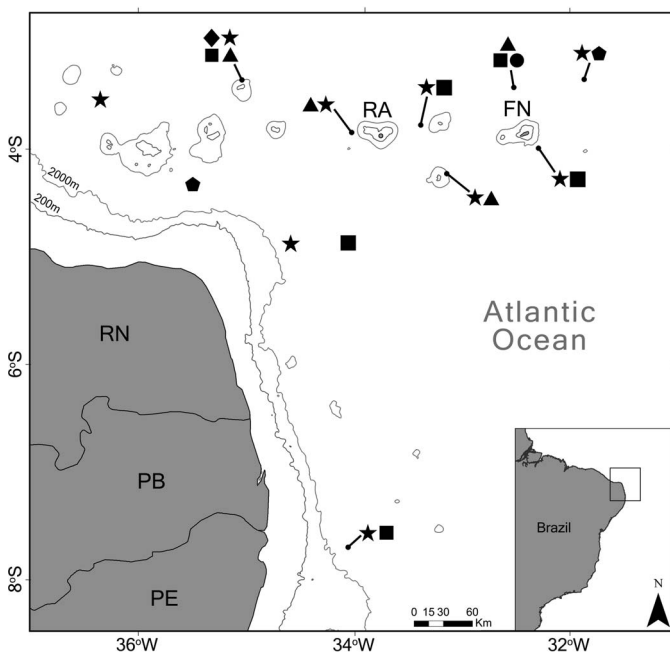


Fig. 2. Records of *Melamphaes eulepis* (triangle), *M. leprus* (circle), *M. longivelis* (pentagon), *M. polylepis* (star), *M. typhlops* (square), and *Melamphaes* sp. (diamond) off northeastern Brazil collected during the ABRACOS surveys. Tip of arrow indicates same collection locality for different species. FN–Fernando de Noronha Archipelago; PB–Paraíba; PE–Pernambuco; RA–Rocas Atoll; RN–Rio Grande do Norte.

Melamphaes leprus Ebeling, 1962

Figure 1B, Table 1

Melamphaes leprus Ebeling, 1962: 60 (type locality: north of Ascension Island, 03°45'S, 10°00'W, about 350 m depth; holotype: ZMUC P41172).

Specimen examined.—NPM 5227, 1, 90 mm (Fig. 1B), RV *Antea*, sta. AB2/41A, 03°19'59.1"S, 32°24'42.1"W to 03°19'31.8"S, 32°25'04.6"W, 430 m, 26 April 2017, 2144–2206 h.

Diagnosis.—*Melamphaes leprus* differs from all congeners, except *M. falsidicus*, *M. macrocephalus*, *M. pachystomus*, and *M. polylepis*, by having 20 or more gill rakers (rarely 19), width near the median region of the larger gill rakers approximately equal to the space between rakers, I, 7 pelvic-fin rays, posttemporal spine absent, and presence simultaneously of 14–15 rays in the pectoral fin and 11 precaudal vertebrae. *Melamphaes leprus* differs from *M. macrocephalus* by the number of transverse series of scales (31–33 vs. 25–28) and by the relative position of the pelvic and pectoral fins (pelvic fin originates after pectoral-fin origin vs. pelvic-fin origin is anterior to pectoral-fin origin). It differs from *M. falsidicus* and *M. polylepis* by the absence of spurs on the haemal arch of the first caudal vertebra (vs. spurs present), and from *M. pachystomus* by the anal-fin origin (in line with the third or fourth dorsal-fin ray, counting from the last ray vs. posterior to the last dorsal-fin

ray) and by the number of vertebrae (27 vs. 28–29; Kotlyar, 2011b, 2012b).

Distribution.—Ebeling (1962) described *Melamphaes leprus* based on ten specimens from the eastern Tropical Atlantic, collected between 11°N and 4°S. Subsequently, Keene (1987) reported a wider distribution for the species in the Atlantic, from 17°N to 13°S, and from 29°W to 11°E, with only three records in the western South Atlantic. Kotlyar (2011b) also reported on a single specimen from the Gulf of Guinea, eastern Atlantic. The single specimen reported herein was collected off the Fernando de Noronha Archipelago, at 430 m depth, and represents the fourth record of the species in the western South Atlantic and the first record in Brazilian waters (Fig. 2).

Habitat.—*Melamphaes leprus* is a meso- to bathypelagic species, with juveniles and half-grown specimens captured at the upper limit of the mesopelagic zone, between 150 and 300 m at night (Ebeling, 1962). One adult specimen was captured in bottom trawling at 1,550 m depth (Kotlyar, 2011b).

***Melamphaes longivelis* Parr, 1933**

Figure 1C, Table 1

Melamphaes microps longivelis Parr, 1933: 16 (type locality: off Acklins Island, Bahama, western Atlantic, 22°31'N, 74°26'W, 10,000 feet [3048 m] wire out; holotype: YPM 2833).

Specimens examined.—NPM 5229, 1, 75.2 mm (Fig. 1C), RV *Antea*, sta. AB2/42A, 03°15'28.1"S, 31°48'29.1"W to 03°15'27.8"S, 31°50'40.6"W, 780 m, 27 April 2017, 1223–1226 h; NPM 5230, 1, 73.8 mm, sta. AB2/35, 04°19'36.6"S, 35°29'51.6"W to 04°18'32.4"S, 35°32'19.8"W, 630 m, 20 April 2017, 2235–2315 h.

Diagnosis.—*Melamphaes longivelis* differs from all congeners, except *M. eulepis* and *M. spinifer*, by having 17–19 (more often 18) gill rakers, width near the median region of the larger gill rakers less than three-quarters of the space between the rakers, eye diameter equal to or larger than the suborbital bone width, anal-fin origin in line with or posterior to the last dorsal-fin ray origin (less than the width of one scale pocket), caudal peduncle depth substantially more than two times in the caudal peduncle length, and III, 17–18 dorsal-fin rays. *Melamphaes longivelis* differs from *M. eulepis* and *M. spinifer* by having less than half (rarely more) body scales present in preserved specimens (vs. all, or almost all, body scales present in preserved specimens; Kotlyar, 2015a, 2016c).

Distribution.—*Melamphaes longivelis* occurs in the Atlantic Ocean, with confirmed records restricted to the eastern and western North Atlantic (Kotlyar, 2015a; Sutton et al., 2020) and the eastern South Atlantic (Sutton et al., 2020). Keene (1987) reported two specimens of *M. longivelis* in the western South Atlantic off southeastern São Pedro e São Paulo Archipelago, but his report was made before Kotlyar's (2015a) revision of the species complex. Therefore, the two specimens collected off the Fernando de Noronha Archipelago and off Rio Grande do Norte State, between depths of 630 and 780 m (Fig. 2) represent the first confirmed records

of *M. longivelis* in the western South Atlantic. Records of the species in the region prior to Kotlyar's (2015a) revision (e.g., Ebeling, 1962; Moore, 2003) require confirmation.

Habitat.—*Melamphaes longivelis* is a mesopelagic species, with juveniles recorded in depths shallower than 150 m and adults below 500 m (Ebeling, 1962; Keene, 1987; Kotlyar, 2015a).

***Melamphaes polylepis* Ebeling, 1962**

Figure 1D, Table 1

Melamphaes polylepis Ebeling, 1962: 43 (type locality: South of Sri Lanka, 05°21'N, 80°38'E, about 2250 m depth; holotype: ZMUC P41178).

Specimens examined.—NPM 5228, 2, 49.0–60.5 mm (Fig. 1D), RV *Antea*, sta. AB2/42A, 03°15'28.1"S, 31°48'29.1"W to 03°15'27.8"S, 31°50'40.6"W, 780 m, 27 April 2017, 1223–1226 h; NPM 5231, 2, 46.3–57.6 mm, sta. AB2/60B, 03°31'43.0"S, 36°21'19.8"W to 03°31'46.8"S, 36°22'25.7"W, 670–700 m, 6 May 2017, 1249–1319 h; NPM 5233, 4, 59.0–67.3 mm, sta. AB2/52A, 03°43'16.2"S, 33°25'09.8"W to 03°42'14.2"S, 33°24'36.2"W, 822–984 m, 2 May 2017, 1147–1218 h; NPM 5234, 2, 52.6–56.8 mm, sta. AB2/16, 07°36'15.0"S, 33°59'30.0"W to 07°36'49.3"S, 33°57'18.7"W, 680 m, 14 April 2017, 2153–2239 h; NPM 5237, 8, 60.5–69.0 mm, sta. AB2/44A, 03°52'52.5"S, 32°17'33.3"W to 03°52'13.4"S, 32°16'28.0"W, 850 m, 28 April 2017, 1244–1317 h, 1244–1317 h; NPM 5238, 4, 64.1–66.4 mm, sta. AB2/53A, 03°48'58.7"S, 33°59'17.1"W to 03°50'05.8"S, 33°58'46.5"W, 610 m, 2 May 2017, 2208–2240 h; NPM 5239, 2, 36.0–66.0 mm, sta. AB2/49A, 04°10'38.1"S, 33°16'07.4"W to 04°10'58.0"S, 33°15'03.8"W, 770–1020 m, 30 April 2017, 2117–2152 h; NPM 5241, 2, 37.0–60.6 mm, sta. AB2/54B, 03°45'17.2"S, 34°41'04.0"W to 03°44'39.2"S, 34°40'04.5"W, 830–1030 m, 3 May 2017, 1311–1347 h; NPM 5242, 11, 58.2–70.2 mm, sta. AB2/39, 04°52'26.9"S, 34°35'22.9"W to 04°50'52.8"S, 34°51'04.7"W, 650–800 m, 24 April 2017, 2149–2237 h.

Diagnosis.—*Melamphaes polylepis* differs from all congeners, except *M. falsidicus*, *M. macrocephalus*, *M. pachystomus*, and *M. leprus*, by having 20 or more (rarely 19) gill rakers, width near the median region of the larger gill rakers approximately equal to the space between rakers, 1,7 pelvic-fin rays, posttemporal spine absent, and presence simultaneously of 14–15 pectoral-fin rays and 11 precaudal vertebrae. *Melamphaes polylepis* differs from *M. falsidicus* by the number of transverse series of scales (30–36 vs. 29–30) and the eye diameter (10.0–16.3% HL vs. 16.4–19.2% HL). It differs from *M. leprus*, *M. macrocephalus*, and *M. pachystomus* by the presence of spurs on the haemal arch of the first caudal vertebra (vs. spurs absent; Kotlyar, 2011b, 2012b).

Distribution.—*Melamphaes polylepis* has a circumglobal distribution, except for the eastern Pacific Ocean (Kotlyar, 2011b). It was originally reported from the North Atlantic between the equator and 20°N, the Indian Ocean and Indonesia between 15°N and 15°S, and the North Pacific between 34°N and 6°N (Ebeling, 1962). Ebeling (1962) also reported the species from the South Pacific, at 30°56'S, 109°17'W, based on a single specimen that might actually represent *M. pachystomus* (Kotlyar, 2011b). Keene (1987) recorded *M.*

polylepis from 32°N to 18°S in the Atlantic Ocean, including the southeastern Caribbean Sea and the western South Atlantic, from eastern São Pedro e São Paulo Archipelago to northern Trindade Island (ISH 484/66, 17°36'S, 28°53'W), off the central Brazilian coast. Further records of the species in Brazil were also made off Bahia and Espírito Santo States based on two specimens collected between depths of 837 and 1,051 m (Mincarone et al., 2014), and off northeastern Brazil (Eduardo et al., 2020a). The 37 specimens examined here were collected off Pernambuco State, the Fernando de Noronha Archipelago, the Rocas Atoll, and the seamounts off Rio Grande do Norte State, between depths of 610 and 1,030 m (Fig. 2).

Habitat.—*Melamphaes polylepis* is a meso- and bathypelagic species, with specimens captured by open-mouth nets at depths down to 4,228 m (Ebeling, 1962; Keene, 1987; Keene et al., 1987; Kotlyar, 2011b). According to Ebeling (1962), juveniles and subadults probably occur at depths below 200–300 m. Keene (1987) reported on vertical migration of juveniles between 500 and 800 m during the day, and mainly between 100 and 400 m at night.

Remarks.—In his unpublished Ph.D. dissertation, Keene (1987) described “*Melamphaes indicoides*” based on specimens collected in the Atlantic. The species, which was never formally described and is, therefore, not valid, is morphologically similar to *M. polylepis*, differing by the number of diagonal series of scales (8 vs. 9–10, respectively). Subsequently, Bartow (2010), based on the examination of only five specimens, proposed that “*Melamphaes indicoides*” and *M. polylepis* might also differ by the following characters (numbers in brackets refer to mode values for counts or mean values for measurements): number of dorsal- (III,15–16 [III,15] vs. III,13–15 [III,14]) and caudal-fin rays (25–27 [25] vs. 27–29 [28]), number of gill rakers on the first gill arch (20 vs. 20–23 [21]), number of scale in horizontal series (25–31 [28] vs. 33–35 [34]), number of scales in diagonal row (5–8 [7] vs. 8–10 [9]), HL (29.76–32.44% [30.92%] SL vs. 35.0–41.4% [37.5%] SL), distance between the end of dorsal fin to caudal-fin origin (27.38–32.83% [30.37%] SL vs. 33.1–36.6% [35.0%] SL), postanal length (25.56–30.77% [28.43%] SL vs. 35.6–41.3% [38.1%] SL), orbit to cheek angle length (10.77–13.75% [12.68%] SL vs. 9.6–11.7% [10.8%] SL), and caudal peduncle length (19.72–23.21% [21.21%] SL vs. 26.6–30.7% [28.3%] SL). The specimens recognized as *M. polylepis* in the current study are partially damaged but might represent the same species provisionally named by Keene (1987) as “*Melamphaes indicoides*.” More in-depth taxonomic studies in the *M. polylepis* species complex are necessary.

***Melamphaes typhlops* (Lowe, 1843)**

Figure 1E, Table 1

Metopias typhlops Lowe, 1843: 90 (type locality: off Madeira; neotype: BMNH 1864.11.8.1 [designated by Ebeling, 1962]).

Specimens examined.—NPM 5225, 1, 60.3 mm (Fig. 1E), RV *Antea*, sta. AB2/54B, 03°45'17.2"S, 34°41'04.0"W to 03°44'39.2"S, 34°40'04.5"W, 830–1030 m, 3 May 2017, 1311–1347 h; NPM 5226, 1, 37.3 mm, sta. AB2/41A, 03°19'59.1"S, 32°24'42.1"W to 03°19'31.8"S, 32°25'04.6"W, 430 m, 26 April 2017, 2144–2206 h; NPM 5232, 1, 65.7 mm,

sta. AB2/52A, 03°43'16.2"S, 33°25'09.8"W to 03°42'14.2"S, 33°24'36.2"W, 822–984 m, 2 May 2017, 1147–1218 h; NPM 5235, 1, 61.6 mm, sta. AB2/16, 07°36'15.0"S, 33°59'30.0"W to 07°36'49.3"S, 33°57'18.7"W, 680 m, 14 April 2017, 2153–2239 h; NPM 5236, 1, 68.2 mm, sta. AB2/44A, 03°52'52.5"S, 32°17'33.3"W to 03°52'13.4"S, 32°16'28.0"W, 850 m, 28 April 2017, 1244–1317 h; NPM 5240, 2, 67.5–71.0 mm, sta. AB2/39, 04°52'26.9"S, 34°03'32.3"W to 04°50'52.8"S, 34°05'06.5"W, 650–800 m, 24 April 2017, 2149–2237 h.

Diagnosis.—*Melamphaes typhlops* differs from congeners, except *M. contradictorius*, *M. eurous*, *M. inconspicuus*, *M. indicus*, *M. janae*, *M. kobylyanskyi*, *M. longivelis*, *M. parvus*, *M. proximus*, and *M. succedaneus*, by having 19 or fewer (rarely 20) gill rakers, width near the median region of the larger gill rakers less than three-quarters of the space between rakers, eye diameter equal to or larger than suborbital bone width, anal-fin origin posterior to the vertical through the last dorsal-fin ray origin, and less than half of body with scales present in preserved specimens (rarely more). *Melamphaes typhlops* differs from *M. contradictorius*, *M. inconspicuus*, *M. janae*, *M. kobylyanskyi*, *M. longivelis*, *M. parvus*, *M. proximus*, and *M. succedaneus* by the distance between anal-fin origin and the vertical through the last dorsal-fin ray origin (usually equal to the width of one to one and a half scale pocket vs. less than the width of one scale pocket) and number of gill rakers on the lower portion of the first gill arch (10–11 vs. 12–14 [a single specimen with 12 in the present study]). It differs from *M. eurous* and *M. indicus* by having gill rakers of the fourth branchial arch present as reduced, flat or slightly convex, patches (vs. gill rakers of the fourth branchial arch in the shape of short knobs; Kotlyar, 2016a, 2016c; this study).

Distribution.—*Melamphaes typhlops* occurs in the Atlantic Ocean, from 41°N to 28°S, including the Gulf of Mexico (Ebeling, 1962; Keene, 1987; Keene et al., 1987; Kotlyar, 2016a; Moore, 2016; Sutton et al., 2020). In the western South Atlantic, the species was previously known from 22 specimens collected off southern São Pedro e São Paulo Archipelago and off the central to southeastern Brazilian coast, with some records inside the country's EEZ (Keene, 1987; Mincarone et al., 2014). Seven specimens collected between depths of 430 and 1,030 m off the Fernando de Noronha Archipelago, the Rocas Atoll, the seamounts off Rio Grande do Norte State, and off Rio Grande do Norte and Pernambuco States are reported here (Fig. 2).

Habitat.—*Melamphaes typhlops* is a meso- to bathypelagic species, with post-larvae captured between the surface and down to 100 m, juveniles between depths of 150 and 1,000 m, and adults below 500 m (Ebeling, 1962; Keene et al. 1987; Kotlyar, 2016a).

***Melamphaes* sp.**

Figure 1F, Table 1

Specimen examined.—NPM 5826, 1, 61.9 mm (Fig. 1F), RV *Antea*, sta. AB2/54B, 03°45'17.2"S, 34°41'04.0"W to 03°44'39.2"S, 34°40'04.5"W, 830–1030 m, 3 May 2017, 1311–1347 h.

Diagnosis.—The only specimen identified here as *Melamphaes* sp. differs from all other species of the genus, except *M. ebelingi*, *M. nikolayi*, and *M. oclusus*, by the number of pelvic-

Table 2. Morphometric and meristic data of species of *Poromitra*, *Scopeloberyx*, and *Scopelogadus* reported in this study.

Species	<i>Poromitra megalops</i>	<i>Poromitra</i> sp.	<i>Scopeloberyx opercularis</i>	<i>Scopeloberyx opisthopterus</i>	<i>Scopelogadus mizolepis</i>
<i>n</i>	28	27	1	4	19
Standard length (SL, mm)	25.0–59.0	48.0–121.0	32.0	25.0–32.0	37.0–70.0
Measurements in % SL					
Head length	32.9–39.7	39.3–44.8	39.0	29.0	34.8–38.6
Head width	11.7–14.5	12.8–16.1	—	—	—
Eye diameter	8.8–12.7	4.3–6.8	6.3	—	—
Postorbital length	17.3–23.0	23.7–28.3	—	—	—
Snout length	4.5–6.9	8.8–11.3	—	—	8.0–10.7
Upper jaw length	13.2–18.3	16.4–19.2	—	—	—
Body depth	22.3–26.7	20.7–26.3	—	—	20.4–22.9
Prepectoral length	35.6–41.3	39.6–47.2	43.8	—	35.2–43.0
Prepelvic length	32.0–36.3	39.8–44.5	—	—	36.9–39.8
Predorsal length	42.0–46.3	44.7–50.8	—	—	41.4–44.8
Preanal length	55.1–62.7	61.9–72.8	—	—	57.6–60.2
Dorsal-fin base length	20.8–25.0	23.6–28.9	—	—	17.6–20.2
Anal-fin base length	8.4–11.8	8.7–12.2	—	—	9.0–11.1
Caudal peduncle length	28.9–34.4	19.4–25.3	22.8	—	29.1–34.9
Caudal peduncle depth	5.8–7.6	7.7–10.0	—	—	8.1–9.4
Counts					
Gill rakers (upper + angle and lower)	6–8+16–20	9–11+21–23	18+8	3–4+11–13	7–8+15–17
Gill rakers (total)	23–27	30–34	26	14–17	22–25
Dorsal-fin rays	II–III, 11–12	III, 11–12	—	—	II, 11
Anal-fin rays	I, 9	I, 8	I, 7	—	I, 8
Pectoral-fin rays	12–14	14–15	—	—	13–14
Pelvic-fin rays	I, 7	I, 7	—	I, 7–8	—
Principal caudal rays (upper/lower)	10/8–10	9–10/9–10	—	—	—
Procurrent caudal rays (upper/lower)	3/3	3/3	—	—	—
Vertebrae (precaudal + caudal)	10+19–20	10–11+15–17	—	—	—
Vertebrae (total)	29–30	26–27	26	25	24–25

fin rays (I,8 vs. I,7). *Melamphaes* sp. differs from *M. ebelingi* by the number of vertebrae (29 vs. 26–27) and by the presence of spurs on the haemal arch of the first caudal vertebra (vs. spurs absent). It differs from *M. occlusus* by the number of gill rakers (20 vs. 22) and by the number of dorsal-fin rays (III,14 vs. III,16), and from *M. nikolayi* by the presence of spurs on the haemal arch of the first caudal vertebra (vs. spurs absent) and by the number of precaudal vertebrae (11 vs. 12; Ebeling, 1962; Keene, 1973; Bartow, 2010; Kotlyar, 2012b). Kotlyar (2015c) reported on the occurrence of one spine and eight soft rays in one side of the pelvic fin of a single specimen of *M. lentiginosus* (typical condition: I,7 pelvic-fin rays), but the specimen reported in the present study differs from *M. lentiginosus* by the number of gill rakers (20 vs. 15–17; Table 1).

Distribution.—Known only from a single specimen, collected near the seamounts off Rio Grande do Norte State, between depths of 830 and 1,030 m (Fig. 2).

Remarks.—This specimen most likely belongs to a new species, which will be described in a forthcoming study.

Poromitra megalops (Lütken, 1878)

Figure 1G, Table 2

Melamphaes megalops Lütken, 1878: 176 (type-locality: south of Azores, eastern North Atlantic [stomach content]; holotype: ZMUC 84).

Specimens examined.—NPM 5632, 9, 32.5–57.0 mm (Fig. 1G), RV *Antea*, sta. AB2/53A, 03°48'58.7"S, 33°59'17.1"W to 03°50'05.8"S, 33°58'46.5"W, 610 m, 2 May 2017, 2208–2240 h; NPM 5927, 2, 46.5–53.0 mm, sta. AB2/52A, 03°43'16.2"S, 33°25'09.8"W to 03°42'14.2"S, 33°24'36.2"W, 822–984 m, 2 May 2017, 1147–1218 h; NPM 5928, 1, 53.0 mm, sta. AB2/49A, 04°10'38.1"S, 33°16'07.4"W to 04°10'58.0"S, 33°15'03.8"W, 770–1020 m, 30 April 2017, 2117–2152 h; NPM 5929, 1, 54.5 mm, sta. AB2/39, 04°52'26.9"S, 34°03'32.3"W to 04°50'52.8"S, 34°05'06.5"W, 650–800 m, 24 April 2017, 2149–2237 h; NPM 5931, 2, 33.0–42.0 mm, sta. AB2/35, 04°19'36.6"S, 35°29'51.6"W to 04°18'32.4"S, 35°32'19.8"W, 630 m, 20 April 2017, 2235–2315 h; NPM 5933, 5, 35.0–59.0 mm, sta. AB2/44A, 03°52'52.5"S, 32°17'33.3"W to 03°51'43.6"S, 32°16'20.0"W, 850 m, 28 April 2017, 1244–1317 h; NPM 5937, 1, 34.0 mm, sta. AB2/59A, 03°38'01.6"S, 36°03'10.6"W to 03°38'07.9"S, 36°02'22.6"W, 700–1113 m, 5 May 2017, 2157–2237 h; NPM 5938, 6, 47.0–59.0 mm, sta. AB2/54B, 03°45'17.2"S, 34°41'04.0"W to 03°44'39.2"S, 34°40'04.5"W, 830–1030 m, 3 May 2017, 1311–1347 h; NPM 6089, 1, 25.0 mm, sta. AB1/22, 04°07'44.8"S, 33°47'24.5"W to 04°07'00.7"S, 33°48'57.9"W, 525 m, 8 October 2015, 2132–2212 h.

Diagnosis.—*Poromitra megalops* differs from all congeners, except *P. jucunda* and *P. macropthalma*, by the eye diameter (2.9–3.2 in HL vs. 4.0–17.2 in HL; Kotlyar, 2010). According to Kotlyar (2010), *P. megalops* differs from *P. macropthalma* by the number of gill rakers (26–28 vs. 21–24), in addition to

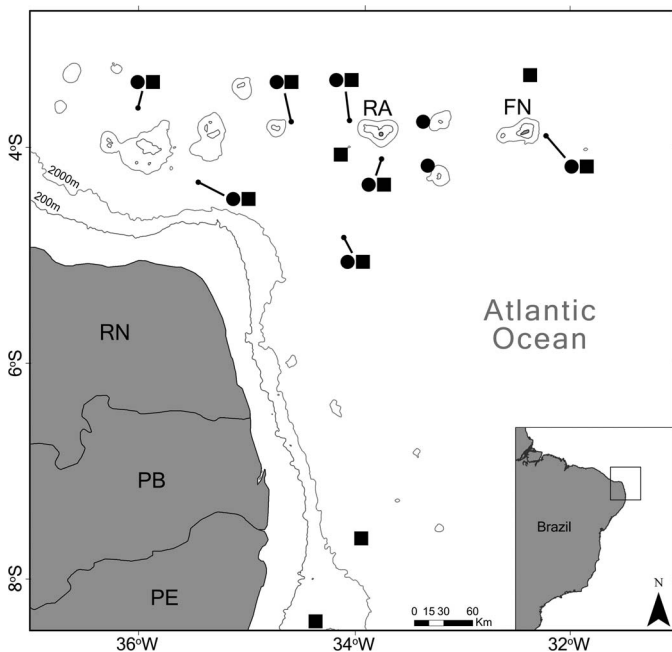


Fig. 3. Records of *Poromitra megalops* (circle) and *Poromitra* sp. (square) off northeastern Brazil collected during the ABRACOS surveys. Tip of arrow indicates same collection locality for both species. FN—Fernando de Noronha Archipelago; PB—Paraíba; PE—Pernambuco; RA—Rocas Atoll; RN—Rio Grande do Norte.

number of pyloric caeca (6 vs. 4–5), number of spines on the posterior margin of the preopercle (2–15 vs. 0–1), and width of the angular region of the preopercle (11.6–13.4% HL vs. 7–12% HL), and from *P. jucunda* also by the number of gill rakers (26–28 vs. 23–25; but see Remarks, below).

Distribution.—*Poromitra megalops* has a circumtropical distribution, being more common in the eastern Atlantic, Indo-Pacific and eastern Central Pacific (Ebeling and Weed, 1973; Keene, 1987; Moore, 2016; Sutton et al., 2020). Previous records in the western South Atlantic were restricted to nine specimens collected off southeastern São Pedro e São Paulo Archipelago and by one further isolated record made at 32°49'S, 26°26'W (Keene, 1987; Judkins and Haedrich, 2018). The species was also recorded off Ascension Island, middle Atlantic, based on two specimens (Keene, 1987). Ebeling and Weed (1973) reported intraspecific variation between populations from the Atlantic and eastern Central Pacific and those of the Indo-Pacific. Kotlyar (2010), however, proposed that those different populations should be recognized as distinct species, restricting *P. megalops* to the Atlantic, except the western South Atlantic (see Remarks, below). In Brazilian waters, the species was previously reported off São Pedro e São Paulo Archipelago (01°20'S, 27°37'W; 01°44'S, 27°44'W; Keene, 1987; Judkins and Haedrich, 2018). In the current study, *P. megalops* is reported from 28 specimens collected off the Fernando de Noronha Archipelago, the Rocas Atoll, and from the seamounts off Rio Grande do Norte State, between depths of 525 and 1,113 m. This also represents the largest single collection of *P. megalops* in the western South Atlantic made to date (Fig. 3).

Habitat.—The species is meso- to bathypelagic, with adults usually occurring below depths of 400–500 m (maximum

depth 1,113 m; this study). Juveniles and post-larvae occur in shallow waters down to 150–200 m (Ebeling and Weed, 1973; Keene, 1987; Keene et al., 1987).

Remarks.—*Poromitra macrophthalmma* was recognized as valid until recently, when Ebeling and Weed (1973) proposed that the species is a junior synonym of *P. megalops*. According to them, specimens previously assigned to *P. macrophthalmma* would represent a different morphotype of *P. megalops* restricted to the Indo-Pacific, only slightly distinct from the Atlantic and middle to eastern Pacific remaining population of the species in the number of anal-fin rays (1,8–10 vs. 1,9–10), number of gill rakers in the lower portion of the first gill arch (14–18 vs. 16–20), number of vertebrae (26–28 vs. 28–30), and number of dorsal-fin spines (usually II vs. usually III). Subsequently, Kotlyar (2010) revalidated *P. macrophthalmma*, restricting its distribution to the Indo-Pacific. He furthermore restricted the distribution of *P. megalops* to the Atlantic and described *P. jucunda* from the Central and eastern Pacific. According to Kotlyar (2010), *P. megalops* differs from *P. jucunda* by the eye diameter (31.3–34.0% HL vs. 24.2–32.6% HL) and number of gill rakers (26–28 vs. 23–25). However, eye diameter of some specimens of *P. megalops* from the Atlantic examined by Keene (1987) is also around 20% HL, with number of gill rakers ranging from 22 to 28. The eye diameter and gill raker counts of some specimens identified herein as *P. megalops* also fall within the range proposed by Kotlyar (2010) for *P. jucunda* (eye diameter 24.3–37.5% HL and number of gill rakers on the first branchial arch 23–27; Table 2). Separation between *P. megalops* and *P. macrophthalmma sensu* Kotlyar (2010) is also problematic. According to Kotlyar (2010), *P. megalops* differs from *P. macrophthalmma* by the following characters: number of gill rakers (26–28 vs. 21–24), number of pyloric caeca (6 vs. 4–5), number of spines on the posterior margin of preopercle (2–15 vs. 0–1), and width of the angular region of the preopercle (11.6–13.4% HL vs. 7–12% HL). However, specimens identified here as *P. megalops* have 23–27 gill rakers, 1–5 inconspicuous spines on the posterior margin of the preopercle, and width of the angular region of the preopercle from 10 to 16.5% HL (Table 2). Summing up, data available from specimens identified here as *P. megalops*, in association with information provided by Keene (1987) and Kotlyar (2010), suggest that *P. macrophthalmma* and *P. jucunda* might not be valid. If correct, the situation would be similar to the one proposed by Ebeling and Weed (1973), in which a single species of the group (*P. megalops*, the senior synonym), with a circumglobal distribution, should be recognized. However, a more thorough taxonomic study of this group of species is necessary, based on examination of more specimens from the Atlantic and Indo-Pacific Oceans.

***Poromitra* sp.**

Figure 1H, Table 2

Specimens examined.—NPM 3189, 1, 110.0 mm, RV *Antea*, sta. AB1/14, 03°58'57.4"S, 34°03'23.1"W to 03°57'43.5"S, 34°04'50.5"W, 510 m, 6 October 2015, 2140–2226 h; NPM 3190, 4, 59.5–72.0 mm, sta. AB1/22, 04°07'44.8"S, 33°47'24.5"W to 04°07'00.7"S, 33°48'57.9"W, 525 m, 8 October 2015, 2132–2212 h; NPM 3198, 1, 48.0 mm, sta. AB1/51, 08°56'29.5"S, 34°29'03.5"W to 08°59'05.6"S, 34°28'35.2"W, 45–200 m, 19 October 2015, 2209–2335 h;

NPM 5331, 3, 100.0–120.0 mm (Fig. 1H), sta. AB2/53A, 03°48'58.7"S, 33°59'17.1"W to 3°50'05.8"S, 33°58'46.5"W, 610 m, 2 May 2017, 2208–2240 h; NPM 5926, 1, 59.0 mm, sta. AB2/16, 07°36'14.4"S, 33°59'33.8"W to 07°36'49.3"S, 33°57'18.7"W, 680 m, 14 April 2017, 2153–2239 h; NPM 5930, 2, 65.0–111.0 mm, sta. AB2/35, 04°19'36.6"S, 35°29'51.6"W to 04°18'32.4"S, 35°32'19.8"W, 630 m, 20 April 2017, 2235–2315 h; NPM 5932, 2, 51.5–66.5 mm, sta. AB2/39, 04°52'26.9"S, 34°03'32.3"W to 04°50'52.8"S, 34°05'06.5"W, 650–800 m, 24 April 2017, 2149–2237 h; NPM 5934, 6, 81.0–121.0 mm, sta. AB2/41A, 03°19'59.1"S, 32°24'42.1"W to 03°19'31.8"S, 32°25'04.6"W, 430 m, 26 April 2017, 2144–2206 h; NPM 5935, 1, 62.0 mm, sta. AB2/44A, 03°52'52.5"S, 32°17'33.3"W to 03°51'43.6"S, 32°16'20.0"W, 850 m, 28 April 2017, 1244–1317 h; NPM 5936, 1, 62.0 mm, sta. AB2/59A, 03°38'01.6"S, 36°03'10.6"W to 03°38'07.9"S, 36°02'22.6"W, 700–1113 m, 5 May 2017, 2157–2237 h; NPM 5939, 5, 62.0–85.0 mm, sta. AB2/54B, 03°45'17.2"S, 34°41'04.0"W to 03°44'39.2"S, 34°40'04.5"W, 830–1030 m, 3 May 2017, 1311–1347 h.

Diagnosis.—Kotlyar (2008a) defined five species groups of *Poromitra* based on the anatomy of the preopercle. The specimens of *Poromitra* sp. examined here are more similar to those of the *P. crassa* and *P. crassiceps* species groups (Kotlyar, 2008a). However, *Poromitra* sp. differs from *P. crassa* (the single species in the *P. crassa* species group) by the number of dorsal-fin rays (III,11–12 vs. III,10), number of gill rakers (30–34 vs. 23–25), and body depth (20.7–26.3% SL vs. 31.5–34.2% SL; Kotlyar, 2008a). In the *P. crassiceps* species group, *Poromitra* sp. differs from *P. coronata* by the number of dorsal-fin rays (III,11–12 vs. III,10), from *P. rugosa* and *P. decipiens* by the relative position of pelvic and pectoral fins (pelvic-fin origin is beneath or slightly anterior to pectoral-fin origin vs. pelvic fin originates after pectoral-fin origin), and from *P. curilensis* by the number of dorsal-fin rays (III,11–12 vs. III,12–14), anal-fin origin (in line with the second to fifth dorsal-fin ray origins vs. in line with the sixth to seventh dorsal-fin ray origins, counting from the last ray), and extension of the posterior margin of the upper jaw (extending beyond the posterior margin of the eye vs. in line with the posterior margin of the eye). See Remarks for further details.

Distribution.—The 27 specimens identified in this study as *Poromitra* sp. were collected off the Fernando de Noronha Archipelago, Rocas Atoll, seamounts off Rio Grande do Norte State, and off Rio Grande do Norte and Pernambuco States, between depths of 45 and 1,113 m (Fig. 3). The species was previously reported off Espírito Santo and Rio de Janeiro States, southeastern Brazil, at depths between 837 and 1,762 m (Mincarone et al., 2014).

Remarks.—The specimens identified here as *Poromitra* sp. represent the same species also recognized as *Poromitra* sp. by Mincarone et al. (2014). Those authors concluded that *Poromitra* sp. belongs to the *P. crassiceps* group of Kotlyar (2008a, 2008b), and this conclusion is supported in the present study based on the new specimens examined. According to Kotlyar (2008a, 2008b), only two species of the *Poromitra crassiceps* group occur in the western Atlantic Ocean, *P. crassiceps* and *P. kukuevi*. *Poromitra crassiceps* differs from *Poromitra* sp. by the number of dorsal- (III,12–13 vs.

III,11–12 [a single specimen with 12]) and anal-fin rays (I,9–10 vs. I,8), number of vertebrae (27–29 vs. 26–27), and relative position of pelvic and pectoral fins (pelvic fin originates after pectoral-fin origin vs. pelvic-fin origin is beneath or slightly anterior to pectoral-fin origin). Despite similarities in terms of shape of the preopercle, number and presence of spines in the preopercle, and counts of pectoral-, pelvic-, dorsal-, and anal-fin rays, *P. kukuevi* (which was described based on a single and possibly juvenile specimen) differs substantially from *Poromitra* sp. in the number of gill rakers (26 vs. 30–34, respectively). Measures and counts of 12 specimens identified as *Poromitra* sp. by Mincarone et al. (2014) are in accordance with those presented here, except by the number of vertebrae (26 vs. 26–27, respectively; Table 2). This variation is interesting, since the single known specimen of *P. kukuevi* also has 27 vertebrae (Kotlyar, 2008b). Mincarone et al. (2014) indicated that the taxonomic situation of at least part of the *Poromitra crassiceps* group is complex, concluding, among other things, that *P. kukuevi* might be a junior synonym of *P. indoceanica*, which has priority over the former by six printed pages (Kotlyar, 2008b). This situation renders the proper identification of *Poromitra* sp. as even more problematic. Bartow (2010) also noted the current taxonomic complexity of the genus *Poromitra* in the Atlantic, especially of the species included in the *Poromitra crassiceps* group. Keene (1987), in his unpublished Ph.D. dissertation, informally described a distinct Atlantic species of the genus and provisionally named it as "*Poromitra gibbsi*" (not *Poromitra gibbsi* Parin and Borodulina, 1989, which is a valid and distinct species), with records along the western South Atlantic, including off Brazil. Measurements and counts of "*Poromitra gibbsi*" *sensu* Keene (1987), such as number of vertebrae (25–27) and dorsal-fin rays (III,10–12), are similar to those reported for *P. glochidiata*, *P. indoceanica*, *P. kukuevi*, and *P. unicornis*, all of them included in the *Poromitra crassiceps* species group of Kotlyar (2008a). Meristic and morphometric data of the specimens identified here as *Poromitra* sp. also fall within the ranges and description provided by Keene (1987) for his "*Poromitra gibbsi*." Therefore, it is possible that the species recognized by Kotlyar (2008a) as *P. kukuevi*, in addition to "*Poromitra gibbsi*" *sensu* Keene (1987) and *Poromitra* sp. *sensu* Mincarone et al. (2014) and this paper, might represent the same Atlantic species. The taxonomic problems of the *Poromitra crassiceps* group can be properly addressed only with a major global review of the group, including the examination of a substantial number of specimens and the type material of all nominal species included in the complex.

***Scopeloberyx opercularis* Zugmayer, 1911**

Figure 1I, Table 2

Scopeloberyx opercularis Zugmayer, 1911: 8 (type-locality: off Portugal, 36°07'N, 10°18'W, 0–4740 m depth; holotype: MOM 0091-1179).

Specimen examined.—NPM 5987, 1, 32.0 mm (Fig. 1I), RV *Antea*, sta. AB2/42A, 03°15'28.1"S, 31°48'29.1"W to 03°15'26.4"S, 31°48'22.9"W, 780 m, 27 April 2017, 1223–1226 h.

Diagnosis.—According to Keene (1987), *Scopeloberyx opercularis* differs from all congeners, except *S. rubriventer*, by the horizontal distance between the pelvic- and pectoral-fin

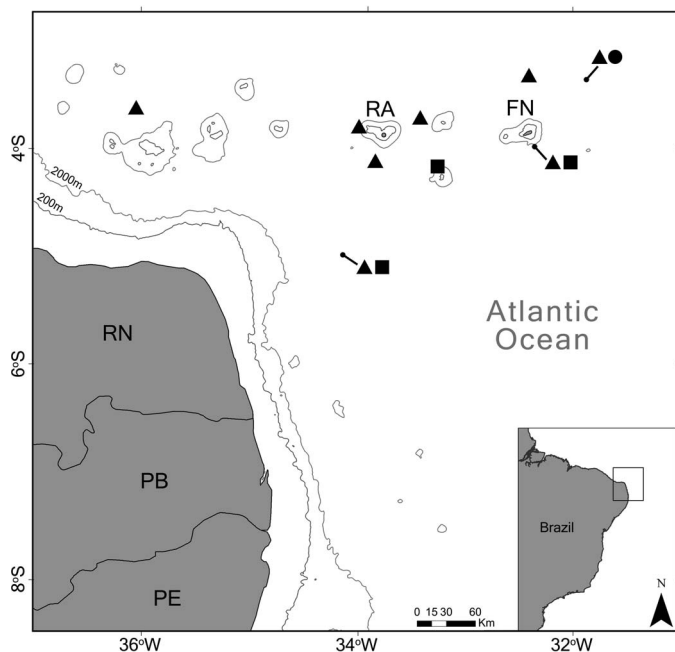


Fig. 4. Records of *Scopeloberyx opercularis* (circle), *Scopeloberyx opisthopectus* (square), and *Scopelogadus mizolepis* (triangle) off northeastern Brazil collected during the ABRACOS surveys. Tip of arrow indicates same collection locality for different species. FN—Fernando de Noronha Archipelago; PB—Paraíba; PE—Pernambuco; RA—Rocas Atoll; RN—Rio Grande do Norte.

origins (5% SL or less vs. 7.5% SL or more) and number of gill rakers (23 or more [rarely 22] vs. 21 or fewer [rarely 22]). *Scopeloberyx opercularis* differs from *S. rubriventer* by the HL (39.0–44.9% SL vs. 46.1–47.8% SL; Keene, 1987; this study). In a recent review, Kotlyar (2004b, 2004c, 2005) described three species of *Scopeloberyx*: *S. bannikovi*, *S. pequenoi*, and *S. rossicus*. *Scopeloberyx opercularis* differs from *S. bannikovi* and *S. pequenoi* by the number of gill rakers (23–26 vs. 15–16) and from *S. rossicus* by the number of vertebrae (25–28 [usually 26] vs. 23–25 [usually 24–25]; Keene, 1987; Kotlyar, 2004b, 2004c, 2005; this study). Kotlyar (2004a, 2004b) also recognized *S. opercularis* as a junior synonym of *S. robustus*, and this conclusion is generally accepted (e.g., Kotlyar, 2004a, 2004b; Mincarone et al., 2014). However, the present study follows Keene (1987) and Moore (2003, 2016), which consider *S. opercularis* as a valid species (see Remarks). In addition to characters indicated previously, *S. opercularis* also differs from *S. robustus* by the number of gill rakers (23–25 vs. 19–22; Keene, 1987; this study).

Distribution.—*Scopeloberyx opercularis* occurs in the western Tropical Atlantic between 28°N and 5°S, including the Gulf of Mexico and south of Caribbean Sea, and in the eastern Atlantic between 39°N and 16°S (Keene, 1987). Keene (1987) indicated records of the species in Brazilian waters off southeastern São Pedro e São Paulo Archipelago (01°20'S, 27°37'W; 01°44'S, 27°44'W), in addition to records outside the Brazilian EEZ. The species was also recorded in Brazilian waters off northern Bahia State (Mincarone et al., 2014; as *Scopeloberyx robustus*). In the present study, a single juvenile specimen was collected off the Fernando de Noronha Archipelago, at 780 m depth (Fig. 4).

Habitat.—According to Keene (1987), most specimens of *S. opercularis* were captured below 700 m depth, and there is no evidence of migratory behavior. The species is, therefore, apparently meso- to bathypelagic.

Remarks.—*Scopeloberyx opercularis* is currently considered as a junior synonym of *S. robustus* (e.g., Ebeling and Weed, 1973; Maul, 1973; Fricke et al., 2020a), but there is still some controversy in the literature about the validity of the species. The synonymy of the two species was followed in the recent revision of Kotlyar (2004b), who concluded that variations in the anal-fin origin in relation to the dorsal-fin origin, number of transverse series of scales, and number of pyloric caeca indicated “a sub-species level of difference between the fishes from the Atlantic Ocean and the Indo-Pacific.” However, Keene (1987), in his unpublished dissertation, recognized *S. opercularis* as a distinct and valid species based on the examination of 162 specimens distributed throughout the Tropical Atlantic. Moore (2003, 2016), probably following Keene (1987), also considered the species as valid. Mincarone et al. (2014) accepted that synonymy but indicated that most characters of the single specimen identified by them as *S. robustus* collected off Bahia State, central coast of Brazil, were in accordance with the description of *S. opercularis* provided by Keene (1987). Identification of the specimen examined here is also in accordance with the diagnosis of *S. opercularis* provided by Keene (1987) based on the number of gill rakers: 6–7+16–18 = 23–25 (8+18 in our specimen, including one rudimentary raker in the upper branch) vs. 5–6+14–17 = 19–22 in *S. robustus* according to Kotlyar (2004b, 2004c, 2005). In addition, the eye diameter of the juvenile specimen examined herein (6.3% SL) is within the range for *S. opercularis* (4.2–4.9% in adults and 5.7–6.4% in juveniles) and differs from values proposed for *S. robustus* by Keene (1987; 2.5–3.5% in adults and 4.2–5.8% in juveniles). Therefore, and following Keene’s (1987) diagnosis and taxonomic conclusion, we propose that *S. opercularis* is a valid species. With the revalidation of *S. opercularis*, and following Keene (1987), distribution of *S. robustus* is restricted to the North Atlantic between about 30–40°N, and the Tropical and Subtropical Atlantic, east of 30°W, including one record in Brazilian waters, off southeastern São Pedro e São Paulo Archipelago (01°44'S, 27°44'W).

Scopeloberyx opisthopectus (Parr, 1933)

Figure 1], Table 2

Melamphaes opisthopectus Parr, 1933: 18 (type-locality: off Cat Island, Bahamas, 24°29'N, 75°53'W, 7000 feet [2134 m]; holotype: YPM 2816).

Specimens examined.—NPM 5985, 1, 25.0 mm (Fig. 1J), RV *Antea*, sta. AB2/49A, 04°10'38.1"S, 33°16'07.4"W to 04°10'58.0"S, 33°15'03.8"W, 770–1020 m, 30 April 2017, 2117–2152 h; NPM 5988, 1, 32.0 mm, sta. AB2/39, 04°52'26.9"S, 34°03'32.3"W to 04°50'52.8"S, 34°05'06.5"W, 650–800 m, 24 April 2017, 2149–2237 h; NPM 5989, 2, 29.0–30.0 mm, sta. AB2/44A, 03°52'52.5"S, 32°17'33.3"W to 03°51'43.6"S, 32°16'20.0"W, 850 m, 28 April 2017, 1244–1317 h.

Diagnosis.—*Scopeloberyx opisthopectus* differs from all congeners, except *S. microlepis*, by the horizontal distance between the verticals through the ventral margin of the pectoral fin

and the origin of the pelvic fin (4.1–9.9% SL vs. 0–5.9% SL). *Scopeloberyx opisthopterus* differs from *S. microlepis* by the number of pelvic-fin rays (6–8 [rarely 6] vs. 6) and number of vertebrae (25–27 vs. 27–29; Kotlyar, 2005).

Distribution.—*Scopeloberyx opisthopterus* has a circumglobal distribution, occurring in both sides of the Atlantic Ocean from off the United Kingdom to approximately 10°S off Africa (Kotlyar, 2005; Sutton et al., 2020). The species was previously reported in Brazilian waters off São Pedro e São Paulo Archipelago (Keene, 1987; Judkins and Haedrich, 2018). Other records in the western South Atlantic were also restricted to the region of São Pedro e São Paulo Archipelago, but outside the Brazilian EEZ (Keene, 1987; Judkins and Haedrich, 2018). The four specimens collected off the Fernando de Noronha Archipelago, between depths of 650 and 1,020 m (Fig. 4), represent an extension of the distribution of the species in the western South Atlantic.

Habitat.—*Scopeloberyx opisthopterus* is meso- to bathypelagic, with larger post-larvae and all other stages inhabiting depths between 800 and at least 1,550 m, whereas smaller post-larvae occur between 50 and 300 m (Keene et al., 1987).

***Scopelogadus mizolepis* (Günther, 1878)**

Figure 1K, Table 2

Scopelus mizolepis Günther, 1878: 185 (type-locality: south of New Guinea, off Aru Island; Molucca Islands, Indonesia, Arafura Sea, western Pacific, 05°41'S, 134°04'30"E, 800 fathoms [1463 m] depth; holotype: BMNH 1887.12.7.9).

Specimens examined.—NPM 5990, 3, 37.0–49.0 mm (Fig. 1K), RV *Antea*, sta. AB2/41A, 03°19'59.1"S, 32°24'42.1"W to 03°19'31.8"S, 32°25'04.6"W, 430 m, 26 April 2017, 2144–2206 h; NPM 5991, 1, 54.5 mm, sta. AB2/52A, 03°43'16.2"S, 33°25'09.8"W to 03°42'14.2"S, 33°24'36.2"W, 822–984 m, 2 May 2017, 1147–1218 h; NPM 5992, 5, 42.0–58.0 mm, sta. AB2/42A, 03°15'28.1"S, 31°48'29.1"W to 03°15'26.4"S, 31°48'22.9"W, 780 m, 27 April 2017, 1223–1226 h; NPM 5993, 1, 43.0 mm, sta. AB2/59A, 03°38'01.6"S, 36°03'10.6"W to 03°38'07.9"S, 36°02'22.6"W, 700–1113 m, 5 May 2017, 2157–2237 h; NPM 5994, 3, 46.0–70.0 mm, sta. AB2/44A, 03°52'52.5"S, 32°17'33.3"W to 03°51'43.6"S, 32°16'20.0"W, 850 m, 28 April 2017, 1244–1317 h; NPM 5995, 2, damaged–45.0 mm, sta. AB2/39, 04°03'32.3"S, 34°35'22.9"W to 04°50'52.8"S, 34°05'06.5"W, 650–800 m, 24 April 2017, 2149–2237 h; NPM 5996, 3, 37.0–40.0 mm, sta. AB2/53A, 03°48'58.7"S, 33°59'17.1"W to 03°50'05.8"S, 33°58'46.5"W, 610 m, 2 May 2017, 2208–2240 h; NPM 6090, 1, 40.0 mm, sta. AB1/22, 04°07'44.8"S, 33°47'24.5"W to 04°07'00.7"S, 33°48'57.9"W, 525 m, 8 October 2015, 2132–2212 h.

Diagnosis.—Four species of *Scopelogadus* are currently considered as valid, with only *S. beanii* and *S. mizolepis* occurring in the Atlantic (Fricke et al., 2020a). *Scopelogadus mizolepis* differs from *S. beanii* by the number of gill rakers 21–26 (6–8+15–18) vs. 26–32 (8–10+18–22; but see Remarks), and by the stomach noticeably darkened posteriorly (vs. stomach not darkened posteriorly; Sutton et al., 2020).

Distribution.—*Scopelogadus mizolepis* occurs in all oceans except the eastern Pacific (Kotlyar, 2020). In the Atlantic, the species is reported between 43°N and 30°S (Ebeling and

Weed, 1973; Keene, 1987; McEachran and Fechhelm, 1998; Moore, 2016; Sutton et al., 2020). Several records are known in the western South Atlantic and also off Ascension Island (Keene, 1987; Judkins and Haedrich, 2018). In Brazilian waters, the species was previously reported off São Pedro e São Paulo Archipelago, Vitória-Trindade Seamount Chain (Keene, 1987), Rocas Atoll, Fernando de Noronha Archipelago (Judkins and Haedrich, 2018), and off Rio de Janeiro State, southeastern Brazil (Costa and Mincarone, 2010; Mincarone et al., 2014). The 19 specimens identified here as *S. mizolepis* were collected near the Fernando de Noronha Archipelago, Rocas Atoll, and the seamounts off Rio Grande do Norte State, between depths of 430 and 1,113 m (Fig. 4).

Habitat.—The species is meso- to bathypelagic, with adults collected below 500 m and post-larvae and juveniles collected between depths of 50 and 300 m (Ebeling and Weed, 1973; McEachran and Fechhelm, 1998).

Remarks.—There is some inconsistency in values of the number of gill rakers on the first gill arch presented by Kotlyar (2020) in his recent review of *S. mizolepis*. In the diagnosis (Kotlyar, 2020: 4), it is stated “on first branchial arch, 16–24 (usually 19–21) rakers,” whereas in the description, presented a few lines later in the same page, it is mentioned “(6–8)+1+(12–17) = 19–25” as the number of gill rakers on the first gill arch. Variation in the number of gill rakers on the first gill arch of the 19 specimens of *S. mizolepis* examined here (22–25; Table 2) is in accordance with values presented by both Kotlyar (2020: description) and Sutton et al. (2020).

Two subspecies of *Scopelogadus mizolepis* were recognized by Ebeling and Weed (1973): *Scopelogadus mizolepis bispinosus* (Gilbert 1915), from the eastern Tropical Pacific, and *Scopelogadus mizolepis mizolepis* (Günther 1878), from the Tropical Atlantic and Central Pacific. These subspecies are not considered herein, as in Iwasaki (2009) and Mincarone et al. (2014). However, according to Kotlyar (2020), the two subspecies of *S. mizolepis* proposed by Ebeling and Weed (1973) actually represent species that await formal recognition at that level.

Cetomimidae

The Cetomimidae (whalefishes) includes meso- and bathypelagic fishes occurring in all oceans between 52°N and 72°S (Paxton, 1989). After Johnson et al.'s (2009) study, the number of species in the family became rather uncertain, as molecular data revealed that species belonging to the Mirapinnidae and Megalomycetidae are, in fact, larvae and males, respectively, of the Cetomimidae, which was previously known only by females. About 21 to 26 nominal species belonging to nine genera have been recognized as valid in the Cetomimidae (Paxton, 1989; Johnson et al., 2009; Nelson et al., 2016; Fricke et al., 2020b), with several species still lacking formal description (Paxton, 1989; Nelson et al., 2016). The Cetomimidae comprises one of the most species-rich groups in the bathypelagic zone (1,000–4,000 m) and it is suspected that this is the most abundant fish family below 1,800 m (Paxton, 1989; Nelson et al., 2016). However, records of the family in the western South Atlantic are still scarce (e.g., Paxton, 1989; Mincarone et al., 2014). Cetomimid fishes are mainly recognized by an elongated body, enormous mouth extending far behind eye, reduced or

rudimentary eyes, absence of scales, and pelvic fins totally absent in females, usually absent in males, and jugular in juveniles (Paxton, 1989; Johnson et al., 2009; Mincarone et al., 2014; Nelson et al., 2016).

Cetomimus sp. 1

Figure 5A, Table 3

Specimens examined.—NPM 5004, 1, 65.1 mm, RV *Antea*, sta. AB2/16, 07°36'14.4"S, 33°59'33.8"W to 07°36'49.3"S, 33°57'18.7"W, 680 m, 14 April 2017, 2153–2239 h; NPM 5005, 1, 62.5 mm (Fig. 5A), sta. AB2/42A, 03°15'28.1"S, 31°48'29.1"W to 03°15'26.4"S, 31°48'22.9"W, 780 m, 27 April 2017, 1223–1226 h.

Diagnosis.—*Cetomimus* has no single, derived character that distinguishes it from other genera of the Cetomimidae (Paxton, 1989). Three free branchial arches are present in *Cetomimus*, and also in *Rhamphocichthys* and *Gyrinomimus*. *Cetomimus* differs from *Rhamphocichthys* by having a cavernous lateral-line system formed by large canals pierced by wide pores on the head and body (vs. absence of these canals), a much shorter, rounded snout (vs. elongated and pointed snout), and by the absence of ventral pharyngeal tooth plates (vs. presence of ventral pharyngeal tooth plates). *Cetomimus* is most similar to *Gyrinomimus*, differing from this genus by the shape of teeth (short, in indistinct diagonal rows vs. long, in distinct, usually longitudinal, rows) and by the shape of the vomerine tooth patch (round or elliptical and dome shaped vs. rectangular or laterally elongate and flat; Paxton, 1989).

Distribution.—Species of *Cetomimus* are reported from the Atlantic and Indo-Pacific Oceans, ranging from 41°N to 57°S in the Pacific and from 41°N to 40°S in the Atlantic (Paxton, 1989). Two specimens badly damaged during the trawl (NPM 5004 and 5005) were collected off Pernambuco State and the Fernando de Noronha Archipelago, between depths of 680 and 780 m (Fig. 6). Those specimens represent the first confirmed records of the genus *Cetomimus* in Brazilian waters and some of the few records in the western South Atlantic.

Habitat.—Species of *Cetomimus* are meso- to bathypelagic, ranging from depths between 500 and approximately 3,300 m (Paxton, 1989; Tolley et al., 1989; Angulo, 2015; Paxton et al., 2016). Juvenile specimens have been recorded in shallow waters (Paxton et al., 2016).

Remarks.—*Cetomimus* currently includes seven nominal species, and at least five species await description (Paxton, 1989). The seven species considered as valid are: *Cetomimus compunctus*, from the western North Pacific and the western South and eastern Central Atlantic (Paxton et al., 2016); *Cetomimus craneae*, from Bermuda (Harry, 1952); *Cetomimus gillii*, from the Atlantic, eastern Pacific, and western Indian Oceans (Angulo, 2015; Paxton et al., 2016); *Cetomimus hempeli*, from the Atlantic Ocean and possibly the North Pacific (Paxton et al., 2016); *Cetomimus kerdops*, from the Bahamas (Parr, 1934; Moore and Boardman, 1991); *Cetomimus picklei*, from the eastern South Atlantic (Paxton and Bray, 1986); and *Cetomimus teevani*, from the western Atlantic (Harry, 1952). The identification at the species level of the two specimens reported here based on the ABRACOS collection (NPM 5004 and 5005; *Cetomimus* sp. 1) was not

possible due to their poor state of preservation. Both specimens are somewhat distorted, and the skin is almost completely unattached to the remaining integument. Another specimen of the genus (MNRJ 26794) was identified as *Cetomimus* sp. 2 (Fig. 5B), collected off Espírito Santo State, southeastern Brazil (19°42'34.1"S, 38°32'01.8"W to 19°42'41.1"S, 38°36'57.7"W), between depths of 875 and 942 m. The skin of specimen MNRJ 26794 is also damaged, compromising the observation of lateral-line pores and flaps and of the cavernous tissue. Nevertheless, some measurements were successfully obtained, in addition to the number of vertebrae, and of the dorsal-, anal-, and pectoral-fin rays (Table 3). *Cetomimus* sp. 1 differs from *Cetomimus* sp. 2 in the shape of the vomerine tooth patch (oval vs. triangular, with its anterior tip narrower) in addition to meristic and morphometric data provided in Table 3. Therefore, at least two species of the genus occur in Brazilian waters, one of them recorded off northeastern Brazil (NPM 5004 and 5005, *Cetomimus* sp. 1) and the other collected off Espírito Santo State (MNRJ 26794, *Cetomimus* sp. 2).

Cetostoma regani Zugmayer, 1914

Figure 5C, Table 3

Cetostoma regani Zugmayer, 1914: 4 (type locality: eastern Atlantic, 30°45'30"N, 25°47'W, 0–2000 m depth; holotype: MOM 0091-1729).

Specimens examined.—NPM 3185, 1, 81.0 mm (Fig. 5C), RV *Antea*, sta. AB1/22, 04°07'44.8"S, 33°47'24.5"W to 04°07'00.7"S, 33°48'57.9"W, 525 m, 8 October 2015, 2132–2212 h; NPM 5001, 1, 96.8 mm, sta. AB2/54B, 03°45'17.2"S, 34°41'04.0"W to 03°44'39.2"S, 34°40'04.5"W, 830–1030 m, 3 May 2017, 1311–1347 h; NPM 5002, 2, 85.2–113.7 mm, sta. AB2/42A, 03°15'28.1"S, 31°48'29.1"W to 03°15'26.4"S, 31°48'2.9"W, 780 m, 27 April 2017, 1223–1226 h; NPM 5151, 1, 95.0 mm, sta. AB2/44A, 03°52'52.5"S, 32°17'33.3"W to 03°51'43.6"S, 32°16'20.0"W, 850 m, 28 April 2017, 1244–1317 h.

Diagnosis.—*Cetostoma regani* is the single species of the genus, and it differs from other genera of the Cetomimidae by the number of dorsal-fin rays (29–37 vs. 13–22), number of anal-fin rays (26–34 vs. 13–20), dorsal- and anal-fin bases elevated in relation to the body (vs. not elevated), predorsal length (1.7–2.0 in SL vs. 1.3–1.6 in SL), a very long, narrow copular tooth patch present as three separate dentigerous plates (vs. one solid plate), the gill slit behind the angle of fourth gill arch tiny and tubular (vs. gill slit behind the ventral arm of fourth gill arch either elongate or absent), numerous small skin ridges along the belly from the pectoral-fin base to the anus (vs. absence of skin ridges), and the fin membrane between last ten anal-fin rays voluminous and curtain-like (vs. fin membrane between posterior anal-fin rays not voluminous and not curtain-like; Paxton, 1989).

Distribution.—*Cetostoma regani* has the broadest distribution of all cetomimids, occurring in the Atlantic and Indo-Pacific Oceans (except the eastern South Pacific), from 50°N to 40°S (Paxton et al., 2016). The species was previously recorded in Brazilian waters off São Pedro e São Paulo Archipelago, North Atlantic, at 02°41'N, 28°56'W, 0–ca. 1,100 m depth (MCZ 42844), and at 00°17'N, 27°31'W, 0–ca. 300 m depth (MCZ 42843; Paxton, 1989). In this study, five specimens were

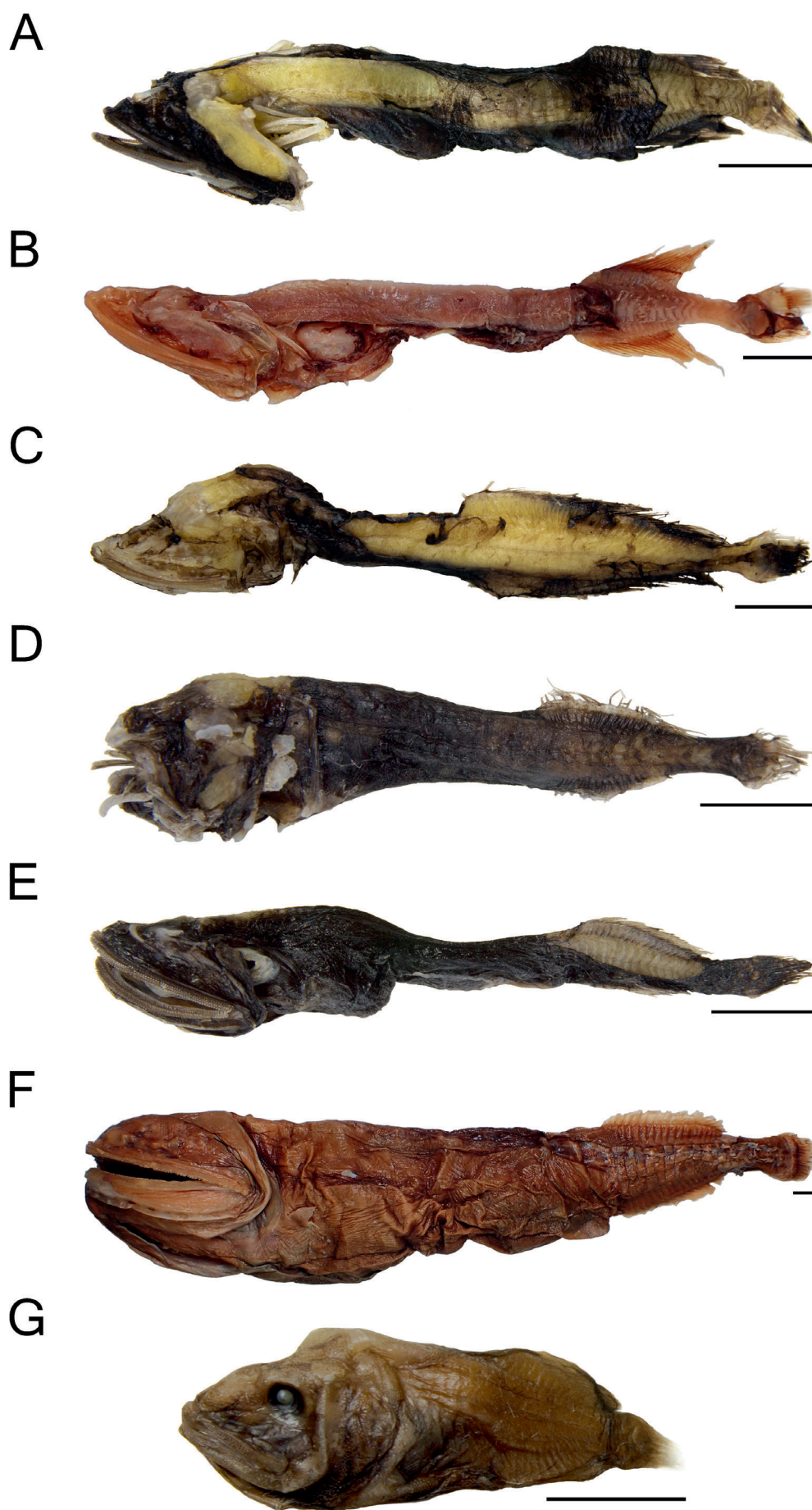


Fig. 5. Species of Cetomimidae and Rondeletiidae reported in this study: (A) *Cetomimus* sp. 1, NPM 5005, 62.5 mm SL; (B) *Cetomimus* sp. 2, MNRJ 26794, 92.0 mm SL; (C) *Cetostoma regani*, NPM 3185, 81.0 mm SL; (D) *Ditropichthys storeri*, NPM 5003, 49.0 mm SL; (E) *Gyrinomimus bruuni*, NPM 5000, 66.2 mm SL; (F) *Gyrinomimus* cf. *bruuni*, MNRJ 26793, 305.0 mm SL; (G) *Rondeletia loricata*, NPM 3197, 32.3 mm SL. Scale bar = 1 cm.

Table 3. Morphometric and meristic data of species of Cetomimidae and Rondeletidae reported in this study (d = damaged).

Species	Cetomimus sp. 1	Cetomimus sp. 2	Cetostoma regani	Ditropichthys storeri	Gyrinomimus bruuni	Gyrinomimus cf. bruuni	Gyrinomimus sp.	Rondeletia loricata
<i>n</i>	2	1	5	1	2	1	1	3
Standard length (SL, mm)	62.5–65.1	92.0	81.0–113.7	49.0	60.0–66.2	305.0	95.0	32.3–78.4
Measurements in % SL								
Head length	d–30.1	26.0	21.4–28.0	33.7	25.5–26.9	27.9	34.8	44.2–45.9
Head width	7.2–10.7	—	6.4–7.6	16.5	—	16.4	19.5	17.2–19.8
Eye diameter	—	—	—	—	—	1.0	1.7	6.5–7.4
Postorbital length	—	—	—	—	—	22.0	24.2	16.4–20.0
Snout length	—	9.5	11.9	—	—	8.4	11.6	18.6–20.0
Upper jaw length	d–29.9	23.0	16.1–19.6	—	10.6–10.7	23.0	32.6	25.0–26.0
Body depth	12.9–13.3	—	6.9–9.0	21.8	24.3–26.4	23.3	—	32.1–37.5
Prepectoral length	36.2–38.7	—	23.2–29.5	36.1	—	30.0	—	43.3–48.5
Prepelvic length	—	—	—	—	27.7–30.7	—	—	60.1–69.3
Predorsal length	72.6–75.0	66.0	54.5–58.8	69.4	—	71.5	67.4	66.6–72.8
Preal length	73.6–76.0	66.0	55.8–60.0	70.4	74.6–76.7	72.1	—	68.1–74.0
Dorsal-fin base length	16.3–16.4	13.0	32.2–40.2	26.7	15.7–15.9	17.0	18.0	19.4–27.9
Anal-fin base length	16.0–16.9	13.9	26.3–32.7	20.4	13.6–13.8	16.6	19.0	16.6–27.9
Caudal peduncle length	9.9–11.5	10.8	9.5–12.7	15.3	8.3–9.0	10.5	12.0	7.7–10.8
Caudal peduncle depth	5.4–5.9	3.3	3.3–4.3	6.0	5.1–5.2	4.4	7.4	8.3–12.4
Head length (HL, mm)	d–17.1	23.9	—	—	d–17.8	85.0	33.1	—
Measurements in % HL								
Copular tooth plate length	d–29.2	33.5	—	—	d–27.0	27.0	30.2	—
Copular tooth plate width max.	d–7.6	6.7	—	—	d–19.1	10.6	13.6	—
Copular tooth plate width min.	d–5.8	4.2	—	—	d–7.9	5.3	12.0	—
Copular tooth plate ratio (max/min)	d–1.3	1.6	—	—	d–2.4	2.0	1.1	—
Counts								
Dorsal-fin rays	15–16	18	30–34	21	20	19	16	11–12
Anal-fin rays	16	17	27–32	16	18–19	18	15	11–12
Pectoral-fin rays	15–20	16	17–20	18	16–18	16	18	7–8
Pelvic-fin rays	—	—	—	—	—	—	—	4–6
Principal caudal rays (upper/lower)	7–8/9	—	7–9/7–10	6/7	8/9–10	8/9	8/9	10–11/10
Procurrent caudal rays (upper/lower)	2–3/2–3	—	—	3/2	3/2	5/4	5/3	5/2–3
Vertebrae (precaudal + caudal)	32+17	33+21	22–26+23–26	22+17	36–38+19–21	38+20	—	10–11+15–16
Vertebrae (total)	48–49	54	48–50	39	57	58	48	25–27
Jaws teeth rows (upper/lower)	—	—	—	—	d–3–4/3–4	6–9/7–10	3/3	—
Vomerine teeth rows	—	—	—	—	2	indistinct	3	—

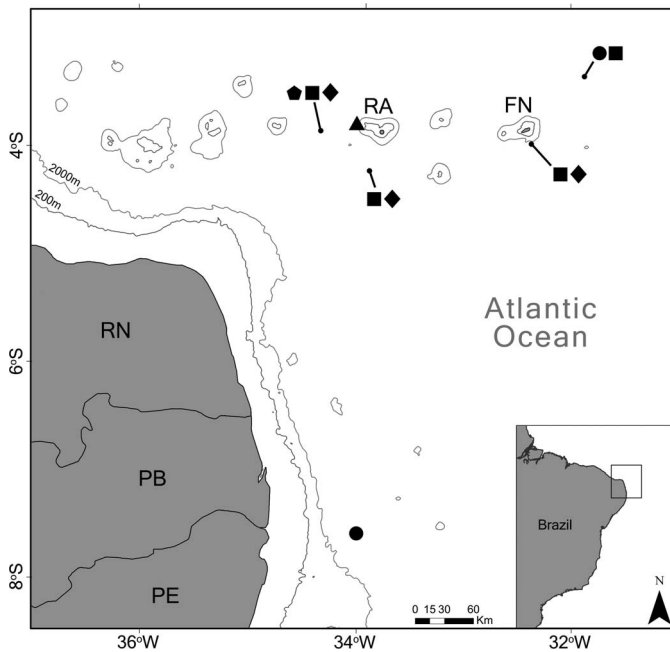


Fig. 6. Records of *Cetomimus* sp. 1 (circle), *Cetostoma regani* (square), *Ditropichthys storeri* (triangle), *Gyrinomimus bruuni* (pentagon), and *Rondeletia loricata* (diamond) off northeastern Brazil collected during the ABRACOS surveys. Tip of arrow indicates same collection locality for different species. FN—Fernando de Noronha Archipelago; PB—Paraíba; PE—Pernambuco; RA—Rocas Atoll; RN—Rio Grande do Norte.

collected off the Fernando de Noronha Archipelago, the Rocas Atoll, and the seamounts off Rio Grande do Norte State, between depths of 525 and 1,030 m (Fig. 6). In addition, another specimen identified as *C. regani* (MNRJ 26795), collected off Espírito Santo State ($21^{\circ}12'17.6''S$, $40^{\circ}00'53.0''W$ to $21^{\circ}09'34.6''S$, $40^{\circ}00'27.7''W$) between depths of 1,333 and 1,390 m, extends the occurrence of the species further south in Brazilian waters. Specimens reported here also represent some of the few confirmed records of the species in the western South Atlantic (Paxton, 1989).

Habitat.—Females of *Cetostoma regani* are meso- to bathypelagic, with adults collected between 100 and 3,700 m, whereas juveniles are reported from shallow waters (Paxton, 1989; Paxton et al., 2016). Males are bathypelagic (Paxton et al., 2016).

Remarks.—In this study, only females were collected. The absence of males might be related to the depth of collections (maximum 1,113 m), which did not reach the bathypelagic zone.

***Ditropichthys storeri* (Goode and Bean, 1895)**

Figure 5D, Table 3

Cetomimus storeri Goode and Bean, 1895: 453 (type locality: western North Atlantic, $39^{\circ}03'15''N$, $70^{\circ}50'45''W$, 1535 fathoms [2807 m] depth; holotype: USNM 35634).

Specimen examined.—NPM 5003, 1, 49.0 mm (Fig. 5D), RV *Antea*, sta. AB2/53A, $03^{\circ}48'58.7''S$, $33^{\circ}59'17.1''W$ to $03^{\circ}50'05.8''S$, $33^{\circ}58'46.5''W$, 610 m, 2 May 2017, 2208–2240 h.

Diagnosis.—*Ditropichthys storeri* is the single species of the genus, differing from all other genera in the Cetomimidae by having fully developed, club-shaped gill rakers, a pair of thin dermal folds along the abdomen, and anal lappets connected as an unbroken fold of skin containing lappet scales over the anal-fin base (Paxton, 1989).

Distribution.—*Ditropichthys storeri* has a circumglobal distribution between $45^{\circ}N$ and $45^{\circ}S$ (Paxton et al., 2016). The absence of the species in some regions may be related to the lack of collecting efforts (Paxton, 1989). The species was previously recorded in the western South Atlantic in five localities off Uruguay and Argentina (Paxton, 1989). A single specimen of *D. storeri* was collected off the Rocas Atoll, at 610 m depth (Fig. 6). This represents the first record of the species in Brazilian waters and one of the few confirmed records in the western South Atlantic (Paxton, 1989).

Habitat.—Small specimens of *D. storeri* (<40 mm) are mesopelagic, occurring from 650 to 1,000 m, whereas larger specimens (>60 mm) are bathypelagic, occurring from 1,000 to approximately 5,000 m (Paxton et al., 2016).

***Gyrinomimus bruuni* Rofen, 1959**

Figure 5E, Table 3

Gyrinomimus bruuni Rofen, 1959: 257 (type locality: off Kenya, $05^{\circ}25'S$, $47^{\circ}09'E$, over 4820 m depth; holotype: ZMUC P23452).

Specimens examined.—NPM 5000, 2, 60.0–66.2 mm (Fig. 5E), RV *Antea*, sta. AB2/54B, $03^{\circ}45'17.2''S$, $34^{\circ}41'04.0''W$ to $03^{\circ}44'39.2''S$, $34^{\circ}40'04.5''W$, 830–1030 m, 3 May 2017, 1311–1347 h.

Diagnosis.—*Gyrinomimus* differs from other genera of the Cetomimidae, except *Rhamphocetichthys* and *Cetomimus*, by having three free branchial arches (vs. four). *Gyrinomimus* differs from *Rhamphocetichthys* by having a round snout (vs. beak-like snout), and by the presence of tooth plates on the second and third branchial arches (vs. plates absent). It differs from *Cetomimus* by having jaw teeth arranged in distinct longitudinal rows (vs. jaw teeth arranged in indistinct diagonal rows), by the length of the teeth (except the newest teeth) more than three times the width of its base (vs. less than two times the width of its base), and by the shape of the vomerine tooth plate, which is flat and rectangular or oval (vs. domed and round or rarely oval; Paxton, 1989). *Gyrinomimus bruuni* differs from its congeners by the following characters: number of dorsal-fin rays (19–20 vs. 14–17 in *G. andriashevi*, *G. grahami*, *G. myersi*, and *G. parri*); number of anal-fin rays (18–20 vs. 14–17 in *G. andriashevi*, *G. grahami*, *G. myersi*, and *G. parri*); number of lateral-line pores (19 vs. 14–15 in *G. myersi* and *G. parri*, and 23 in *G. andriashevi*); and pectoral-fin length (6.2–9.8% SL vs. 2.9% SL in *G. andriashevi*; Parr, 1934; Richardson and Garrick, 1946; Rofen, 1959; Bigelow, 1961; Fedorov et al., 1987; Paxton, 1989).

Distribution.—*Gyrinomimus bruuni* has a circumglobal distribution between $30^{\circ}N$ and $10^{\circ}S$ (Paxton, 2003). This is the first report of this species in Brazilian waters, and it is based on two specimens collected off the Rocas Atoll, between depths of 830 and 1,030 m (Fig. 6). Those specimens also

represent one of the few records of the genus in the South Atlantic and apparently the first confirmed record of the species in the region (see Remarks).

Habitat.—Maximum depth reported for the species is 1,805 m (MNRJ 26793, this study). Other species of the genus are bathypelagic, captured between 1,594 and 2,350 m (Mincarone et al., 2014; Paxton et al., 2016).

Remarks.—In addition to *G. bruuni*, four other species of *Gyrinomimus* are currently regarded as valid: *G. andriashevi*, from the Antarctic Ocean; *G. grahami*, cosmopolitan in the South Hemisphere; *G. myersi*, circumglobal; and *G. parri*, from the western Atlantic and western Pacific (Paxton, 1989; Paxton et al., 2016; Fricke et al., 2020a). Two species groups of *Gyrinomimus* in the North Atlantic are recognized: the *bruuni* species group, with *G. bruuni* and two undescribed species, and the *myersi* species group, with *G. myersi*, *G. parri*, and one undescribed species (Moore et al., 2003; Paxton et al., 2016).

Mincarone et al. (2014) reported the first specimen of *Gyrinomimus* in Brazilian waters (MNRJ 36421, 95 mm SL), collected off Rio de Janeiro State, southeastern Brazil. This specimen was highly damaged and its identification at the species level was not possible. A comparison made between the specimens reported here as *G. bruuni* with the one reported by Mincarone et al. (2014) as *Gyrinomimus* sp. clearly indicates that the latter belongs to a different species. *Gyrinomimus* sp. differs from *G. bruuni* by the following characters: three distinct gill arches bearing well-developed holobranchs, a reduced gill slit behind the ventral arm of the third arch, near the angle vs. four distinct gill arches bearing well-developed holobranchs, a relatively well-developed gill slit behind the ventral arm of the third arch; holobranchs on fourth gill arch highly undeveloped, in the shape of tubercles vs. holobranchs more developed (0.5 times length of holobranchs on first gill arch) and with a regular shape; number of dorsal-fin rays (16 vs. 20); number of anal-fin rays (15 vs. 18–19); number of distinct teeth rows on vomer (3 vs. 2); number of vertebrae (48 vs. 57); middle portion of preural centra distinctly constricted vs. centra only slightly constricted; HL (34.8% SL vs. 25.5–26.9% SL); upper-jaw length (32.6% SL vs. 24.3–26.4% SL); predorsal length (67.4% SL vs. 74.0–75.5% SL); dorsal-fin base length (18.0% SL vs. 15.7–15.9% SL); anal-fin base length (19.0% SL vs. 13.6–13.8% SL); caudal-peduncle length (12.0% SL vs. 8.3–9% SL); and caudal peduncle depth (7.4% SL vs. 5.1–5.2% SL; Table 3).

In addition to *G. bruuni* and *Gyrinomimus* sp., another specimen of the genus (MNRJ 26793, 305 mm SL) collected off Rio de Janeiro State, from 21°28'36.7"S, 39°40'18.2"W to 21°25'31.4"S, 39°40'26.6"W, between depths of 1,790 and 1,805 m, was tentatively identified as *Gyrinomimus* cf. *bruuni*, but it may represent an undescribed species (Fig. 5F, Table 3; Paxton, 1989; J. Paxton, pers. comm.). Morphometric and meristic data comparing *G. bruuni* "stricto sensu" (NPM 5000, 2 specimens) and *Gyrinomimus* cf. *bruuni* (MNRJ 26793) are presented in Table 3. Other characters that differ between *G. bruuni* and *Gyrinomimus* cf. *bruuni* are: the shape of preural centra (middle portion of the centra only slightly constricted vs. distinctly constricted) and the number of teeth rows on upper (3–4 vs. 6–9, increasing anteriorly) and lower jaws (3–4 vs. 7–10, increasing anteriorly). *Gyrinomimus* cf. *bruuni* also has cavernous tissue up to above the third anal-fin ray, about

three anal lappets, about 21–22 lateral-line pores, and the length of the holobranchs on the fourth arch is 0.54 the length on those of the first arch (J. Paxton, pers. comm.; present study). A further specimen of *Gyrinomimus* (MCZ 50688), collected off Rio Grande do Sul State, southern Brazil, in 1967, referred to as *Gyrinomimus* sp. by Mincarone et al. (2014), still seems to be lost.

Rondeletiidae

The Rondeletiidae includes only two species, *Rondeletia bicolor* Goode and Bean 1895 and *Rondeletia loricata* Abe and Hotta 1963 (Paxton et al., 2001). Both species are meso- and bathypelagic in tropical and temperate waters, with *R. bicolor* occurring in the Atlantic and Pacific Oceans, and *R. loricata* having an almost circumglobal distribution (Paxton and Trnski, 2003; Kobylansky et al., 2020). *Rondeletia* is mainly recognized among the Stephanoberycoidei by having the following combination of characters: large mouth with jaws not extending beyond the posterior margin of eye; pelvic fins with five or six soft rays; lack of teeth on basibranchials; lateral line as vertical rows of papillae without supporting internal scales; and lack of external body scales (Paxton and Trnski, 2003).

Rondeletia loricata Abe and Hotta, 1963

Figure 5G, Table 3

Rondeletia loricata Abe and Hotta, 1963: 43, Pls. 11 (figs. 1–7), 12 (figs. 8–9) (type locality: off Kesennuma, Miyagi Prefecture, Japan, 750 m depth; holotype: ZUMT 52196).

Specimens examined.—NPM 3197, 1, 32.3 mm (Fig. 5G), RV *Antea*, sta. AB1/22, 04°07'44.8"S, 33°47'24.5"W to 04°07'00.7"S, 33°48'57.9"W, 525 m, 8 October 2015, 2132–2212 h; NPM 4144, 1, 78.4 mm, sta. AB2/54B, 03°45'17.2"S, 34°41'04.0"W to 03°44'39.2"S, 34°40'04.5"W, 830–1030 m, 3 May 2017, 1311–1347 h; NPM 4228, 1, 46.4 mm, sta. AB2/44A, 03°52'52.5"S, 32°17'33.3"W to 03°51'43.6"S, 32°16'20.0"W, 850 m, 28 April 2017, 1244–1317 h.

Diagnosis.—*Rondeletia loricata* differs from *R. bicolor* by the number of vertical rows of lateral-line pores (14–19 vs. 24–26), the lack of a bony sphenotic hook over the orbit (vs. presence of a bony sphenotic hook), and supratemporal and cleithrum with large posterior extensions (vs. absence of large posterior extensions; Paxton, 1974; Paxton and Trnski, 2003).

Distribution.—*Rondeletia loricata* has an almost circumglobal distribution, being reported from 60°N to 50°S in all oceans (Paxton, 1974; Bast and Klinkhardt, 1990; Kotlyar, 1996; Paxton et al., 2001; Paxton and Trnski, 2003; Kharin, 2006; Balanov and Kharin, 2009; Møller et al., 2010; Mincarone et al., 2014). Records of the species in the western South Atlantic are restricted to off Argentina and Brazil (Figueroa et al., 1998; Mincarone et al., 2014). The species was first reported in Brazilian waters by Mincarone et al. (2014), based on three specimens collected off Bahia and Espírito Santo States, between depths of 837 and 1,049 m. *Rondeletia loricata* is recorded here based on three specimens collected off Rocas Atoll, the Fernando de Noronha Archipelago, and seamounts off Rio Grande do Norte State, between depths of 525 and 1,030 m (Fig. 6).

Table 4. Species of the Stephanoberycoidei recorded in Brazilian waters. * The four specimens of *B. rufa* (and only known records of the species off Brazil) reported as missing by Mincarone et al. (2014) have now been located, in lots MNRJ 42181, 42182, 42183, and 42184.

Species	Distribution	References
Barbourisiidae		
<i>Barbourisia rufa</i>	Circumglobal	Mincarone et al. (2014)*
Cetomimidae		
<i>Cetostoma regani</i>	Circumglobal, except eastern South Pacific	Paxton (1989), present study
<i>Cetomimus</i> sp. 1	off northeastern Brazil	present study
<i>Cetomimus</i> sp. 2	off Espírito Santo, Brazil	present study
<i>Ditropichthys storeri</i>	Circumglobal	present study
<i>Gyrinomimus bruuni</i>	Circumglobal	present study
<i>Gyrinomimus</i> cf. <i>bruuni</i>	off Rio de Janeiro, Brazil	present study
<i>Gyrinomimus</i> sp.	off Rio de Janeiro, Brazil	Mincarone et al. (2014); present study
Gibberichthyidae		
<i>Gibberichthys pumilus</i>	western Tropical Atlantic	Asano Filho et al. (2005); Mincarone et al. (2014)
Melamphaidae		
<i>Melamphaes eulepis</i>	Circumtropical, except eastern Pacific	present study
<i>Melamphaes hubbsi</i>	Tropical South Atlantic	Judkins and Haedrich (2018)
<i>Melamphaes leprus</i>	Tropical Atlantic	present study
<i>Melamphaes longivelis</i>	Circumglobal, except eastern Pacific	present study
<i>Melamphaes polylepis</i>	Circumglobal	Keene (1987); Mincarone et al. (2014); Eduardo et al. (2020a); present study
<i>Melamphaes typhlops</i>	Atlantic	Keene (1987); Mincarone et al. (2014); present study
<i>Melamphaes</i> sp.	off Rio Grande do Norte, Brazil	present study
<i>Poromitra megalops</i>	Circumtropical	Keene (1987); Judkins and Haedrich (2018); present study
<i>Poromitra</i> sp.	off Brazil	Mincarone et al. (2014); present study
<i>Scopeloberyx opercularis</i>	Tropical Atlantic	Keene (1987); Mincarone et al. (2014, as <i>S. robustus</i>); present study
<i>Scopeloberyx opisthopterus</i>	Circumglobal	Keene (1987); Judkins and Haedrich (2018); present study
<i>Scopeloberyx robustus</i>	Circumglobal, except eastern Pacific	Keene (1987); Judkins and Haedrich (2018)
<i>Scopelogadus beanii</i>	Circumglobal	Judkins and Haedrich (2018)
<i>Scopelogadus mizolepis</i>	Circumglobal	Keene (1987); Costa and Mincarone (2010); Mincarone et al. (2014); Judkins and Haedrich (2018); present study
Stephanoberycidae		
<i>Acanthochaenus luetkenii</i>	Atlantic, Indian and South Pacific	Mincarone et al. (2014)
<i>Stephanoberyx monae</i>	western Atlantic	Mincarone et al. (2014)
Rondeletiidae		
<i>Rondeletia bicolor</i>	Atlantic and Pacific	Mincarone et al. (2014)
<i>Rondeletia loricata</i>	Circumglobal	Mincarone et al. (2014); present study

Habitat.—The species is meso- to bathypelagic, with most records of adults below 400 m, with a maximum record of 1,200 m depth (Paxton et al., 2001; Kharin, 2006; Balanov and Kharin, 2009). Larvae (3.5–4.6 mm SL) are captured in shallow waters, between 8 and 40 m, and juveniles (<20 mm SL) are captured between 110 and 175 m (Paxton et al., 2001).

DISCUSSION

Scientific expeditions conducted since the last decades of the 20th century resulted in new records and new species descriptions of several groups of deep-sea fishes in Brazilian waters, substantially contributing to the understanding of this important component of the diversity in the western South Atlantic (e.g., Figueiredo et al., 2002; Melo, 2008; Santos and Figueiredo, 2008; Carvalho-Filho et al., 2010; Melo et al., 2010; Lima et al., 2011; Braga et al., 2014; Pinheiro et al., 2015; Eduardo et al., 2018, 2019a, 2019b, 2020a, 2020b; Mincarone et al., 2019, 2020). However, knowledge on the deep-sea fish diversity of the western

South Atlantic is still insufficient (Paxton, 1989; Mincarone et al., 2014; Nielsen et al., 2015; Reis et al., 2016). The eight new records and nine range extensions of species of the Stephanoberycoidei reported here for Brazil, for instance, were based on two relatively short deep-sea collecting campaigns, indicating that a substantial diversity of deep-sea fishes is still waiting to be discovered and properly studied in the region.

With the new records presented here, a total of 26 species of the Stephanoberycoidei are reported from off Brazil (Keene, 1987; Paxton, 1989; Mincarone et al., 2014; Judkins and Haedrich, 2018; Table 4). Based on the distribution of melamphaidae reported by Ebeling (1962) and Keene (1987), other species of the family that potentially occur in Brazilian waters are: *Melamphaes suborbitalis* (recorded in the central Atlantic and off Rio da Prata, between Uruguay and Argentina); *M. microps* (south of 27°S, near the Brazilian EEZ off Rio Grande do Sul State); *M. simus* (central Atlantic); and *Sio nordenskjoeldii* (south of 32°S, off Uruguay). *Scopeloberyx nigrescens*, which was considered as a junior synonym of *Scopeloberyx robustus* by Kotlyar (2004b), but considered as

valid by Moore (2003, 2016), was also reported from the central Atlantic and, if valid, also potentially occurs off Brazil (Keene, 1987).

The complex taxonomic scenario revealed by the examination of relatively few specimens of *Melamphaes*, *Poromitra*, and *Scopeloberyx* in this study indicates that the systematics of certain components of those genera are still in need of revision, despite Kotlyar's extensive taxonomic work (e.g., Kotlyar, 2004b, 2004c, 2005, 2008a, 2008b, 2009a, 2009b, 2009c, 2010, 2011a, 2011b, 2012a, 2012b, 2013, 2014, 2015a, 2015b, 2015c, 2016a, 2016b, 2016c). Part of the problem might be due to the fact that a substantial number of species in the group have been described based on relatively few specimens or even on a single specimen in some cases, as previously noted by other authors (e.g., Ebeling, 1962; Bartow, 2010). This situation is quite common for deep-sea organisms and might not necessarily represent a problem in itself when species are unambiguously distinct from congeners or are presumably rare or with relatively restricted geographic ranges, for instance. However, some species of the Melamphaidae, particularly those of the genera *Melamphaes*, *Poromitra*, and *Scopeloberyx*, are apparently abundant and have presumably large geographic ranges. Therefore, descriptions or taxonomic revisions of components of those genera based on relatively few specimens patchily distributed over large areas have a worrying tendency of neglecting relevant anatomical variation. The experience accumulated in the last decades indicate that extensive taxonomic studies including proper examination of the type series and a large, truly representative number of specimens on a global scale are required for a more coherent and realistic taxonomic scenario of the group to emerge. In this context, and also based on the results presented by Mincarone et al. (2014), more investments in deep-sea collections in historically neglected regions such as the South Atlantic are still necessary in order to properly assess the diversity of the Stephanoberycoidae.

DATA ACCESSIBILITY

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ACKNOWLEDGMENTS

We thank the French oceanographic fleet for funding the ABRACOS at-sea survey and the officers and crew of the RV *Antea* for their effort and technical skills during the expeditions. Thanks are also due to James Maclaine (Natural History Museum, London) for sharing data, illustrations, and radiographs of the type specimens for the study of Mincarone et al. (2014), which were also relevant in the present study. We sincerely thank Jon A. Moore and John Paxton for providing insightful comments and for sharing unpublished information on stephanoberycoids that substantially improved the manuscript. We further extend our gratitude to Marcelo Britto and Cristiano Moreira (MNRJ) for loan of specimens, and Jørgen Nielsen (ZMUC) for providing literature. The first author received a student scholarship from the "Programa Institucional de Bolsas de Iniciação

Científica–Universidade Federal do Rio de Janeiro" (PIBIC/UFRJ) during the study. Leandro Eduardo was supported by CAPES (grant 88882.436215/2019-01), CAPES-Print (grant 88887.364976/2019-00), and FUNBIO/HUMANIZE ("Programa Bolsas Funbio–Conservando o Futuro"–011/2019). Fabio Di Dario, F. Lucena-Frédou, and M. Mincarone are supported by CNPq (grants PROTAX 443302/2020, 308554/2019-1, and 314644/2020-2, respectively). This study is a contribution to the LMI TAPIOCA, program CAPES/COFECUB (88881.142689/2017-01), and EU H2020 TRIATLAS project under Grant Agreement 817578. The NPM Fish Collection has been supported by the project Multipesca (FUNBIO) under the grant "Pesquisa Marinha e Pesqueira" (104/2016). This study is part of the final paper developed by the first author to obtain a bachelor's degree in Biological Sciences at the Universidade Federal do Rio de Janeiro. We are especially grateful to members of the examination board, Marcelo Britto (MNRJ), and Luciano Fischer (NUPEM/UFRJ) for their valuable suggestions.

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