
New records of rare deep- sea fishes (Teleostei) collected from off northeastern Brazil, including seamounts and islands of the Fernando de Noronha Ridge

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Abstract :

Here we report on new data on the occurrence and distribution of rare deep-sea fishes (Teleostei) collected from off northeastern Brazil, including seamounts and oceanic islands of the Fernando de Noronha Ridge (Rocas Atoll and Fernando de Noronha Archipelago). Collections were made by the French RV Antea during the ABRACOS (Acoustics along the BRAzilian COaSt) expeditions, between 29 September and 21 October 2015, and April 9 and May 10, 2017. Occurrences of *Photostylus pycnopterus* (Alepocephalidae), *Gigantura chuni* (Giganturidae), *Ahliesaurus berryi* (Notosudidae), *Benthalbella infans*, *Rosenblattichthys hubbsi*, *Scopelarchoides danae* (Scopelarchidae), *Scopelengys tristis* (Neoscopelidae), *Zu cristatus* (Trachipteridae), *Stylephorus chordatus* (Stylephoridae), and *Pseudoscopelus cordilluminatus* (Chiasmodontidae) are reported for the first time or confirmed in the Brazilian Exclusive Economic Zone. *Photostylus pycnopterus* and *G. chuni* are also recorded for the first time in the western South Atlantic, whereas records of *P. cordilluminatus* are the first in the western Atlantic. Other records of rare species of those families are also reported and discussed.

Keywords : Taxonomy, distribution, deep-sea fishes, Tropical Atlantic

1. INTRODUCTION

Mesopelagic fishes are one of the most important vertebrate groups of the world's oceans, usually presenting high biodiversity and abundance in deep-sea waters. Despite their relevance on a global scale, there is a major lack of knowledge regarding their regional composition. In the western South Atlantic, a still relatively poorly sampled region, knowledge about the diversity and distribution of deep-sea fishes is mostly based on local and fragmentary studies. In this context, studies performed along the vast Brazilian coastline (about 7,500 km) and its associated Economic Exclusive Zone, including oceanic islands and seamounts, are key for better understanding the marine biodiversity of the region (e.g., Reis *et al.*, 2016).

Major scientific surveys performed in the last decades along the Brazilian coast

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focused mostly on the demersal fish diversity (e.g. Bernardes *et al.*, 2005; Costa *et al.*, 2007; Costa & Mincarone, 2010; Klautau *et al.*, 2020; Lins Oliveira *et al.*, 2015), while relatively less attention has been given to the meso- and bathypelagic fishes (e.g. Braga *et al.*, 2014; Figueiredo *et al.*, 2002; Lima *et al.*, 2011; Mincarone *et al.*, 2014). In recent years, the team members of the Project ABRACOS (Acoustics along the BRAzilian COaSt) conducted a multidisciplinary study off northeastern Brazil to better understand the degree of connectivity between the continental margin and the oceanic islands and seamounts of the region. The two surveys performed along the study area revealed a rich mesopelagic fish fauna, including many new distributional records in groups of the Teleostei such as the Argentiniformes (Mincarone *et al.*, 2021), Stomiiformes (Eduardo *et al.*, 2020a, 2020b; Villarins *et al.*, 2022), Ceratioidei (Mincarone *et al.*, 2021), Stephanoberycoidei (Afonso *et al.*, 2021), Caristiidae (Mincarone *et al.*, 2019), Howellidae (Eduardo *et al.*, 2019), and Trichiuridae (Eduardo *et al.*, 2018). Here, we provide new distributional records of rare species of the families Alepocephalidae, Chiasmodontidae, Giganturidae, Scopelarchidae, Stylephoridae, and Trachipteridae collected during the ABRACOS expeditions off northeastern Brazil.

2. MATERIALS AND METHODS

Specimens examined were collected during the ABRACOS expeditions, carried out between 29 September and 21 October 2015 (ABRACOS 1 – AB1; Bertrand, 2015), and between 9 April and 10 May 2017 (ABRACOS 2 – AB2; Bertrand, 2017). Both expeditions were conducted by the French RV *Antea* off northeastern Brazil, including collections along the Fernando de Noronha Ridge (Rocas Atoll, Fernando de Noronha Archipelago, and seamounts off Rio Grande do Norte State). The surveys comprised 82 fishing stations, between the surface and 1,113 m depth, and resulted in the collection of more than 9,000 fish specimens. Further information on sampling methods and fishing gear is provided by Mincarone *et al.* (2021). All specimens are deposited in the fish collection of the “Instituto de Biodiversidade e Sustentabilidade, Universidade Federal do Rio de Janeiro – NPM”. Other institutional abbreviations follow Sabaj (2020). Diagnostic features of the species reported along the text are composed of a mixture of pertinent characters from different taxonomic levels (family, genus, and species) in order to facilitate the identification of specimens.

Ethical Statement: All methods were approved and conducted in accordance with regulations of the Brazilian Ministry of Environment (SISBIO authorization number: 47270–5). Operations of the RV *Antea* were approved by the Brazilian Navy Authority (“Estado-Maior da Armada”) under the Ordinances 178 (08/09/2015) and 4 (24/01/2017).

3. RESULTS

3.1 *Photostylus pycnopterus* Beebe 1933 (Alepocephalidae)

(Figures 1a and 2a)

Specimens examined. NPM 5015, 1, 95 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, 21:17–21:52 h; NPM 5018, 1, 75 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, 11:47–12:18 h.

Diagnostic features. *Photostylus pycnopterus* is distinguished by the scaleless body, covered with photophores on raised stalks; a small head (about 14–19% SL) with an oblique upper profile; snout length longer than eye length; ventral outline of upper jaw with obtuse angle at end of premaxilla; maxilla extends near to posterior margin of eye; pseudobranch absent; pectoral fins fan like and with 17–20 rays; dorsal-fin base shorter than anal-fin base, with 12–15 rays; 17–19 anal-fin rays (Beebe, 1933; McEachran & Fechhelm, 1998; Sutton *et al.*, 2020; Tsukamoto *et al.*, 1992; Wisner, 1976). The genus is monotypic (Fricke *et al.*, 2022)

Distribution. *Photostylus pycnopterus* is a meso- to bathypelagic species with a wide distribution in the tropical and temperate waters of the Atlantic, Pacific and Indian oceans, from 840 to 2,868 m depth (Beebe, 1933, Fitch & Lavenberg, 1968; Goodyear, 1969; Grey, 1958; Kashkin, 1975; Mundy, 2005; Parin *et al.*, 1976; Quéro, 1974; Rivaton *et al.*, 1990; Sutton *et al.*, 2020; Tsukamoto *et al.*, 1992; Wisner, 1976). In the western Atlantic, the species was reported from Davis Strait (Canada) to the Caribbean Sea, including the Gulf of Mexico (Beebe, 1933; Becker *et al.*, 1975; Carter & Hartel, 2003; McEachran & Fechhelm, 1998; Moore *et al.*, 2003; Nakamura & Okamura, 1995). The two specimens reported here were collected from depths between 770 and

1,020 m near the seamounts off eastern Rocas Atoll (Figure 2a). They represent the first records of the species in the western South Atlantic and in Brazilian waters.

Remarks. This is the only species of the Alepocephalidae collected during the ABRACOS expeditions. About 18 species of that family are currently reported in Brazilian waters (e.g., Melo *et al.*, 2020), but this number is certainly underestimated according to ongoing studies by the authors.

3.2. *Gigantura chuni* Brauer 1901 (Giganturidae)

(Figures 1b and 2b)

Specimens examined. NPM 4241, 1, 167 mm, sta. AB2/44A, 03°52'52.5"S, 32°17'33.3"W to 03°51'13.4"S, 32°16'28.0"W, 850 m, 28 April 2017, 12:44–13:17 h; NPM 5238, 2, 42–? (damaged) 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, 22:08–22:40 h.

Diagnostic features. *Gigantura chuni* has a body relatively deep and compressed; snout very short; horizontal tubular eyes directed forward; mouth extends to bellow middle of pectoral-fin base; jaw teeth moderate to long, depressible, arranged in two or three rows; pelvic fin absent in adults; a deeply forked caudal fin, with a greatly elongated lower lobe. It can be distinguished from its only congener, *Gigantura indica* Brauer 1901, by having 30–33 pectoral-fin rays (*vs.* 36–42), 8–10 anal-fin rays (*vs.* 11–14), head length 20.0–30.0% SL (*vs.* 12.0–19.0%), depth of caudal peduncle 8.1–11.0% SL (*vs.* 2.0–3.6%) (Johnson & Bertelsen, 1991; McEachran & Feckhelm, 1998; Sutton *et al.*, 2020).

FIGURE 1

Distribution. *Gigantura chuni* is meso- to bathypelagic, with a wide distribution in the tropical waters of the Atlantic, Pacific and Indian oceans, from 500 to 2,000 m depth (Johnson & Bertelsen, 1991). Nearly all records are within approximately 20°N and 20°S. Previous records of this species are widespread in the Tropical Atlantic, except off Brazil. The three specimens reported herein were collected off Fernando de Noronha

and Rocas Atoll, at 610 and 850 m depth (Figure 2b), and are the first records of *G. chuni* in Brazilian waters, and in the western South Atlantic.

Remarks. In addition to *Gigantura chuni*, 30 specimens of *G. indica* (24–190 mm SL) were also collected in 17 collection stations of the ABRACOS expeditions. Most specimens of that species were collected along the Fernando de Noronha Ridge, but some specimens were also collected off states of Rio Grande do Norte, Paraíba, and Pernambuco, between depths of 50 and 1,113 m (Figure 2b). Previous records of *G. indica* in Brazilian waters are known off Rio Grande do Norte State (as *Rosaura rotunda* Tucher 1954, junior synonym of *Gigantura indica*), Paraíba State, Fernando de Noronha Archipelago, and Trindade Island (Johnson & Bertelsen, 1991). Additional unpublished records of *G. indica* in Brazilian waters are also known off northern Bahia State, based on four specimens (MNRJ 49747, 49748, 49749, 42858; 175–230 mm SL) collected in June 2000 by the RV *Thalassa*, during the REVIZEE Program.

FIGURE 2

3.3. *Ahliesaurus berryi* Bertelsen, Krefft & Marshall 1976 (Notosudidae)

(Figures 1c and 3a)

Specimen examined. NPM 4574, 1, 198 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, 12:44–13:17 h.

Diagnostic features. Body slender, elongate; snout relatively short (6.1–7.9% SL), sharply pointed, somewhat depressed; jaw extends close to the rear of eye; jaw teeth small, no enlarged fangs; dorsal fin midway on body; adipose dorsal fin above anal fin; anal fin placed far back on body; body and head covered with large, deciduous, cycloid scales; pelvic fins inserted below or just in front of dorsal-fin origin; posterior infraorbitals as simple half tubes, without posterior expansion; ventral body wall thin and transparent, dark peritoneum clearly visible. It can be distinguished from its only congener, *Ahliesaurus brevis* Bertelsen, Krefft & Marshall 1976 (not recorded in the Atlantic), by having 47–50 vertebrae (vs. 42–46) and 8–11 pyloric caeca (vs. 4–8) (Bertelsen *et al.*, 1976; Krefft, 1986; Sutton *et al.*, 2020).

Distribution. *Ahliesaurus berryi* is a meso- to bathypelagic species known from the subtropical and tropical waters of the Atlantic, Indian, and Pacific oceans. (Bertelsen *et al.*, 1976; Krefft, 1986, 1990; Moore *et al.*, 2003; Russel, 2016; Sutton *et al.*, 2020). In the western South Atlantic, the species was previously reported from about 10° to 40°S, outside the Brazilian EEZ (Bertelsen *et al.*, 1976). The species was previously included in lists of Brazilian marine fishes based on its presumed occurrence in the region (Figueiredo & Menezes, 2003; Melo *et al.*, 2020), but the single specimen collected near the Fernando de Noronha Archipelago at 850 m depth represents the first confirmed record of *A. berryi* in Brazilian waters (Figure 3a).

Remarks. A single specimen of *Scopelosaurus smithii* Bean 1925, another notosuidid, was also collected during the ABRACOS expeditions, from off Pernambuco State, at 680 m depth (NPM 4573, 177 mm SL; Figure 3a). This species was previously recorded in Brazilian waters from off Bahia to Rio de Janeiro states, in addition to the Vitória-Trindade Seamount Chain and Trindade Island (Bertelsen *et al.*, 1976, fig. 30; Bonecker & Castro, 2006). Other species of Notosuididae recorded in the Brazilian EEZ are: *Luciosudis normani* Fraser-Brunner 1931, from off Santa Catarina and Rio Grande do Sul states (Bertelsen *et al.*, 1976, fig. 63; Figueiredo *et al.*, 2002); *Scopelosaurus argenteus* (Maul 1954), from off Fernando de Noronha and Saint Peter and Saint Paul archipelagos (MCZ 83603: 01°02'30"S, 34°58'30"W; MCZ 83604–83605: 01°13'30"S, 34°35'30"W; MCZ 83606: 00°26'30"N 32°06'30"W; Bertelsen *et al.*, 1976, fig. 33); and *Scopelosaurus herwigi* Bertelsen, Krefft & Marshall 1976, from off Espírito Santo (DZUFRJ 8979: 21°12'00"S, 37°46'27"W; Bonecker & Castro, 2006) and Rio Grande do Sul (Figueiredo *et al.*, 2002) states, with additional records outside the Brazilian EEZ between 25°S and 33°S (Bertelsen *et al.*, 1976).

3.4. *Benthalbella infans* Zugmayer 1911 (Scopelarchidae)

(Figures 1d and 3b)

Specimen examined. NPM 3553, 1, 57 mm, sta. AB1/26, 06°09'13.5"S, 34°34'34.0"W to 06°09'49.6"S, 34°33'44.5"W, 560 m, 12 October 2015, 12:48–13:08 h.

Diagnostic features. *Benthalbella infans* is distinguished by the body moderately elongated, compressed; eyes large, tubular, with glistening white oval lens on side of

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eye tube; mouth large, extending beyond posterior margin of eye; adipose dorsal fin present; gill-rakers absent, replaced by tooth plates on anterior arches; 55–62 large lateral line scales, each scale consisting of a bony plate with a distinct bony shelf behind the pore that mostly or completely covers the pore; four luminous organs on the ventral surface of body, the first on the isthmus (IO), the second just anterior to the pelvic fin base (POa), the third just posterior to the pelvic fin (POp), and the fourth immediately anterior to the anal fin (AO); dorsal-fin base short, with 9 (rarely 8) rays; 25–28 pectoral-fin rays; 20–25 anal-fin rays (Johnson, 1974a, 1986; Merrett *et al.*, 1971, 1973; Stewart, 2015; Sutton *et al.*, 2020).

Distribution. *Benthalbella infans* is meso- to bathypelagic, with a wide distribution in the tropical and warm-temperate waters of the Atlantic, Pacific and Indian oceans, mainly between 45°N and 35°S (Johnson, 1974a, 1982, 1986; Merrett *et al.* 1973; Russell, 2016; Sutton *et al.*, 2020). The species was reported from the western South Atlantic by Johnson (1974a; ISH 1437-1968, 30°01'S, 42°30'W), Menezes & Figueiredo (2003: MCZ 70342, 30°36'S, 41°56'W), and Judkings & Haedrich (2018: RGB 1423, 12°12'S, 31°06'W; RGB 1431, 23°00'S, 32°12'W). Those records are outside the Brazilian EEZ, but Menezes & Figueiredo (2003) and Melo *et al.* (2020) included *B. infans* in their lists of Brazilian marine fishes based on the likely occurrence of the species in waters of the country, given its wide distribution in the Atlantic. The specimen collected at 560 m depth off Rio Grande do Norte State represents the first confirmed record of *B. infans* in the Brazilian EEZ (Figure 3b).

3.5. *Rosenblattichthys hubbsi* Johnson 1974 (Scopelarchidae)

(Figures 1e and 3b)

Specimens examined. NPM 4554, 4, 40–100 mm, sta. AB2/21, 06°50'21.0''S, 34°18'24.0''W to 06°48'24.3''S, 34°20'29.5''W, 800 m, 16 April 2017, 11:25–12:12 h.

Diagnosis. *Rosenblattichthys hubbsi* is distinguished by the body relatively short, deep and robust; eyes large, tubular, with glistening white oval lens on side of eye tube; a streak of dense black pigment bordering anterior margin of eye; mouth large, extending beyond posterior margin of eye; adipose dorsal fin present; gill-rakers absent, replaced by tooth plates on anterior arches; 47–53 large lateral line scales, each scale consisting

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of a bony plate with a distinct bony shelf behind the pore that mostly or completely covers the pore; pectoral and pelvic fins elongated and equal in length, pelvic fins inserting slightly anterior to dorsal-fin origin; 21–23 pectoral-fin rays; 8–9 dorsal-fin rays; 23–25 anal-fin rays; 49 vertebrae (Johnson 1974a, 1974b, 1982, 1986; McEachran & Fechhelm, 1998; Okiyama & Johnson, 1986; Sutton *et al.*, 2020). Species of *Rosenblattichthys* are also characterized by a unique configuration of accessory pigment areas or spots: *Rosenblattichthys hubbsi* has only two pigment areas as its congener *R. nemotoi* Okiyama & Johnson 1986, but its dorsal pigmented area is located over the posterior one-third of the anal-fin base instead of over the anterior one-third of the anal-fin base in *R. nemotoi* (Okiyama & Johnson, 1986).

Distribution. *Rosenblattichthys hubbsi* is meso- to bathypelagic, with a wide distribution in the subtropical and tropical waters of the Atlantic, Pacific and Indian oceans (Johnson, 1974a, 1974b, 1982, 1986). The species was included in previous lists of Brazilian marine fishes (Melo *et al.*, 2020; Menezes & Figueiredo, 2003) based on adult specimens collected outside the country's EEZ (e.g., Bonecker & Castro, 2006; Johnson, 1974b, 1982; Judkings & Haedrich, 2018), and larvae collected off Pará (MCZ 70305: 01°00'N, 45°46'W; Judkings & Haedrich, 2018) and off southern Bahia states (DZUFRJ 3237; Bonecker & Castro, 2006). The four specimens collected off Paraíba State, at 800 m depth (Figure 3b), are the first confirmed records of *R. hubbsi* in Brazilian waters.

3.6. *Scopelarchoides danae* Johnson 1974 (Scopelarchidae)

(Figures 1f and 3b)

Specimen examined. NPM 4555, 1, 80 mm, 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, 12:23–12:26 h.

Diagnostic features. *Scopelarchoides danae* is distinguished by the body moderately elongated, compressed; heavy dermal pigmentation forming a dark stripe ventral to lateral line that extends from the pelvic-fin region to the lower caudal-fin lobe, pigment absent or weakly developed dorsal to lateral line and on upper caudal-fin lobe; eyes large, tubular, with glistening white oval lens on side of eye tube; mouth large, extending beyond posterior margin of eye; adipose dorsal fin present; gill-rakers absent,

replaced by tooth plates on anterior arches; 50–52 large lateral line scales, each scale consisting of a bony plate with a distinct bony shelf behind the pore that mostly or completely covers the pore; pelvic fin distinctly longer than pectoral fin, origin of pelvic fin under anterior one-third of dorsal-fin base; 20–22 pectoral-fin rays; 6–9 (usually 7 or 8) dorsal-fin rays; 24–27 anal-fin rays; 48–50 vertebrae (McEachran & Fechhelm, 1998; Johnson, 1974a, 1974b, 1986; Stewart, 2015; Sutton *et al.*, 2020).

Distribution. *Scopelarchoides danae* is a mesopelagic species with a wide distribution in the tropical and temperate waters of the Atlantic, Pacific and Indian oceans (Johnson, 1974a, 1974b, 1982, 1990). The species was included in previous lists of Brazilian marine fishes (Melo *et al.*, 2020; Menezes & Figueiredo, 2003) based on specimens collected outside the country's EEZ, off northern and northeastern Brazil (MCZ 70371, 70380; Johnson, 1982). The single specimen reported from off Fernando de Noronha Archipelago, at 780 m depth, is the first confirmed record of *S. danae* in Brazilian waters (Figure 3b).

FIGURE 3

Remarks. In addition to *Benthalbella infans*, *Rosenblattichthys hubbsi* and *Scopelarchoides danae*, two species of the Scopelarchidae previously recorded in Brazilian waters were also collected during the ABRACOS expeditions: *Scopelarchus analis* (Brauer 1902), from off São Pedro and São Paulo Archipelago (MCZ 127130: 00°56'24"N, 29°37'00"W; MCZ 69323: 00°58'S, 27°34'W) and Trindade Island (MCZ 69284: 18°10'S, 29°40'W) (Johnson, 1982); and *Scopelarchus guentheri* Alcock 1896, from off Pará State (MCZ 70953: 01°24'N, 45°24'W). During the ABRACOS expeditions, two specimens of *S. analis* (NPM 3260, 3261; 91–115 mm SL) were collected around the Rocas Atoll, between depths of 510 and 525 m. In addition, eight specimens of *S. guentheri* (NPM 4553, 4556, 4557, 4558, and 4559; 38–113 mm SL) were collected off Rio Grande do Norte and Paraíba states and in the vicinities of the Rocas Atoll, between depths of 610 and 1,030 m (Figure 3b).

Scopelarchus michaelsarsi Koefoed 1955 is another scopelarchid reported from Brazil (Melo *et al.*, 2020; Menezes & Figueiredo, 2003). However, the occurrence of the species in Brazilian waters still require confirmation since all known records of the

species are outside the country's EEZ (e.g., MCZ 70969-71; ISH 1259-1968; ISH 1087-1968).

3.7. *Scopelengys tristis* Alcock 1890 (Neoscopelidae)

(Figures 1g and 4a)

Specimen examined. NPM 4620, 1, 145 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, 770–1,020 m, 30 April 2017, 21:17–21:52 h. NPM 4621, 1, 98 mm, 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, 12:23–12:26 h.

Diagnostic features. Body elongated, compressed; dorsal-fin origin above pelvic-fin origin; dorsal adipose fin over end of anal fin; anal-fin origin well behind dorsal-fin base; pectoral and pelvic fins long, both reaching to anus; no photophores on body; eye small (11.8–15.9% HL); upper jaw extending beyond vertical through posterior margin of orbit; a patch of small teeth on each side of vomer; mesopterygoid teeth absent; scales cycloid, highly deciduous. It can be distinguished from its only congener, *Scopelengys clarkei* Butler & Ahlstrom 1976, by the number of pectoral-fin rays (14–17 vs. 12–13), number of vertebrae (29–32 vs. 34–35), and depth of caudal peduncle (5.6–8.3% SL vs. 9.4–10.2% SL) (Butler & Ahlstrom, 1976; Fujii, 1983; Hartel & Craddock, 2003; Nafpaktitis, 1977; Romero Camarena, 2009).

Distribution. *Scopelengys tristis* is a meso- to batypelagic species with a wide distribution in the tropical and temperate waters of the Atlantic, Pacific and Indian oceans (Butler & Ahlstrom, 1976; Hartel & Craddock, 2003; Milkova *et al.*, 2016; Nafpaktitis, 1977; Nakabo, 2002; Romero Camarena, 2009; Sutton *et al.*, 2020). The species was reported by Menezes *et al.* (2003a) and Marceniuk *et al.* (2021) as occurring in Brazilian waters based on one specimen (MCZ 101792), which was actually collected in the western North Atlantic outside the country's EEZ. Therefore, the two specimens of *S. tristis* collected off Rocas Atoll and Fernando de Noronha Archipelago, between depths of 770 and 1,020 m, are the first record of the species in the Brazilian EEZ (Figure 4a).

Remarks. Other species of Neoscopelidae reported from Brazil are *Neoscopelus macrolepidotus* Johnson 1863 and *Neoscopelus microchir* Matsubara 1943. *Neoscopelus macrolepidotus* has been recorded along the entire Brazilian coast (e.g. Haimovici *et al.*, 1994; Asano Filho *et al.*, 2005; Bernardes *et al.*, 2005; Braga *et al.*, 2007; Bonecker *et al.*, 2012; Lins Oliveira *et al.*, 2015), while *N. microchir* is known only from two specimens collected off southern Brazil (Figueiredo *et al.*, 2002).

3.8. *Zu cristatus* (Bonelli 1819) (Trachipteridae)

(Figures 1h and 4b)

Specimens examined. NPM 3186, 1, 86 mm, sta. AB1/5, 04°05'22.2"S, 32°10'51.6"W to 04°04'32.4"S, 32°11'55.2"W, 85 m, 2 October 2015, 21:18–21:48 h; NPM 3187, 1, 89 mm, sta. AB1/1, 03°46'18.6"S, 32°25'13.2"W to 03°46'03.0"S, 32°23'48.6"W, 150 m, 30 September 2015, 22:32–23:02 h; NPM 3188, 1, 78 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, 21:32–22:12 h; NPM 3193, 1, 53 mm, sta. AB1/20, 03°45'18.6"S, 33°53'10.8"W to 03°44'32.4"S, 33°54'04.8"W, 60 m, 7 October 2015, 21:13–21:37 h; NPM 3309, 1, 10 mm, sta. AB1/11, 03°44'58.8"S, 33°13'39.6"W to 03°44'58.8"S, 33°12'09.0"W, 650 m, 5 October 2015, 12:03–12:47 h; NPM 3310, 1, 15 mm, sta. AB1/21, 03°39'27.4"S, 33°41'26.6"W to 03°38'33.6"S, 33°42'53.4"W, 75–115 m, 8 October 2015, 10:09–10:49 h; NPM 4504, 1, 430 mm, sta. AB2/48A, 04°25'05.3"S, 32°57'52.1"W to 04°25'24.9"S, 32°56'55.5"W, 505 m, 24 April 2017, 10:30–10:58 h; NPM 5033, 1, 69 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, 21:49–22:37 h.

Diagnostic features. *Zu cristatus* is distinguished by the body elongated and tapering, with a wavy or scalloped ventral body margin; upper jaw highly protractile; head short and deep; dorsal fin scarlet, origin over posterior margin of orbit, consisting of about 5–6 elongated rays followed by about 125–145 shorter rays; posterior portion of lateral line running along ventral edge of tail as a series of sharp spines that point in alternating directions; caudal fin reddish black, darker posteriorly. It can be distinguished from its only congener, *Zu elongatus* Heemstra & Kannemeyer 1984, by the body depth in adults (20–26% *vs.* 12–16% SL), eye diameter (13–16% *vs.* 9–10% of distance from snout to anus), and number of lateral-line scales (99–106 *vs.* 126–130) (Angulo &

López-Sánchez, 2017; Heemstra & Kannemeyer, 1986; McEachran & Fechhelm, 1998; Olney & Hartel, 2016a; Sutton *et al.*, 2020).

Distribution. *Zu cristatus* is a mesopelagic species, with a wide distribution in the tropical and temperate waters of the Atlantic, Pacific and Indian oceans (Angulo & López-Sánchez, 2017; Olney & Hartel, 2016a; Sutton *et al.*, 2020). The presumed occurrence of the species in Brazilian waters (e.g., Menezes *et al.*, 2003b; Melo *et al.*, 2020; Marceniuk *et al.*, 2021) was based on a few records of the species in the western Tropical Atlantic outside the country's EEZ (MCZ 58928; MCZ 84634; NSMT-P 40246) and also on larvae collected off Rio de Janeiro State (Bonecker *et al.*, 2014) and near the Martin Vaz Archipelago (Stocco & Joyeux, 2015). The eight specimens reported here, collected between depths of 40 and 800 m off the Rio Grande do Norte, Rocas Atoll, and Fernando de Noronha, are the first confirmed records of juvenile and adult specimens of *Zu cristatus* in the Brazilian EEZ (Figure 4b).

Remarks. Other species of Trachipteridae reported from Brazilian waters are *Desmodema polystictum* (Ogilby 1898), recorded off Rio de Janeiro and Rio Grande do Sul states (Costa & Mincarone, 2010; Figueiredo *et al.*, 2002), and *Trachipterus jacksonensis* (Ramsay 1881), reported from off Rio de Janeiro to Rio Grande do Sul states (Figueiredo *et al.* 2002; Mancini *et al.*, 2003; Menezes, 1971; Mincarone *et al.*, 2001). One additional specimen of *Desmodema polystictum* was also collected during the ABRACOS expeditions (NPM 5055, 74 mm SL), at 850 m depth near the Fernando de Noronha Archipelago (Figure 4b). Additionally, five very small specimens of *Trachipterus* sp. (NPM 3206, 3326, 3331, 3369, 5050; 18–55 mm SL) were collected off the Rocas Atoll, Rio Grande do Norte, and Pernambuco states (Figure 4b). They could not be identified at species level due to their small sizes but may represent *T. jacksonensis*, since this is so far the only species of the genus reported from the western South Atlantic (Mincarone *et al.*, 2001).

FIGURE 4

3.9. *Stylephorus chordatus* Shaw 1791 (Stylephoridae)

(Figures 1i and 5a)

Specimens examined: NPM 3178, 2, 170–255 mm, sta. AB1/14, 03°58'58.2"S, 34°03'22.2"W to 03°57'42.0"S, 34°04'52.2"W, 510 m, 6 October 2015, 21:40–22:26 h; NPM 4222, 7, 143–210 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, 21:49–22:37 h; NPM 4100, 4, 112–168 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, 12:23–12:26 h; NPM 4126, 5, 145–176 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, 22:08–22:40 h; NPM 4143, 5, 130–220 mm, sta. AB2/44A, 03°52'52.5"S, 32°17'33.3"W to 03°51'13.4"S, 32°16'28.0"W, 850 m, 28 April 2017, 12:44–13:17 h; NPM 4183, 4, 192–242 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, 22:35–23:15 h; NPM 4212, 1, 220 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, 11:47–12:18 h; NPM 4213, 2, 139–165 mm, sta. AB2/40A, 03°31'21.0"S, 32°31'39.8"W to 03°31'30.8"S, 32°30'40.6"W, 440 m, 26 April 2017, 10:43–11:06 h; NPM 4244, 10, 90–250 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, 21:44–22:06 h; NPM 4433, 1, damaged, sta. AB2/41B, 03°19'15.7"S, 32°25'42.3"W to 03°19'13.8"S, 32°25'10.5"W, 25 m, 26 April 2017, 23:16–23:31 h; NPM 4435, 1, 71 mm, sta. AB2/46A, 04°08'31.3"S, 32°18'14.8"W to 04°08'56.5"S, 32°17'28.9"W, 360 m, 29 April 2017, 11:20–11:45 h; NPM 4454, 1, 111 mm, sta. AB2/46B, 04°10'29.7"S, 32°16'04.2"W to 04°10'56.8"S, 32°15'29.0"W, 440 m, 29 April 2017, 13:08–13:34 h; NPM 4602, 1, 121 mm, sta. AB2/52B, 03°41'56.4"S, 33°23'29.4"W to 03°42'34.2"S, 33°22'36.1"W, 385 m, 2 May 2017, 14:00–14:30 h; NPM 5408, 11, 59–279 mm, sta. AB2/21, 06°50'21.0"S, 34°18'24.0"W to 06°48'24.3"S, 34°20'29.5"W, 800 m, 16 April 2017, 11:25–12:12 h.

Diagnosis. *Stylephorus chordatus* is the only species in the Stylephoriformes (e.g., Dornburg & Near, 2021; Hughes *et al.*, 2018; Miya *et al.*, 2007). It can be recognized by a slender, compressed, elongate body; eyes conspicuous, telescopic, directed forward and somewhat upward; jaws highly protrusible, mouth small and tubular, lower jaw extending in front of upper jaw; inside of mouth and gill chamber black; teeth absent or minute; dorsal-fin base long, with more than 100 rays, extending from nape to caudal fin, the first and second rays longer than remaining rays; anus immediately before anal-fin origin; pelvic-fin with just one ray, about below pectoral-fin base; anal fin short;

caudal fin with two highly modified externally visible lobes, upper caudal-fin lobe with five or six short rays, lower with two long rays, forming a projection or tapering equal to or exceeding body length when intact (Hulley, 1986; Olney & Hartel, 2016b; Sutton *et al.*, 2020). The genus is monotypic (Fricke *et al.*, 2022).

Distribution: *Stylephorus chordatus* is meso- to bathypelagic, distributed in the tropical and temperate waters of the Atlantic, Pacific and Indian oceans (Olney, 2003; Olney & Kartel, 2016b; Sutton *et al.*, 2020). Records are widespread in the Atlantic Ocean, except in the western South Atlantic. The 53 specimens reported here were collected between depths of 25 and 900 m off Fernando de Noronha, Rocas Atoll, the seamounts of Fernando de Noronha Ridge, and off Rio Grande do Norte and Paraíba states (Figure 5a). They represent the first published records of *S. chordatus* in Brazilian waters, but additional specimens are also known from off Maranhão State (MCZ 147847: 01°12'N, 44°39'W), the Rocas Atoll (MCZ 147900: 01°13'S, 34°35'W; MCZ 147840: 01°02'S, 34°58'W), and the São Pedro and São Paulo Archipelago (MCZ 96864: 00°34'N, 30°43'W).

3.10 *Pseudoscopelus cordilluminatus* Melo 2010 (Chiasmodontidae)

(Figures 1j and 5b)

Specimens examined. NPM 5027, 1, 31 mm, sta. AB2/6, 08°51'21.0"S, 34°35'40.8"W to 08°53'38.9"S, 34°36'19.0"W, 240 m, 11 April 2017, 10:53–11:55 h; NPM 4536, 1, 57 mm, sta. AB2/44A, 03°52'52.5"S, 32°17'33.3"W to 03°51'13.4"S, 32°16'28.0"W, 850 m, 28 April 2017, 12:44–13:17 h.

Diagnosis. *Pseudoscopelus cordilluminatus* is distinguished by the body elongated and moderately compressed; dorsal fin divided into two fins; head and body with photophores; belly moderately distensible; mouth terminal, large, nearly horizontal; premaxillary and dentary teeth curved posteriorly, not flared outwards; a long and broadened premaxilla, with a unique dentition pattern where the mesial series is organized in rows of two to three teeth, the first (outer) and second teeth much smaller than the innermost (oral) tooth; lateral series of premaxillary teeth without hooked teeth (Melo, 2010; Sutton *et al.*, 2020). According to Melo (2010) *P. cordilluminatus* can be distinguished in the *Pseudoscopelus scriptus* species group by the premaxillary

dentition pattern (a single row in *P. pierbartus* and *P. obtusifrons*; teeth of the mesial series gradually increasing in size in *P. cephalus*, *P. sagamianus*, and *P. scriptus*). Also according to Melo (2010), *P. cordilluminatus* can be further distinguished from *P. scriptus* by the series of anal-fin photophores (*saf*) extending anteriorly to about the anus region (*vs. saf* not extending anteriorly to anus), from *P. cephalus* by the vertebral count (total vertebrae 35–36, precaudal 18–19 *vs.* 31 and 14, respectively), and from *P. sagamianus* by melanophores inside mouth restricted to the region of tooth insertion (*vs.* internal area of mouth and gill arches completely black).

Distribution: *Pseudoscopelus cordilluminatus* is a mesopelagic species from the equatorial and tropical eastern Atlantic (Melo, 2010; Prokofiev, 2014; Sutton *et al.*, 2020) and possibly the Indian Ocean (Melo, 2010; Prokofiev, 2014). The holotype was collected in the eastern Atlantic close to the Mid-Atlantic Ridge (MCZ 161017; 0°00'30.0"N, 19°45'30.0"W). The two specimens reported here, collected between depths of 240 and 850 m off the Pernambuco State and Fernando de Noronha Archipelago (Figure 5b), are the first records of the species in the western Atlantic and in Brazilian waters.

Remarks. In addition to *P. cordilluminatus*, other 13 rare species of the Chiasmodontidae are reported from Brazilian waters (Figueiredo *et al.*, 2003; Melo, 2008, 2009, 2010; Séret & Andreato, 1992). Four of those species were also collected during the ABRACOS expeditions: *Chiasmodon niger* Johnson 1864, *C. braueri* Weber 1913, *Kali kerberti* (Weber 1913), and *Pseudoscopelus scutatus* Krefft 1971.

Chiasmodon niger was previously reported from Brazilian waters based on a single specimen (USU 1364, 134 mm SL; apparently lost) collected off Espírito Santo State (21°24.16'S, 39°56.19'W, 1,320–1,360 m depth; Melo, 2009; Séret & Andreato, 1992), and another specimen (BMNH 1879.5.14.588, 50.6 mm SL) collected off Saint Peter and Saint Paul Archipelago (01°22'N, 26°36'W; Melo, 2009). The identification of other specimens collected off Saint Peter and Saint Paul Archipelago (ISH 1711-1966: 01°22'N, 26°36'W) and Santa Catarina State (ISH 1817-1968: 29°57'S, 47°35'W) requires further corroboration as they were not reported by Melo (2009). In our survey, a single specimen of *C. niger* was collected (NPM 4537, 90 mm SL) at 850 m depth off eastern Fernando de Noronha Archipelago (Figure 5b).

Four specimens of *Chiasmodon braueri* (53–171 mm SL), collected between depths of 1,209 and 1,929 off Bahia and Espírito Santo states, are known in Brazilian waters (Melo, 2009). Two additional specimens (NPM 4487; 70–95 mm SL) were identified in our collections, from depths between 830 and 1,030 m off western Rocas Atoll (Figure 5b).

Kali kerberti is known in Brazilian waters by a single specimen (MNRJ 26712, 133.8 mm SL) collected at 21°07'S, 39°46'W (Melo, 2008). Johnson & Cohen (1974) also reported on a specimen of *Kali normani* (Parr 1931) from northeastern Brazil. This species is now considered a junior synonym of *K. kerberti* (Melo, 2008) or a subspecies of *K. kerberti* restricted to the East Pacific (Prokofiev, 2014). Six specimens of *Kali kerberti* (NPM 4488, 4489, 4490, 4491; 69–170 mm SL) were identified in our collections. They were collected off Rio Grande do Norte State, Rocas Atoll, and Fernando de Noronha Archipelago, between depths of 650 and 1,020 m (Figure 5b).

Pseudoscopelus scutatus was described from the tropical Atlantic (between 02°N and 28°S, west of 25°W), including some records off northeastern Brazil, outside the EEZ (Figueiredo *et al.*, 2003; Krefft, 1971). The species was subsequently recorded in Brazilian waters, based on one specimen (MNRJ 26700, 91 mm SL) collected off Espírito Santo State (21°25'S, 39°43'W) between depths of 1,712–1,721 m (Melo, 2010). Another specimen (NPM 985, 85 mm SL), collected between depths of 1,210 and 1,215 m from off Rio de Janeiro State (23°24'01"S, 40°59'00"W), is also known (Mincarone *et al.*, 2017). During the ABRACOS expeditions two additional specimens of *P. scutatus* (NPM 4486, 4570; 67–75 mm SL) were collected between depths of 430 and 984 m off Rocas Atoll and the Fernando de Noronha Archipelago (Figure 5b).

FIGURE 5

4. DISCUSSION

The United Nations Decade of Ocean Science for Sustainable Development (2021–2030) recognizes the deep sea as a frontier of science and discovery and calls for research to advance understanding of this environment, its diversity, vulnerabilities, and roles in the global ecosystems (Howell *et al.*, 2020). However, there is an uneven capacity to conduct deep-ocean science across nations primarily due to differing levels of funding capabilities. As a joint scientific collaboration between Brazil and France,

the ABRACOS expeditions stand out in the context of international efforts that might help alleviate this situation.

When all published accounts of the ABRACOS expeditions are considered together (Afonso *et al.*, 2021; Eduardo *et al.*, 2018, 2019, 2021; Mincarone *et al.*, 2019, 2020, 2021; Villarins *et al.*, 2022; this study), a total of 50 species of deep-sea fishes are newly reported for Brazilian waters. Some of those records are also new for the western South Atlantic or larger areas, as the Atlantic Ocean. This high number of new records is based on just two deep-sea collecting campaigns, reinforcing that an ecologically relevant portion of the deep-sea fish diversity of South America is still insufficiently known (e.g., Reis *et al.*, 2016). For example, the first record of the enigmatic *Stylephorus chordatus* presented here for the western South Atlantic was based on 53 specimens collected in relatively few trawls, revealing that the species is likely common in the region. A similar situation was also recently reported for *Winteria telescopa* Brauer 1901 (Argentiniformes: Opisthoproctidae) by Mincarone *et al.* (2020). Other apparently abundant but still unrecorded species of deep-sea fishes were not collected in the region so far most likely due to the paucity of scientific expeditions. This huge gap in basic knowledge hinders the proper management and conservation of deep-sea habitats, a situation that is particularly problematic in Brazil since the offshore exploration of oil and gas is one of the main economic activities of the country (e.g., ANP, 2021). Expansion of offshore economic activities worldwide is actually a trend in the following decades, and as a consequence, proposals for mitigating anthropogenic impacts on deep-sea habitats will be required at an increasing pace especially in the emerging context of Blue Economy (Almada & Bernardino, 2017; Novaglio *et al.*, 2021). Therefore, recent efforts towards increasing the knowledge of the deep-sea fish diversity of the western South Atlantic and off Brazil in particular should be celebrated (e.g., Bauer *et al.*, 2021; Klautau *et al.*, 2020; Melo *et al.*, 2020, 2022; Schwarzhans *et al.*, 2020; our studies). However, offshore oil companies and funding agencies in general should increase investments necessary for the proper understanding and management of this complex but still insufficiently known environment.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

CONTRIBUTIONS

M.M.M., data generation, data analysis, manuscript preparation. L.N.E., data generation, data analysis, manuscript preparation. F.D.D., data generation, data analysis, manuscript preparation. T.F., data generation, funding. A.B., data generation, funding. F.L.F., data generation, funding. All authors have reviewed and approved the final version of the manuscript.

ADDITIONAL MATERIAL EXAMINED

GIGANTURIDAE: *Gigantura indica* — NPM 4232, 2, 131–165 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, 21:53–22:39 h; NPM 4233, 2, 175–190 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, 21:49–22:37 h; NPM 4234, 3, 63–146 mm, sta. AB2/48B, 04°26'25.2"S, 32°56'15.4"W to 04°27'16.1"S, 32°55'42.1"W, 70 m, 30 April 2017, 12:15–12:45 h; NPM 4235, 1, 183 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, 11:47–12:18 h; NPM 4236, 4, 73–176 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, 21:17–

21:52 h; NPM 4237, 2, 142–170 mm, sta. AB2/40A, 03°31'21.0"S, 32°31'39.8"W to 03°31'30.8"S, 32°30'40.6"W, 440 m, 26 April 2017, 10:43–11:06 h; NPM 4238, 4, 50–164 mm, sta. AB2/44A, 03°52'52.5"S, 32°17'33.3"W to 03°51'13.4"S, 32°16'28.0"W, 850 m, 28 April 2017, 12:44–13:17 h; NPM 4239, 1, 65 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, 21:44–22:06 h; NPM 4242, 1, 60 mm, sta. AB2/52B, 03°41'56.4"S, 33°23'29.4"W to 03°42'34.2"S, 33°22'36.1"W, 385 m, 2 May 2017, 14:00–14:30 h; NPM 4405, 1, 74 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, 22:08–22:40 h; NPM 4431, 2, 54–61 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, 12:23–12:26h; NPM 4434, 1, 84 mm, sta. AB2/42B, 03°15'43.6"S, 31°48'59.5"W to 03°15'26.4"S, 31°48'22.9"W, 50 m, 27 April 2017, 14:52–15:26 h; NPM 4451, 2, 54–64 mm, sta. AB2/44B, 03°52'18.4"S, 32°17'58.5"W to 03°52'46.4"S, 32°18'19.7"W, 130 m, 28 April 2017, 14:47–15:02 h; NPM 4894, 1, 58 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, 21:57–22:37 h; NPM 4895, 1, damaged, sta. AB2/58A, 03°56'53.6"S, 36°06'13.9"W to 03°57'56.9"S, 36°09'27.9"W, 520 m, 5 May 2017, 11:58–12:29 h; NPM 5092, 1, 24 mm, sta. AB2/7, 08°46'29.4"S, 34°45'37.0"W to 08°46'28.3"S, 34°42'57.0"W, 112 m, 11 April 2017, 15:39–16:27 h; NPM 5411, 1, 56 mm, sta. AB2/21, 06°50'21.0"S, 34°18'24.0"W to 06°48'24.3"S, 34°20'29.5"W, 800 m, 16 April 2017, 11:25–12:12 h; MNRJ 49747, 1, 201 mm, RV *Thalassa*, sta. E-0496, 13°17.580'S, 38°17.599'W to 13°12.030'S, 38°14.873'W, 1635–1864 m, 7 June 2000; MNRJ 49748, 1, 230 mm, RV *Thalassa*, sta. E-522, 13°30.495'S, 38°38.977'W to 13°29.472'S, 38°37.943'W, 1044–1275 m, 21 June 2000; MNRJ 49749, 175 mm, RV *Thalassa*, sta. E-520, 13°21.837'S, 38°16.683'W to 13°26.455'S, 38°13.836'W, 1981–2271 m, 20 June 2000; MNRJ 42858, 211 mm, RV *Thalassa*, sta. E-519, 13°19.944'S, 38°19.654'W to 13°22.615'S, 38°21.960'W, 1726–1929 m, 20 June 2000.

NOTOSUDIDAE: *Scopelosaurus smithii* — NPM 4573, 1, 177 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, 21:53–22:39 h.

SCOPELARCHIDAE: *Scopelarchus analis* — NPM 3260, 1, 115 mm, sta. AB1/14, 03°58'58.2"S, 34°03'22.2"W to 03°57'42.0"S, 34°04'52.2"W, 510 m, 6 October 2015,

21:40–22:26 h; NPM 3261, 1, 91 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, 21:32–22:12 h. *Scopelarchus guentheri* — NPM 4553, 2, 89–110 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, 22:08–22:40 h; NPM 4556, 1, 87 mm, sta. AB2/52B, 03°41'56.4"S, 33°23'29.4"W to 03°42'34.2"S, 33°22'36.1"W, 385 m, 2 May 2017, 14:00–14:30 h; NPM 4557, 2, 100–113 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, 22:35–23:15 h; NPM 4558, 1, 90 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, 13:11–13:47 h; NPM 4559, 2, 38–48 mm, sta. AB2/21, 06°50'21.0"S, 34°18'24.0"W to 06°48'24.3"S, 34°20'29.5"W, 800 m, 16 April 2017, 11:25–12:12 h.

TRACHIPTERIDAE: *Desmodema polystictum* — NPM 5055, 1, 74 mm, sta. AB2/44A, 03°52'52.5"S, 32°17'33.3"W to 03°51'13.4"S, 32°16'28.0"W, 850 m, 28 April 2017, 12:44–13:17 h. *Trachipterus* sp. — NPM 3206, 1, 55 mm, AB1/14, 03°58'58.2"S, 34°03'22.2"W to 03°57'42.0"S, 34°04'52.2"W, 510 m, 6 October 2015, 21:40–22:26 h; NPM 3326, 1, 23 mm, AB1/13, 03°54'35.2"S, 33°50'55.8"W to 03°53'56.3"S, 33°51'56.3"W, 110 m, 6 October 2015, 11:03–11:38 h; NPM 3331, 1, 40 mm, AB1/23, 05°08'35.4"S, 34°42'52.2"W to 05°08'02.4"S, 34°44'40.2"W, 35–100 m, 9 October 2015, 10:35–11:20 h; NPM 3369, 1, 18 mm, AB1/21, 03°39'27.4"S, 33°41'26.6"W to 03°38'33.6"S, 33°42'53.4"W, 75–115 m, 8 October 2015, 10:09–10:49 h; NPM 5050, 1, 48 mm, AB2/7, 08°46'29.4"S, 34°45'37.0"W to 08°46'28.3"S, 34°42'57.0"W, 112 m, 11 April 2017, 15:39–16:27 h.

CHIASMODONTIDAE: *Chiasmodon braueri* — NPM 4487, 2, 70–95 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, 13:11–13:47 h. *Chiasmodon niger* — NPM 4537, 1, 90 mm, sta. AB2/44A, 03°52'52.5"S, 32°17'33.3"W to 03°51'13.4"S, 32°16'28.0"W, 850 m, 28 April 2017, 12:44–13:17 h. *Kali kerberti* — NPM 4488, 2, 69–156 mm, sta. AB2/44A, 03°52'52.5"S, 32°17'33.3"W to 03°51'13.4"S, 32°16'28.0"W, 850 m, 28 April 2017, 12:44–13:17 h; NPM 4489, 1, 170 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, 21:17–21:52 h; NPM 4490, 1, 126 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, 21:49–22:37 h; NPM 4491, 2, 106–164 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, 12:23–12:26 h. *Pseudoscopelus scutatus* — NPM 4486, 1, 75 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, 21:44–22:06 h; NPM 4570, 2, 67 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, 11:47–12:18 h.

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FIGURE CAPTIONS

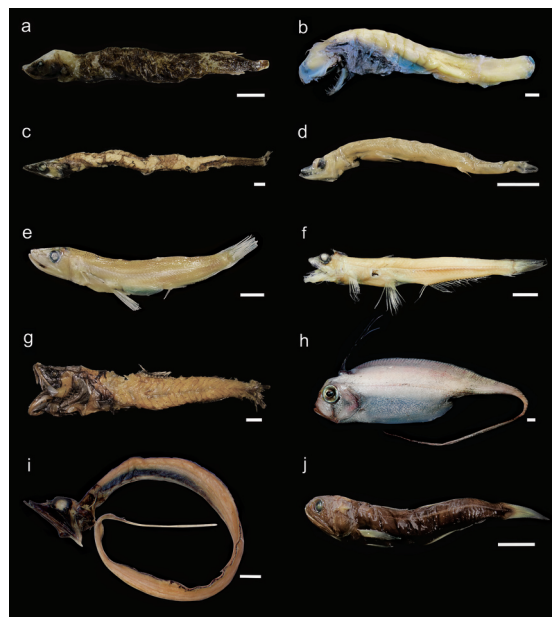
FIGURE 1 (a) *Photostylus pycnopterus*, NPM 5015, 95 mm SL; (b) *Gigantura chuni*, NPM 4241, 167 mm SL; (c) *Ahliesaurus berryi*, NPM 4574, 198 mm SL; (d) *Benthalbella infans*, NPM 3553, 57 mm SL; (e) *Rosenblattichthys hubbsi*, NPM 4554, 85 mm SL; (f) *Scopelarchoides danae*, NPM 4555, 80 mm SL; (g) *Scopelengys tristis*, NPM 4620, 145 mm SL; (h) *Zu cristatus*, NPM 4504, 430 mm SL; (i) *Stylephorus chordatus*, NPM 3178, 255 mm SL; (j) *Pseudoscopelus cordilluminatus*, NPM 4536, 57 mm SL. Scale bar = 10 mm.

FIGURE 2 Records of species of (a) Alepocephalidae and (b) Giganturidae in Brazilian waters made during the ABRACOS expeditions. RA – Rocas Atoll; FN – Fernando de Noronha Archipelago.

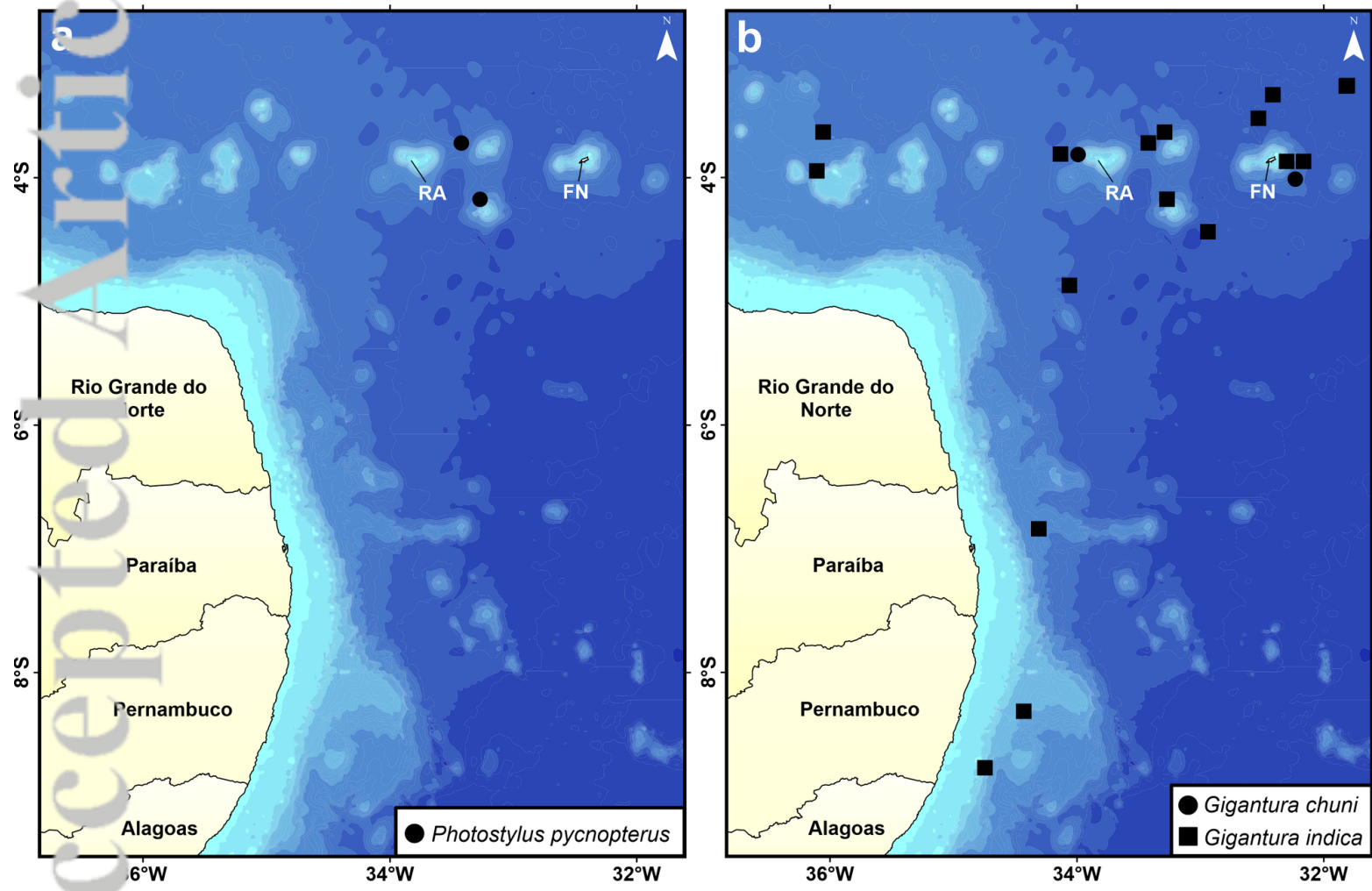
FIGURE 3 Records of species of (a) Notosudidae and (b) Scopelarchidae in Brazilian waters made during the ABRACOS expeditions. RA – Rocas Atoll; FN – Fernando de Noronha Archipelago.

FIGURE 4 Records of species of (a) Neoscopelidae and (b) Trachipteridae in Brazilian waters made during the ABRACOS expeditions. RA – Rocas Atoll; FN – Fernando de Noronha Archipelago.

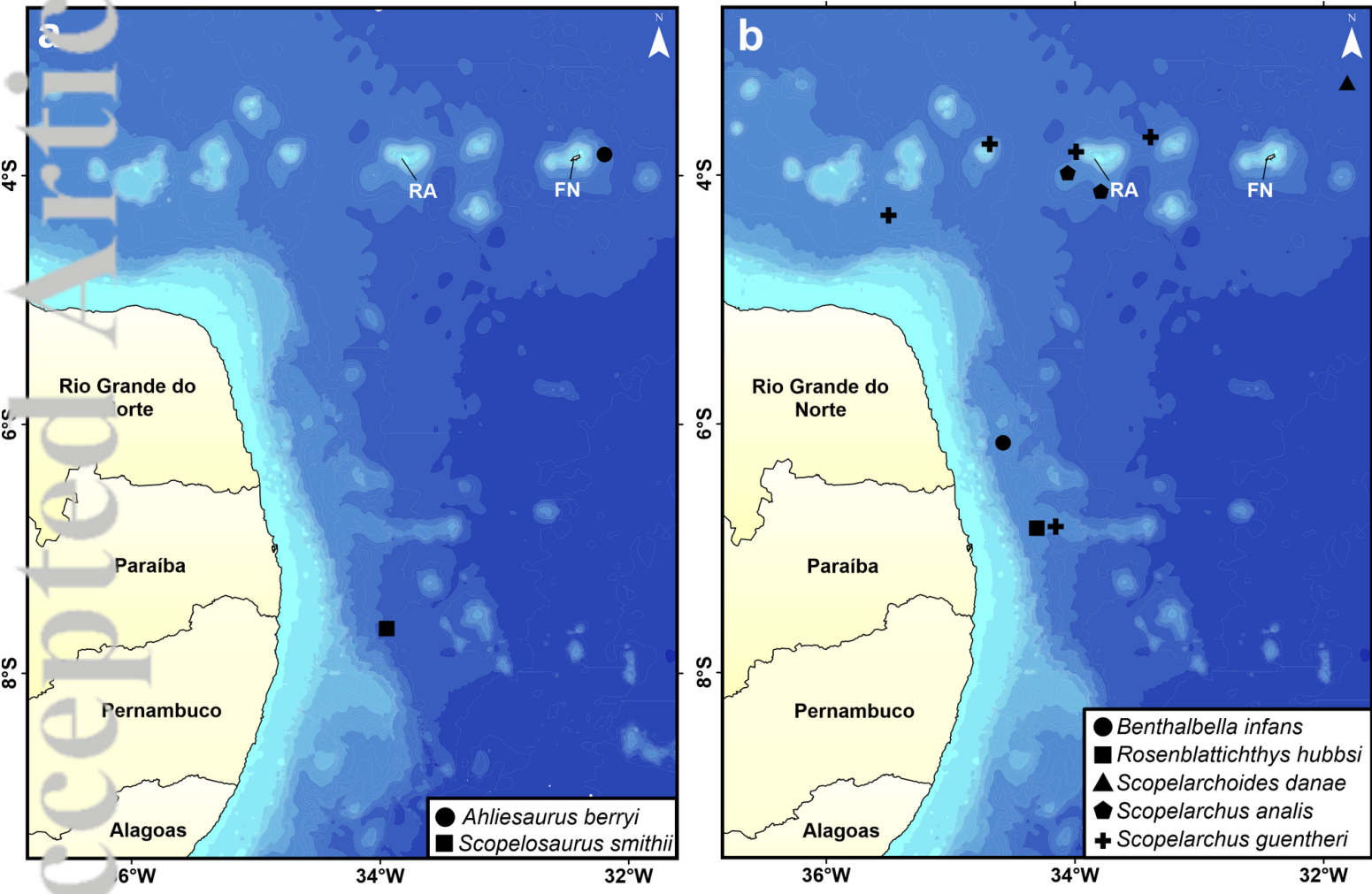
FIGURE 5 Records of species of (a) Stylephoridae and (b) Chiasmodontidae in Brazilian waters made during the ABRACOS expeditions. RA – Rocas Atoll; FN – Fernando de Noronha Archipelago.



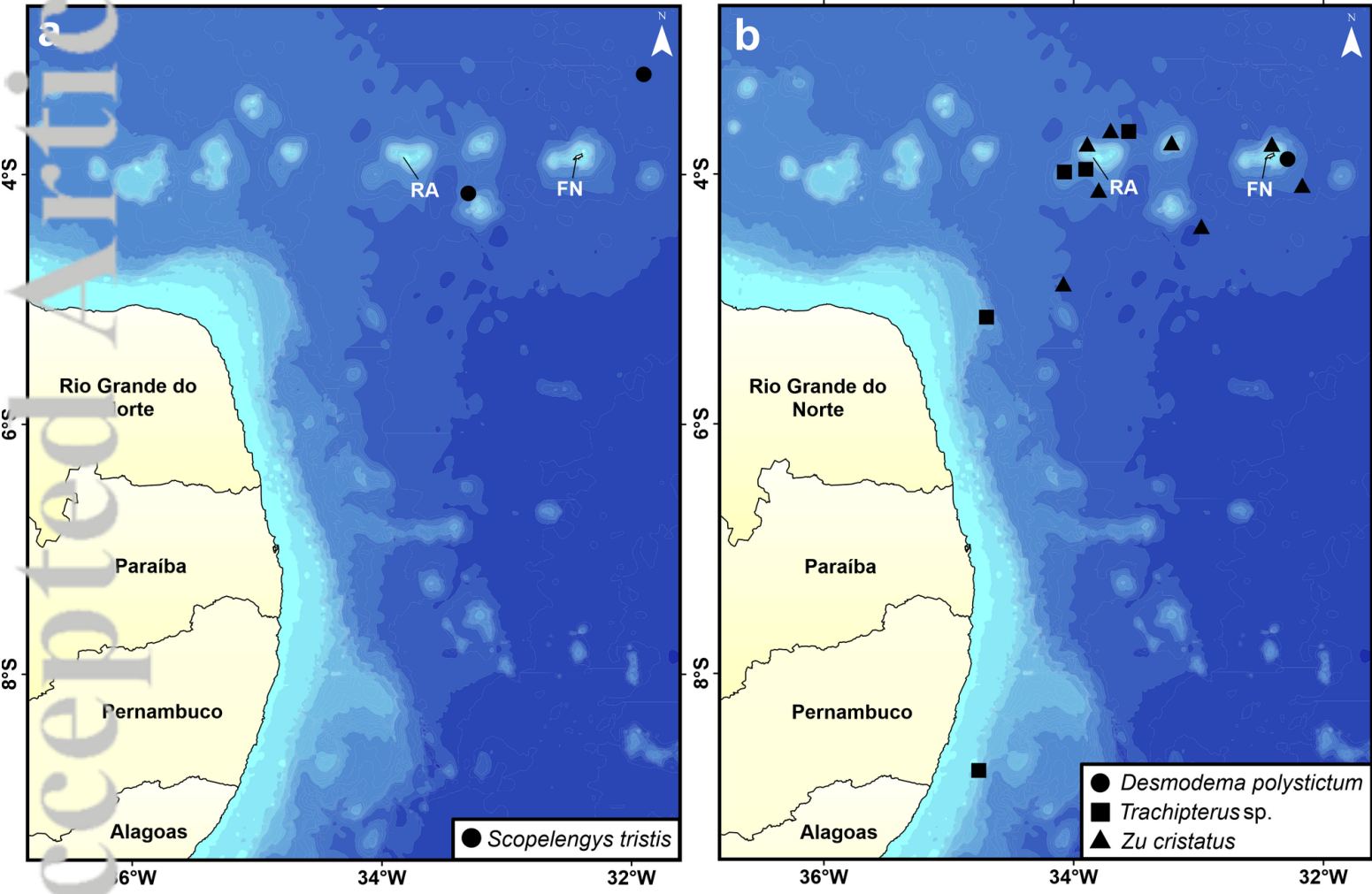
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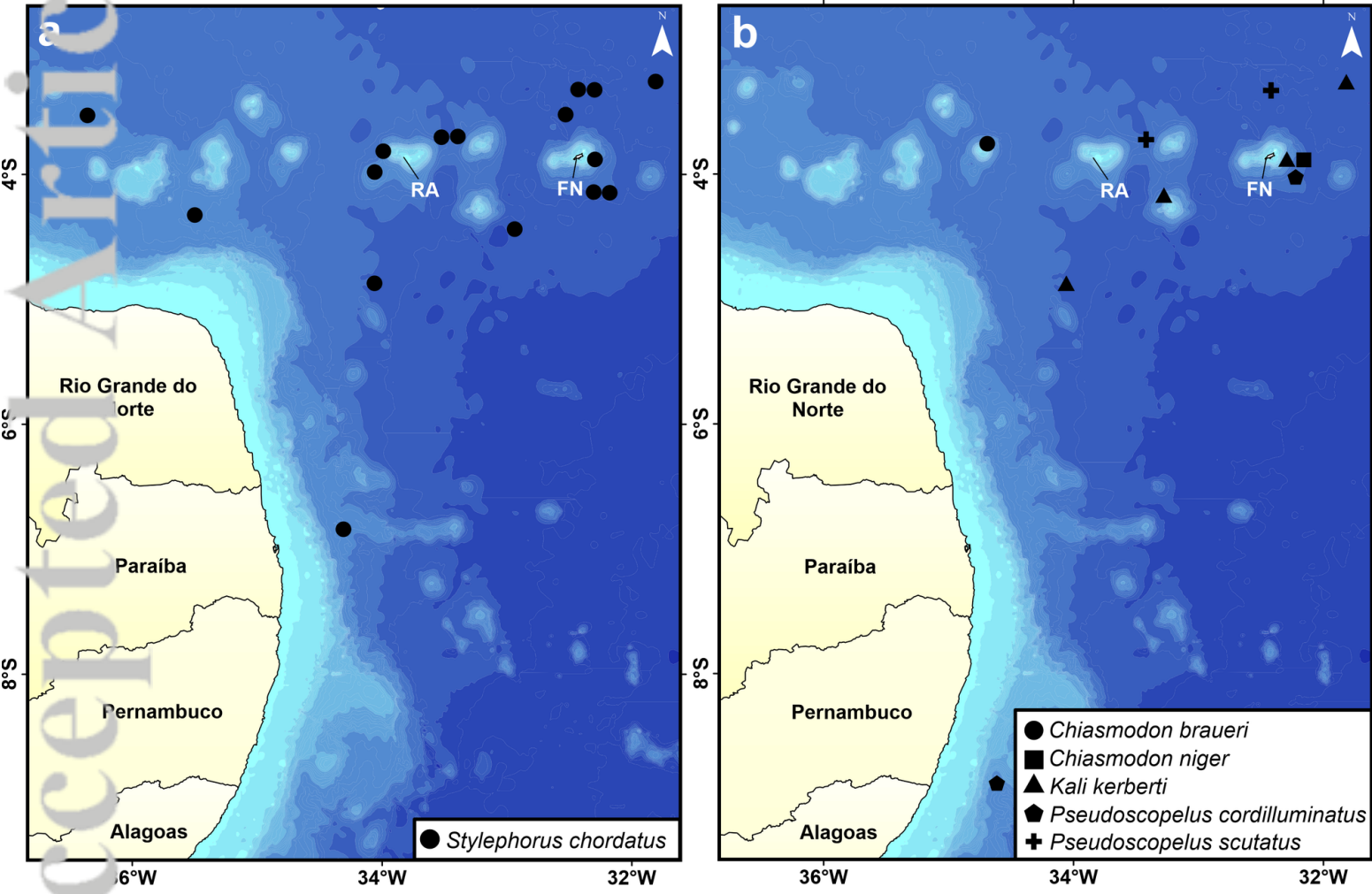
JFB_15155_FIG 2.tif



JFB_15155_FIG 3.tif



JFB_15155_FIG 4.tif



JFB_15155_FIG 5.tif