Decapod crustaceans on dead coral from reef areas on the coast of Bahia, Brazil

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Abstract

The decapod crustaceans inhabiting dead portions of the fire-coral Millepora alcicornis Linnaeus, 1758 and coral rubble were surveyed in six reef areas on the coast of the state of Bahia, Brazil, in 2011. A total of 453 specimens belonging to 39 species in the infraorders Stenopodidea (family Spongicolidae), Caridea (families Palaemonidae, Alpheidae, Hippolytidae, and Processidae), Axiidea (family Callianassidae), Gebiidea (family Upogebiidae), Anomura (family Porcellanidae), and Brachyura (families Majidae, Pilumnidae, Domeciidae, Panopeidae, and Grapsidae) were collected. Members of the families Alpheidae and Porcellanidae were prominent, with 14 and 9 species, respectively. Of the species collected, the alpheid shrimp Alpheus peasei (Armstrong, 1940) is recorded for the first time in the southwestern Atlantic. Microprosthema semilaeve (von Martens, 1872), Corallianassa hartmeyeri Schmitt, 1935, and Petrolisthes marginatus Stimpson, 1859 also had their known geographic ranges extended along the western Atlantic. Alpheus nuttingi (Schmitt, 1924), Synalpheus scaphoceris Coutière, 1910, and Pachycheles riisei (Stimpson, 1858) are new records for Bahia.

Key words: coral reefs, Crustacea, cryptic fauna, Decapoda, new records.

Introduction

Coral reefs are the most biodiverse marine ecosystems (Abele, 1974; Reaka-Kudla, 1997; Hoeksema et al., 2012). Many groups are associated with living corals, including non-colonial organisms such as flatworms, polychaetes, crustaceans, mollusks, echinoderms, sipunculans, bryozoans, and fishes, as well as colonial invertebrates such as sponges and ascidians (Young, 1986; Scott, 1987; Nogueira, 2003; Oigman-Pszczol and Creed, 2006; Garcia et al., 2008; Hoeksema et al., 2012). Living corals provide a hard substrate for the attachment of sessile organisms, and sites for protection and food (including coral mucus) for mobile organisms (Coles, 1980; Gotelli and Abele, 1983; Garcia et al., 2009; Leray et al., 2012).

The cryptoфаuna is especially rich in species and biomass in coral reef communities. Such cryptoфаuna consists predominantly of boring invertebrates such as sponges, polychaetes, crustaceans, sipunculans, and bivalves (Kropp, 1987; Reaka-Kudla, 1997; Hoeksema et al., 2012), and encrusting forms and motile nestlers that inhabit crevices generated by burrowing (Reaka-Kudla, 1997). Perforating invertebrates, along with algae and bacteria, are primarily responsible for

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bioerosion, which may not only reduce the strength of the coral skeleton, but may also kill portions of coral colonies (Kropp, 1987).

The living and the dead coral portions, both in live colonies as well as in fragments (coral rubble), serve as substrates for various animals, which may use this microhabitat as a refuge from predators and as sites for feeding and reproduction (Coles, 1980; Grajal and Laughlin, 1984; Young, 1986; Kropp, 1987; Moreno-Forero et al., 1998). These portions are inhabited by epilithic organisms and a perforating biota composed of macroscopic and microscopic organisms (Moreno-Forero et al., 1998). Decapod crustaceans are prominent, where they are represented by an abundant and rich fauna (Coles, 1980; Grajal and Laughlin, 1984; Young, 1986; Moreno-Forero et al., 1998).

The decapod crustaceans associated with living corals have been little studied in Brazil (Young, 1986; Nogueira, 2003; Johnsson et al., 2006; Oigman-Pszczol and Creed, 2006; Garcia et al., 2008; 2009). The northeastern Brazilian coast has the greatest coral biodiversity in the South Atlantic (Hetzel and Castro, 1994; Castro and Pires, 2001). Although the state of Bahia has the longest coastline of all Brazilian states and houses the largest and most diverse coral reefs, including large numbers of endemic species (Leão and Dominguez, 2000; Leão, 2002), no studies have specifically surveyed the decapod crustaceans in dead coral in this region. Almeida et al. (2010, 2012) reported, in general surveys, a few decapods in crevices of coral rubble in southern Bahia. The present study surveyed the fauna of decapod crustaceans associated with these reef habitats in six reef areas of the coast of Bahia.

**Material and Methods**

The material examined was collected in 2011 during the project “Diversidade de Crustáceos do Sudeste e Sul da Bahia, Brasil”. Sampling was carried out on coral reefs of the following beaches: Moreré (Cairú, May 2011, 13°36’49.5”S / 38°54’16.2”W), Tassimirim (Cairú, May 2011, 13°34’49.6”S / 38°54’49.4”W), Taipús de Fora (Marau, July 2011, 13°56’22.0”S / 38°55’35.4”W), Algodoés (Marau, August 2011, 14°04’37.1”S / 38°57’17.2”W), Mutá (Porto Seguro, March and November 2011, 16°21’52.2”S / 39°00’15.9”W), and Coroa Vermelha (Santa Cruz Cabrália, March 2011, 16°19’58.5”S / 39°00’21.5”W) (Fig. 1).

![Study area, coast of the state of Bahia, Brazil.](image)

Figure 1. Study area, coast of the state of Bahia, Brazil. (CB) Camamu Bay. (TSB) Todos os Santos Bay. Arrows indicate (1) Municipality of Cairu, Boipeba Island; (2) Municipality of Marau, Marau Peninsula; (3) Municipalities of Santa Cruz Cabrália and Porto Seguro, where decapod crustaceans were sampled from dead coral.

Samples were taken in the intertidal and shallow subtidal zones in shallow pools up to 1.5 m deep in general surveys. The salinity was measured with an optical refractometer. Two kinds of dead coral substrates were examined for decapods: dead portions of colonies of the fire-coral *Millepora alcicornis* Linnaeus, 1758 in standing position and partially exposed during spring low tides and coral rubble taken from tide pools (see Figs. 2A, B). Dead portions of colonies of *M. alcicornis* were recognized by the algal covering and incrusting animals.
such as sponges, zoanthids and bryozoans. Portions of dead coral were detached from the colonies by hammer and chisel or taken from the bottom and wrapped in plastic bags to prevent the associated animals from escaping. The fragments were also broken up with a hammer and chisel, and the decapods obtained on the surface and cavities or galleries constructed mainly by polychaetes, bivalves, and sipunculans (Figs. 2B, D).

Specimens obtained were anesthetized on ice and photographed, particularly shrimps of the family Alpheidae, where the color pattern has taxonomic significance; and then fixed in 70% ethanol for later identification to species level. Because males of the shrimp genus Synalpheus Spence Bate, 1888 lack an appendix masculina on the endopod of the second pair of pleopods (see Tóth and Bauer, 2007; 2008), the specimens were classified as non-ovigerous (nov) and ovigerous female (ovf). The specimens were deposited in the crustacean collection of the Universidade Estadual de Santa Cruz, Ilhéus, Bahia, Brazil (UESC). The classification adopted follows De Grave et al. (2009). Other abbreviations used: (m) male, (f) female, (ni) sex not identified.

**Figure 2.** Habitats sampled and some decapod crustaceans found on dead coral on the coast of the state of Bahia, Brazil. (A) View of the Mutá Beach coral reef in Porto Seguro, where part of the samples was taken. On the right, note emerging colonies of the fire-coral *Millepora alcicornis* Linnaeus, 1758 during spring tide. (B) View of a broken piece of coral rubble, showing longitudinal and transverse galleries excavated by perforating fauna, which serve as a habitat for many decapod species. (C) The endolithic snapping shrimp *Alpheus simus* Guérin-Méneville, 1855 in a gallery in the dead skeleton of *M. alcicornis* Linnaeus, 1758. (D) The snapping shrimp *Alpheus formosus* Gibbes, 1850 in a crevice of coral rubble.
Results

A total of 453 decapods were examined, belonging to 39 species in the following infraorders: Stenopodidea (family Spongicolidae), Caridea (families Palaemonidae, Alpheidae, Hippolytidae, and Processidae), Axidea (family Callianassidae), Gebiidea (family Upogebiidae), Anomura (family Porcellanidae), and Brachyura (families Majidae, Pilumnidae, Domeciidae, Panopeidae, and Grapsidae). The families Alpheidae and Porcellanidae were most prominently represented, with 14 and 9 species respectively. A total of 19 and 32 species were obtained from dead portions of *M. alcicornis* and fallen dead-coral rubble, respectively.

Taxonomy

Order Decapoda Latreille, 1802
Suborder Pleocyemata Burkenroad, 1963
Infraorder Stenopodidea Spence Bate, 1888
Family Spongicolidae Schram, 1986

*Microprosthema semilaeve* (von Martens, 1872) (Fig. 3A)


Distribution: Western Atlantic: Bahamas, southern Florida, West Indies, northern South America, and Brazil (Fernando de Noronha, Pernambuco, and Bahia) (Coelho and Ramo-Porto, 1998; Coelho et al., 2006).

Remarks: *Microprosthema semilaeve* is a small stenopodidean shrimp with a few records from Brazil (Pocock, 1890, as *Stenopusculus spinosus* Pocock, 1890; Coelho, 1969; Coelho et al., 2006). Illustrations (line drawings or photographs) of Brazilian material had not been previously provided. The color pattern of the female examined here agrees in part with that described by Manning (1961) (Fig. 3A).

It has been collected on coral reefs and other rocky bottoms, and on sand flats, sometimes studded with boulders (Manning, 1961; Coelho, 1969; Chace, 1972). Our specimen was collected in a crevice of coral rubble at a depth of 1–1.5 m. The present record represents a minor southward range extension in the western Atlantic, from Itapuá Beach, Salvador (Coelho, 1969) to Taipús de Fora Beach, Maraú.

Infraorder Caridea Dana, 1852
Superfamily Palaemonoidea Rafinesque, 1815
Family Palaemonidae Rafinesque, 1815
Subfamily Pontoniinae Kingsley, 1879

*Cuapetes americanus* (Kingsley, 1878)


Distribution: Western Atlantic: North Carolina to western Gulf of Mexico, West Indies, Colombia, Venezuela, and Brazil (Atol das Rocos, seamounts of North Brazilian Chain, and from Amapá to São Paulo) [Holthuis, 1951, as *Periclimenes (Harpilius) americanus*; Grajal and Laughlin, 1984, as *P. americanus*; Williams, 1984, as *P. americanus*; Ramos-Porto and Coelho, 1998, as *P. americanus*].

Remarks: Frequently found on fouling organisms on the surface of coral rubble and in more superficial crevices of coral rubble.
Reported on various kinds of substrata in southern Bahia (Almeida et al., 2012). Grajal and Laughlin (1984) observed C. americanus (as Periclimenes americanus) in dead portions of corals Acropora prolifera (Lamarck, 1816) and A. cervicornis (Lamarck, 1816), and Young (1986) recorded the species on dead parts of Mussismilia barthi (Verrill, 1868), M. bispida (Verrill, 1902), and Siderastrea stellata (Verrill, 1868).

Superfamily Alpheoidea Rafinesque, 1815
Family Alpheidae Rafinesque, 1815
Alpheus bouvieri A. Milne-Edwards, 1878
(Fig. 3B)


Remarks: Alpheus bouvieri is commonly found under rocks or in crevices of rocks and rubble, more rarely on sabellariid reefs, and also on sand and sand-mud bottoms (Anker et al., 2009a). Almeida et al. (2012) reported the species in crevices of coral rubble in southern Bahia.

Alpheus carlae Anker, 2012 (Fig. 3C)


Distribution: Western Atlantic: Southern Florida, Puerto Rico, Jamaica, Belize, Panama, Venezuela, French Guyana, and Brazil (Ceará to São Paulo) (Anker, 2012).

Remarks: Alpheus carlae belongs to the large A. armillatus H. Milne-Edwards, 1837 species complex (Anker, 2012). It has been recorded in various types of habitats and substrata from the intertidal to shallow subtidal (0–3 m), including under coral rubble (Anker, 2012). Part of the material referred from southern Bahia as A. cf. armillatus correspond to A. carlae (Almeida et al., 2012).

Alpheus cristulifrons Rathbun, 1900 (Fig. 3D)


Distribution: Western Atlantic: Florida, Gulf of Mexico, West Indies, Central America, northern South America, and Brazil (Atol das Rocas, Fernando de Noronha, and from Rio Grande do Norte to Rio de Janeiro) (Christoffersen, 1998; Anker et al., 2008a).

Remarks: Alpheus cristulifrons is typically found in hard substrates (dead and living portions of several corals, coral rubble, concretions of coralline algae, sabellariid polychate reefs, bryozoans) and occasionally in sponges (Grajal and Laughlin, 1984; Young, 1986; Moreno-Forero et al., 1998; Anker et al., 2008a). In Bahia, Almeida et al. (2012) recorded the species on coral rubble and in the present survey we collected A. cristulifrons in male/female pairs on several occasions on dead portions in live position of M. alcicornis. It is not considered a boring species, but it is capable of excavating or enlarging small natural cavities using its major claw (Anker et
Alpheus formosus Gibbes, 1850 (Fig. 3E)


Distribution: Western Atlantic: Bermuda, North Carolina to Brazil (Atol das Rocas, Fernando de Noronha, and from Ceará to São Paulo) (Christoffersen, 1998; Anker et al., 2008b).

Remarks: Commonly found in various types of hard substrata, including dead and living portions of coral and coral rubble (Young, 1986; Castro et al., 2006; Anker et al., 2008b). Castro et al. (2006) reported A. formosus on living colonies of M. alcicornis in Colombia, but we have not found the species in dead portions of this coral in our sampling. A previous record on coral rubble from southern Bahia was provided by Almeida et al. (2012), where the species is apparently very abundant in this kind of microhabitat.

Alpheus intrinsecus Spence Bate, 1888 (Fig. 3F)

Material examined: 2 m, 4 f (1 ovf), 31.VII.2011, Maraú, Taipús de Fora Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 38 p.s.u., on dead coral rubble, UESC 1468; 1 m, 2 f (1 ovf), 31.VII.2011, Maraú, Puerto Rico to Brazil (Piauí to Santa Catarina). Eastern Atlantic: Western Sahara to Gabon (Crosnier and Forest, 1966; Christoffersen, 1979). Alpheus nuttingi has been reported in several types of soft bottoms, such as mud, clay, sand, sand with gorgonians, Halodule beds, coarse sand with shells, and on calcareous algae, from 0 to 40 m (Christoffersen, 1979; Almeida et al., 2006). Our material was obtained in crevices of coral rubble, which is, as far as we know, a previously unreported habitat for the species.

Alpheus nuttingi (Schmitt, 1924) (Fig. 3G)


Distribution: Western Atlantic: southern Florida, southwestern Gulf of Mexico, West Indies to Brazil (Ceará to Santa Catarina) (Coelho et al., 2006; Anker et al., 2007). Alpheus nuttingi is common on sandy bottoms with abundant coral rubble and rocks, in crevices of coral rocks, on sabellariid polychaete reefs, and in clumps of Halimeda (Anker et al., 2007); therefore its occurrence in coral rubble was not unexpected. In Brazil, the species is known from Ceará to Santa Catarina states, but there are no previous records from the state of Bahia, filling a gap in the distribution (Coelho et al., 2006; Anker et al., 2007).

Alpheus cf. packardii Kingsley, 1880 (Fig. 3H)

Material examined: 1 m, 2 ovf, 30.VII.2011, Maraú, Taipús de Fora Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 38 p.s.u., on dead coral rubble, UESC 1464; 1 m, 2 f (1 ovf), 31.VII.2011, Maraú,

**Distribution:** Western Atlantic: Bermuda, Virginia to South Carolina, Florida, Gulf of Mexico, Bahamas, Mexico (Quintana Roo and Yucatan), West Indies, Venezuela, and Brazil (Atol das Rocas, Fernando de Noronha, and from Amapá to São Paulo) (Christoffersen, 1979; 1998, as *A. normanni* Kingsley, 1878; Rodríguez, 1980, as *A. normanni*; Martínez-Iglesias et al., 1996, as *A. normanni*).

**Remarks:** *Alpheus packardii* is a species complex (Almeida et al., 2012; A. Anker, pers. comm.). It has been reported in crevices of coral rubble from southern Bahia (Almeida et al., 2012).

*Alpheus cf. paracrinitus* Miers, 1881 (Fig. 3I)

**Material examined:** 1 m, 3 ovf, 30.VII.2011, Maraú, Taipús de Fora Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 38 p.s.u., on dead coral rubble, UESC 1461.

**Distribution:** Western Atlantic: Bermuda and Florida Keys to Tobago, and westward to Providencia Island and the Yucatan Peninsula (Chace, 1972; Rodríguez, 1980). The present record is the first from the southwestern Atlantic, significantly enlarging the southern range of this alpheid and creating a huge gap in the species distribution, including the Guianas and northern and most of northeastern Brazil. The presently known distribution of *A. peasei* suggests an Antillean disjunct distribution for this species, similar to some other western Atlantic decapods (see Coelho and Ramos 1972; Melo 1985). *Alpheus peasei* has been collected in interstices of rocks and dead coral and on sponges (Chace, 1972; Rodríguez, 1980) and polychaete tubes, from the intertidal to 25 m (Martínez-Iglesias et al., 1996). In this study, the species was obtained in shallow pools in crevices of coral rubble. The color pattern of the Bahian material agrees with that observed in the Caribbean (A. Anker, pers. comm.).

*Alpheus cf. rostratus* W. Kim and Abele, 1988 (Fig. 4A)


**Distribution:** Western Atlantic: Bermuda and Florida Keys to Tobago, and westward to Providencia Island and the Yucatan Peninsula (Chace, 1972; Rodríguez, 1980).

**Distribution:** *Alpheus* cf. *rostratus*: Western Atlantic: Brazil (Bahia) (Almeida et al., 2012). *Alpheus rostratus*: Eastern Pacific: Gulf of California to Colombia (Kim and Abele, 1988; Ramos, 1995).

**Remarks:** This species belongs to the *A. paracrinitus* complex, based on morphology and color pattern (Almeida et al., 2012; A. Anker, pers. comm.). It was recently recorded from southern Bahia for the first time, although with no report from coral rubble in that region (Almeida et al., 2012), where it is apparently very abundant. Additionally, we observed this species on the coral *Mussismilia harttii* (1 ovf, 20.III.2011, Porto Seguro, Mutá Beach, UESC 1408).

**Alpheus simus** Guérin-Méneville, 1855 [in Guérin-Méneville, 1855–1856] (Fig. 4B)


**Distribution:** Western Atlantic: Florida, Yucatan, West Indies, Central America, northern South America, and Brazil (Rio Grande do Norte and Bahia) [Chace, 1972, as *Thunor simus* (Schmitt, 1924); Christoffersen, 1979, as *T. rathbunae*; Bezerra and Almeida, 2008].

**Remarks:** The rock-boring snapping shrimp *A. simus* is an inhabitant of shallow-water hard bottoms such as coral reefs and coral rock bottoms, crevices of coral rocks and rubble, and also in dead portions of living corals (Grajal and Laughlin, 1984; Cortes, 1985; Moreno-Forero et al., 1998, as *Thunor simus*; Bezerra and Almeida, 2008). It is common in suitable habitats in the Caribbean (A. Anker, pers. comm.). However, in Brazil, *A. simus* is known based on only two records. Christoffersen (1979, as *Thunor rathbunae*) recorded the species from Abrolhos Archipelago, and Bezerra and Almeida (2008) recorded it from Rio Grande do Norte. The material reported by Christoffersen (1979) was obtained between 2–5 m depth, on sand and calcareous algae bottoms; and the material reported by Bezerra and Almeida (2008) was obtained between 3–4 m, on *M. alcicornis*. No other details on the species habitat were provided by the latter authors. At Coroa Vermelha Beach, we found *A. simus* living endolithically in galleries constructed in the *M. alcicornis* skeleton (Fig. 2C). These galleries occurred in both dead and living parts of the coral. We also observed perforations on the coral skeleton, connecting the gallery to the outside. These perforations resemble the sieve pores or plates such as those observed in the habitats of endolithic alpheids, including *A. simus* in the Caribbean (Cortes, 1985; Fischer and Meyer, 1985; Kropp, 1987; Werding, 1990). By means of these plates, the shrimp communicate with the environment outside their habitation, extending the second chelate pereopods through the perforations to pick up debris and take it into the galleries (Kropp, 1987; Werding, 1990).

**Synalpheus cf. brevicarpus** (Herrick, 1891) (Figs. 4C, D)


**Distribution:** Western Atlantic: Bermuda, Florida, Bahamas, West Indies, Panama, and Brazil (Ceará to Rio Grande do Sul) (Christoffersen, 1979; 1998; Bezerra and Coelho, 2006). The eastern Pacific records correspond to S. digueti Coutière, 1909 (which also corresponds to multiple species) (A. Anker, pers. comm.).

Remarks: Synalpheus brevicarpus is a species complex including S. brevicarpus sensu Herrick, 1891, S. brevicarpus guerini Coutière, 1909, and several undescribed species (A. Anker, pers comm.). In the study area, two distinct color patterns of S. cf. brevicarpus indicate the existence of at least two species (Figs. 4C, D). Both species are apparently very common, either on dead portions of M. alcicornis or in coral rubble.

Synalpheus fritzmuelleri Coutière, 1909

(Fig. 4E)


**Distribution:** Western Atlantic: Bermuda, Carolinas, Florida, northern Gulf of Mexico (Texas), Mexico (Veracruz, Quintana Roo), Colombia ( Providencia), West Indies, Venezuela, and Brazil (São Pedro and São Paulo Archipelago, Pernambuco to Santa Catarina). Central Atlantic: Ascension and Saint Helena Islands. Records from the eastern Pacific (e.g., Tres Marías Archipelago, Mexico) refer to other species (Christoffersen, 1979; 1998; Holthuis et al., 1980; Manning and Chace, 1990; A. Anker, pers. comm.).

Remarks: Species found in various types of substrata in southern Bahia (Almeida et al., 2012), and, apparently, very common in dead coral in the study areas. The occurrence of S. fritzmuelleri in pieces of dead coral was documented by Grajal and Laughlin (1984), Young (1986), and Moreno-Forero (1998). Additionally, we observed this species on the coral Mussismilia harttii (1 nov, 20.III.2011, Porto Seguro, Mutá Beach, UESC 1407), as documented by Young (1986).

Synalpheus scaphoceris Coutière, 1910

(Fig. 4F)

**Material examined:** 1 nov, 1 ovf, 01.VIII.2011, Maraú, Algodôes Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 38 p.s.u., on dead coral rubble, UESC 1489; 1 nov, 25.IX.2011, Porto Seguro, Mutá

*Distribution*: Western Atlantic: Florida, Gulf of Mexico, West Indies, Venezuela, and Brazil (Paraíba, Espírito Santo, Rio de Janeiro, and São Paulo) (Chace, 1956, as *Synalpheus townsendi scaphoceris*; Christoffersen, 1979; Dardeau, 1986).

*Remarks*: *Synalpheus scaphoceris* is found on both living and dead corals (Dardeau, 1986). The species is recorded for the first time from Bahia, filling a gap in its distribution.

**Family Hippolytidae** Spence Bate, 1888

*Lysmata* cf. *intermedia* (Kingsley, 1878)


*Distribution*: Western Atlantic: Florida Keys to Trinidad and Tobago, Curaçao, and Brazil (Pernambuco to Rio de Janeiro) (Christoffersen, 1998; d’Udekem d’Acoz, 2000; Almeida et al., 2007).

*Remarks*: *Lysmata intermedia* is a species complex (Anker et al., 2009b), and the material examined here possibly belongs to a hitherto undescribed species (Almeida et al., 2012). Material from southern Bahia has been collected on a reef, within crevices of calcareous algal concretions (Almeida et al., 2012); here, we record the species in crevices of coral rubble.

*Thor manningi* Chace, 1972


*Distribution*: Western Atlantic: Bermuda, North Carolina to Brazil (seamounts of the North Brazilian Chain, Fernando de Noronha, Ceará to São Paulo). Central Atlantic: Ascension Island (Manning and Chace, 1990; Christoffersen, 1998; Coelho Filho, 2006).

*Remarks*: *Thor manningi* can be found on living and dead corals and several other substrata (Chace, 1972; Grajal and Laughlin, 1984; Young, 1986). Almeida et al. (2012) recorded the species from Bahia, in concretions of calcareous algae.

**Superfamily Processoidea** Ortmann, 1896

**Family Processidae** Ortmann, 1896

*Processa fimbriata* Manning and Chace, 1971


*Distribution*: Western Atlantic: North Carolina, Florida, Gulf of Mexico, Yucatan, Bahamas, West Indies, and Brazil (Atol das Rocas, and from Rio Grande do Norte to Rio de Janeiro) (Christoffersen, 1979; 1998).

*Remarks*: *Processa fimbriata* is also reported from various types of substrata, such as sponges, coral flats, and among coral-encrusted rocks (Manning and Chace, 1971; Chace, 1972).

**Infraorder Axiidea** de Saint Laurent, 1979

**Family Callianassidae** Dana, 1852

*Corallianassa hartmeyeri* (Schmitt, 1935) (Fig. 4G)


*Distribution*: Western Atlantic: West Indies (Jamaica) and Brazil (Alagoas) (Coelho, 1997; Melo, 1999).

*Remarks*: Very poorly known species, described by Schmitt (1935) from Jamaica based on holotype only, with no observations regarding ecology. Manning and Chace (1990) recorded the species from Ascension, from burrows in sand in shallow tide pools.
and under a rock, and commented on some differences that they observed in relation to the holotype. The only record from Brazil was provided by Coelho (1997) from Alagoas, with no illustrations, morphological account, or information regarding the type of substrata. Subsequent listings (Melo, 1999; Coelho et al., 2007) are based on Coelho’s (1997) record. The southern range limit of this species is extended here from Alagoas to Taipús de Fora Beach, Maraú. The material was attached to the undersurface of a coral rubble fragment in a sandy-bottom pool (1–1.5 m). A revision of Caribbean, Central Atlantic, and Brazilian material is desirable, because of the variation reported by Manning and Chace (1990) and the need to compare the Brazilian material with other specimens.

**Infraorder Gebiidea de Saint Laurent, 1979**

**Family Upogebiidae Borradaile, 1903**

*Pomatogebia operculata* (Schmitt, 1924)


*Distribution:* Western Atlantic: Central America, Colombia, Venezuela, and Brazil (Maranhão to São Paulo) (Melo, 1999).

*Remarks:* Species found on various types of substrata, including corals (Gore, 1982; Young, 1986; Veloso and Melo, 1993). A previous record in crevices of coral rubble in southern Bahia was provided by Almeida et al. (2010). Additionally, we observed this species on the coral *Mussismilia harttii* (1 m, 20.III.2011, Porto Seguro, Mutá Beach, UESC 1378), as also recorded by Young (1986).

*Megalobrachium soriatum* (Say, 1818)


Infraorder Anomura MacLeay, 1838

**Superfamily Galatheoidea Samouelle, 1819**

**Family Porcellanidae Haworth, 1825**

*Megalobrachium roseum* (Rathbun, 1900)


*Distribution:* Western Atlantic: Central America, Colombia, Venezuela, and Brazil (Maranhão to São Paulo) (Melo, 1999).

*Remarks:* Species found on various types of substrata, including corals (Gore, 1982; Young, 1986; Veloso and Melo, 1993). A previous record in crevices of coral rubble in southern Bahia was provided by Almeida et al. (2010). Additionally, we observed this species on the coral *Mussismilia harttii* (1 m, 20.III.2011, Porto Seguro, Mutá Beach, UESC 1378), as also recorded by Young (1986).
**Distribution:** Western Atlantic: North Carolina to Florida, Gulf of Mexico, Mexico, Central America, Colombia, Venezuela, and Brazil (Ceará to São Paulo). Eastern Pacific: California to Panama (Melo, 1999; Lira et al., 2001; Rodríguez et al., 2005).

**Remarks:** Species found on various types of substrata, including corals (Young, 1986; Veloso and Melo, 1993). Additionally, we recorded this species on the coral *Mussismilia harttii* (2 ovf, 20.III.2011, Porto Seguro, Mutá Beach, UESC 1379), as documented by Young (1986).

*Pachycheles greeleyi* (Rathbun, 1900)


**Distribution:** Western Atlantic: Florida, Gulf of Mexico, West Indies, Venezuela, and Brazil (Rio Grande do Norte to Santa Catarina). Eastern Pacific: Ecuador (Melo, 1999).

**Remarks:** Also known from various kinds of hard substrata, including corals (Veloso and Melo, 1993; Micheletti-Flores and Negreiros-Franozo, 1999; Nogueira, 2003).

*Pachycheles riisei* (Stimpson, 1858) (Fig. 4H)

**Material examined:** 1 m, 1 ovf, 31.VII.2011, Marau, Taipus de Fora Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 38 p.s.u., on dead coral rubble, UESC 1488; 1 m, 1 ovf, 01.VIII.2011, Marau, Algodoes Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 38 p.s.u., on dead coral rubble, UESC 1498.

**Distribution:** Western Atlantic: Florida, West Indies, Colombia, Venezuela, and Brazil (Fernando de Noronha, Trindade, and from Paraiba to Sao Paulo) (Melo, 1999; Rodriguez et al., 2005; Tagliafico et al., 2005; Lira et al., 2007).

**Remarks:** *Pachycheles riisei* is found on hard substrata, including corals (Werding, 1982; Young, 1986, as *P. riisipi sic*, misspelled; Veloso and Melo, 1993). The present record is the first from Bahia, filling a gap in the species' distribution.
**Petrolisthes armatus** (Gibbes, 1850)


*Distribution:* Western Atlantic: North Carolina to Florida, Gulf of Mexico, West Indies, Colombia, Venezuela, and Brazil (Fernando de Noronha, and from Pará to Santa Catarina). Eastern Atlantic: Senegal to Angola. Central Atlantic: Ascension. Eastern Pacific: Gulf of California, Costa Rica, Ecuador (Galapagos), and Peru (Rodríguez, 1980; Barros *et al*., 1997a; Melo, 1999).

*Remarks:* *Petrolisthes armatus* is found in highly diverse substrata, especially in estuaries. It has also been reported on living and dead corals (Gore and Abele, 1976; Werding, 1982; Veloso and Melo, 1993; Castro *et al*., 2006; Almeida *et al*., 2010). A previous record from coral rubble in southern Bahia was provided by Almeida *et al.* (2010).

**Petrolisthes galathinus** (Bosc, 1802)


*Distribution:* Western Atlantic: Florida, Gulf of Mexico, Gulf of San Blas (Panama), Puerto Rico, Barbados, northern South America, Trinidad and Tobago, and Brazil (Maranhão, Fernando de Noronha, and Trindade Island). Central Atlantic: Ascension. Eastern Atlantic: Cape Verde to Annobon (Manning and Chace, 1990; Ferreira, 2009).

*Remarks:* Recorded from several types of bottom, including coral heads (Gore, 1983; Manning and Chace, 1990). The southernmost record in the Western Atlantic was provided by Ferreira (2009) from Trindade Island, around 1,100 km from the Brazilian coast (20º30'S / 29º18'W) (Clemente *et al*., 2006). Our record from Porto Seguro represents the presently known southern limit for this species, if we consider Brazilian coastal waters.

**Distribution:** Western Atlantic: Central America, Colombia, and Brazil (Paraíba to Bahia) (Melo, 1999).

**Remarks:** Also present on living and dead corals, among other hard substrata (Werding, 1982; Young, 1986; Moreno-Forero et al., 1998). We found this species on the coral *Mussismilia harttii* (1 m, 2 f, 20.III.2011, Porto Seguro, Mutá Beach, UESC 1395), as also observed by Young (1986).

Infraorder Brachyura Latreille, 1802
Superfamily Majoidea Samouelle, 1819
Family Majidae Samouelle, 1819
Subfamily Mithracinae MacLeay, 1838

**Microphrys bicornutus** (Latreille, 1825)


**Distribution:** Western Atlantic: North Carolina to Florida, Gulf of Mexico, West Indies, Venezuela, and Brazil (Fernando de Noronha, and from Maranhão to Rio Grande do Sul) (Melo, 1996).

**Remarks:** *Microphrys bicornutus* is known from several kinds of hard substrata, including dead coral (Powers, 1977; Grajal and Laughlin, 1984; Almeida et al., 2010). We also recorded this species on dead portions of the coral *Siderastrea stellata* (1 m, 21.III.2011, Santa Cruz Cabrália, Coroa Vermelha Beach, UESC 1397).

**Mithraculus forceps** (A. Milne-Edwards, 1875)


**Distribution:** Western Atlantic: North Carolina to Florida, Gulf of Mexico, West Indies, Venezuela, and Brazil (São Pedro and São Paulo Archipelago, Fernando de Noronha, Atol das Rocas, and from Maranhão to Santa
Catarina) (Holthuis et al., 1980; Melo, 1996; Rieger and Giraldi, 1996).

Remarks: Known from various kinds of hard substrata, including living and dead corals (Powers, 1977, as Mithrax forceps; Grajal and Laughlin, 1984, as Mithrax forceps; Young, 1986, as Mithrax forceps; Nogueira, 2003; Almeida et al., 2010). A previous record from coral rubble in southern Bahia was provided by Almeida et al. (2010). We also observed M. forceps on the coral Mussismilia harttii (3 m, 20.III.2011, Porto Seguro, Mutá Beach, UESC 1370).

Mithrax braziliensis Rathbun, 1892


Distribution: Western Atlantic: North Carolina to Florida, Gulf of Mexico, West Indies, northern South America, and Brazil (Paraíba to Santa Catarina) (Melo, 1996).

Remarks: Species found on various kinds of hard bottoms, including dead corals (Powers, 1977; Young, 1986; Almeida et al., 2010).

Superfamily Pilumnoidea Samouelle, 1819
Family Pilumnidae Samouelle, 1819
Subfamily Pilumninae Samouelle, 1819
Pilumnus dasypodus Kingsley, 1879


Distribution: Western Atlantic: Brazil (Piauí to São Paulo) (Melo, 1996; Dall’Occo et al., 2004).

Remarks: This endemic Brazilian species is found on various kinds of hard bottoms, including dead corals (Young, 1986; Almeida et al., 2010). During our sampling, we also collected this species on the coral Mussismilia harttii (3 f, 20.III.2011, Porto Seguro, Mutá Beach, UESC 1381).

**Distribution:** Western Atlantic: Central America, West Indies, northern South America, and Brazil (Pará to Rio Grande do Sul). Eastern Pacific: Gulf of California to Gulf of Panama (Hendrickx, 1995; Melo, 1996).

**Remarks:** *Pilumnus reticulatus* is found on various kinds of hard bottoms (Almeida et al., 2010). A previous record from coral rubble in southern Bahia was provided by Almeida et al. (2010).

Superfamily *Trapezioidea* Miers, 1886
Family *Domeciidae* Ortmann, 1893

*Domecia acanthophora* (Desbonne and Schramm, 1867)

**Material examined:** 1 m, 1 ovf, 20.III.2011, Porto Seguro, Mutá Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 39 p.s.u., on dead portions of *M. alcicornis*, UESC 1402.

**Distribution:** Western Atlantic: Bermuda, North Carolina, Florida, Gulf of Mexico, West Indies, northern South America, and Brazil (São Pedro and São Paulo Archipelago, Atol das Rocas, Fernando de Noronha, and from Paraíba to São Paulo) (Melo, 1996, as *D. acanthophora acanthophora*; Alves et al., 2006, as *D. acanthophora acanthophora*).

**Remarks:** Patton (1967) noted that *D. acanthophora* specimens on living colonies of *Acropora palmata* (Lamarck, 1816) from Puerto Rico inhabited structural deformations in the living coral tissue, which he called “resting places”. Grajal and Laughlin (1984) did not observe such deformations caused by *D. acanthophora* on *A. palmata* colonies from Venezuela, although they noted a high number of ovigerous females and a sex ratio of 1:2.05 (m:f). This skewed sex ratio was also noted by Patton (1967). Patton (1967) and Grajal and Laughlin (1984) also commented that, among the decapods obtained on colonies of *A. palmata*, *D. acanthophora* seemed to be the only true symbiont. *Domecia acanthophora*, however, is also found in other acroporid corals, on dead coral, and on other substrata (Patton, 1967; Powers, 1977; Grajal and Laughlin, 1984; Young, 1986). We observed *D. acanthophora* on dead portions of *M. alcicornis* colonies, but it may also have occurred in the living part. We also did not find these crabs in any particular kind of shelter.

Superfamily *Xanthoidea* MacLeay, 1838
Family *Panopeidae* Ortmann, 1893
Subfamily *Panopeinae* Ortmann, 1893

*Panopeus harttii* Smith, 1869

**Material examined:** 1 m, 1 f, 21.III.2011, Santa Cruz Cabrália, Coroa Vermelha Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 32 p.s.u., on dead coral rubble, UESC 1401.

**Distribution:** Western Atlantic: Florida, West Indies, and Brazil (Maranhão to São Paulo). Central Atlantic: Ascension (Manning and Chace, 1990; Melo, 1996).

**Remarks:** Species common on various kinds of hard bottoms (Powers, 1977; Almeida et al., 2010). A previous record from coral rubble in southern Bahia was provided by Almeida et al. (2010).

Superfamily *Grapsoidea* MacLeay, 1838
Family *Grapsidae* MacLeay, 1838

*Pachygrapsus gracilis* (Saussure, 1858)

**Material examined:** 4 m, 2 f, 21.III.2011, Santa Cruz Cabrália, Coroa Vermelha Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 32 p.s.u., on dead coral rubble, UESC 1400.

**Distribution:** Western Atlantic: Gulf of Mexico (Texas), West Indies, Venezuela, French Guyana, Brazil (Trindade Island, and from Pará to Rio Grande do Sul), and Argentina. Eastern Atlantic: Senegal to Angola (Rodríguez, 1980; Melo, 1996; Barros et al., 1997b; Poupin et al., 2005).

**Remarks:** Found in several kinds of substrata, including soft and hard, mainly in...
estuaries (Almeida et al., 2010). In southern Bahia it is one of the most abundant decapods found on Crassostrea rhizophorae (Guilding, 1828) (Almeida et al., 2010). Moreno-Forero et al. (1998) recorded P. gracilis on dead Acropora palmata in Colombia, and therefore its occurrence in crevices of coral rubble on the Bahia coast is not surprising.

Discussion

Most of the decapods recorded herein belong to the families Alpheidae (n=14) and Porcellanidae (n=9), which together comprised almost 60% of the decapods obtained. In another study in northeastern Brazil (state of Paraíba), Young (1986), studying the fauna associated with three hermatypic corals, observed that Alpheidae was the most prominent decapod group occurring on dead coral surfaces in terms of the number of species, whereas the Porcellanidae was the most prominent group in terms of the number of specimens. Alpheid shrimps are frequent components of the cryptofauna in a wide variety of marine and estuarine microhabitats (Felder 1982; Bauer, 2004; Anker et al., 2006) and some species have adaptations that allow them to excavate or enlarge natural cavities in living and dead coral (Cortes, 1985; Fischer and Meyer, 1985; Kropp, 1987; Werding, 1990; Anker et al., 2008a). We obtained at least two species (Alpheus cristulifrons and A. simus) that are capable of these activities. Other alpheids apparently benefit from crevices produced by other boring organisms, or live among the fouling organisms that grow on dead coral surfaces. Porcellanid crabs also live in various habitats such as under rocks, in worm tubes, cavities of sponges, and excavations in coral reefs (Gore and Abele, 1976; Gore, 1982; Rodríguez et al., 2005). Living and dead coral pieces are generally rugose, rich in crevices, grooves, and other narrow spaces that are suitable habitats for the settlement of porcellanids. Undoubtedly, their dorsoventrally flattened body allows them to enter and move about in these small spaces.

Although some of the decapods that we obtained are apparently abundant in the microhabitat investigated, the great majority of the species are found in a wide variety of hard substrata along their geographic range (e.g., Alpheus carlae, Petrolisthes armatus, Mithraculus forceps). In other words, none of the species sampled occurs only on dead corals. The taxonomic composition of the fauna living on dead coral rocks is expected to differ from that observed on living coral tissue (Coles, 1980; Grajal and Laughlin, 1984; Young, 1986), although some species may live in both habitats [e.g., Domecia acanthophora (Patton, 1967; Grajal and Laughlin, 1984; Young, 1986)]. The surface of living corals provides a habitat for a variety of ectocommensal decapods and for those species that live in galls or burrows in the coral skeleton (Coles, 1980; Young, 1986; Nogueira, 2003). Coles (1980) observed that the composition of the decapod community associated with the coral Pocillopora meandrina Dana, 1846 in Hawaii changed gradually from dominance by symbiotic species to a more diverse fauna of facultatively associated decapods, as the host corals died due to environmental disturbance. On live corals, the facultative species are relatively few in number and are in general restricted to non-living portions, while on dead coral more species and individuals are expected to be found (Coles, 1980).

The fauna found in such microhabitats is in general little known because of its cryptic life style, especially in certain reef areas that are still little studied, such as those in northeastern Brazil. Our samplings yielded 39 species, including some new records and significant range extensions, especially that of the alpheid shrimp Alpheus peasei, the first report in the South Atlantic. Some of the species recorded herein (e.g., Microprosthema semilaeve and Coralianassa hartmeyeri) have been rarely recorded, and consequently their biology and ecology are scarcely known. Systematic sampling of the dead coral microhabitat in the study area and other Brazilian reefs would doubtless provide various new records and
range extensions, contributing to knowledge of the geographic ranges of the decapod fauna. Moreover, dead corals have great potential for the discovery of taxa new to science.

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