

## 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 marginatu* Stimpson, 1859 also had their known geographic ranges extended along the western Atlantic. *Alpheus nuttingi* (Schmitt, 1924), *Synalpheus scaphocercis* 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 cryptofauna is especially rich in species and biomass in coral reef communities. Such cryptofauna consists predominantly of boring invertebrates such as sponges, polychaetes, crustaceans, sipunculans, and bivalves (Kropp, 1987; Reaka-Kudla, 1997; Hoeksema *et al.*, 2012), and incrusting forms and motile nestlers that inhabit crevices generated by burrowing (Reaka-Kudla, 1997). Perforating invertebrates, along with algae and bacteria, are primarily responsible for

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

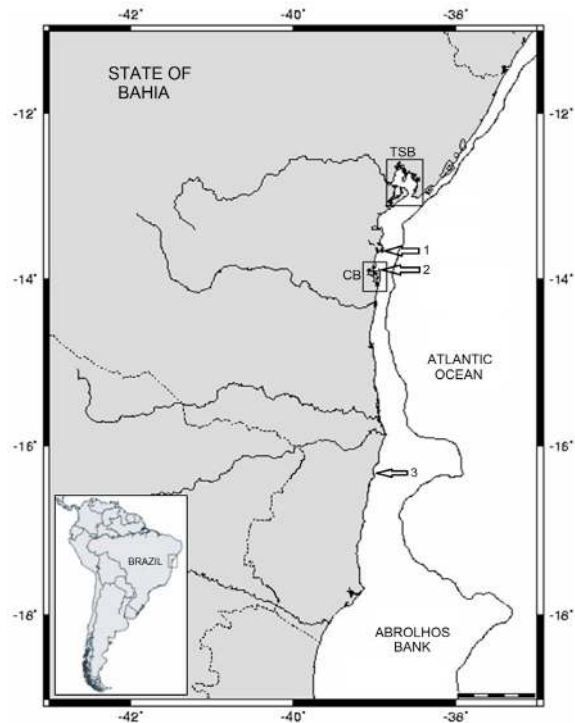
The living and the dead coral portions, both in live colonies as well as in fragments (coral rubble), serve as substrates for various animals, which may use this microhabitat as a refuge from predators and as sites for feeding and reproduction (Coles, 1980; Grajal and Laughlin, 1984; Young, 1986; Kropp, 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 (Hetzl 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 (Maraú, July 2011, 13°56'22.0”S / 38°55'35.4”W), Algodões (Maraú, 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).



**Figure 1.** Study area, coast of the state of Bahia, Brazil. (CB) Camamu Bay. (TSB) Todos os Santos Bay. Arrows indicate (1) Municipality of Cairú, Boipeba Island; (2) Municipality of Maraú, Maraú 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), Axiidea (family Callianassidae), Gebiidea (family Upogebiidae), Anomura (family Porcellanidae), and Brachyura (families Majidae, Pilumnidae, Dromedidae, 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. alvicornis* 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)

*Material examined:* 1 f, 31.VII.2011, Marau, 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 1477.

*Distribution:* Western Atlantic: Bahamas, southern Florida, West Indies, northern South America, and Brazil (Fernando de Noronha, Pernambuco, and Bahia) (Coelho and Ramos-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, Marau.

Infraorder Caridea Dana, 1852

Superfamily Palaemonoidea Rafinesque, 1815

Family Palaemonidae Rafinesque, 1815

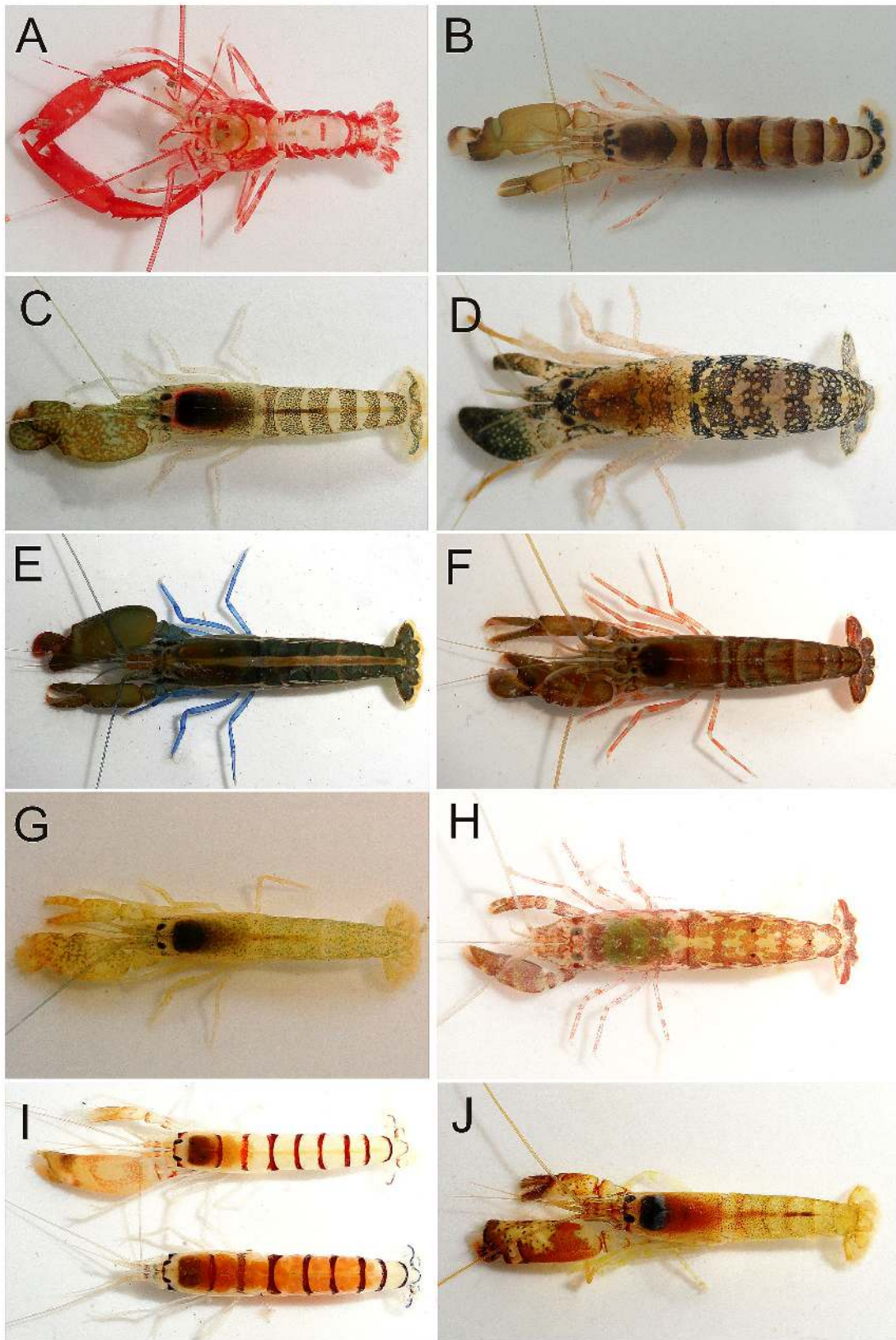
Subfamily Pontoniinae Kingsley, 1879

*Cuapetes americanus* (Kingsley, 1878)

*Material examined:* 3 f (1 ovf), 22.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 1412; 1 ovf, 22.III.2011, Santa Cruz Cabrália, Coroa Vermelha Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 36 p.s.u., on dead coral rubble, UESC 1413; 2 m, 5 f (4 ovf), 19.V.2011, Cairú, Boipeba Island, Tassimirim Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 31 p.s.u., on dead coral rubble, UESC 1419; 4 m, 7 f (5 ovf), 20.V.2011, Cairú, Boipeba Island, Moreré Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 38 p.s.u., on dead coral rubble, UESC 1436; 1 m, 1 ovf, 30.VII.2011, Marau, 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 1466; 2 m, 6 f (4 ovf), 31.VII.2011, Marau, 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 1475.

*Distribution:* Western Atlantic: North Carolina to western Gulf of Mexico, West Indies, Colombia, Venezuela, and Brazil (Atol das Rocas, 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.



**Figure 3.** Decapod crustaceans collected on dead coral on the coast of the state of Bahia, Brazil. (A) *Microprosthema semilaeve* (von Martens, 1872) (Stenopodidae). (B) *Alpheus bouvieri* A. Milne-Edwards, 1878 (Alpheidae). (C) *Alpheus carlae* Anker, 2012 (Alpheidae). (D) *Alpheus cristulifrons* Rathbun, 1900 (Alpheidae). (E) *Alpheus formosus* Gibbes, 1850 (Alpheidae). (F) *Alpheus intrinsecus* Spence Bate, 1888 (Alpheidae). (G) *Alpheus nuttingi* (Schmitt, 1924) (Alpheidae). (H) *Alpheus* cf. *packardii* Kingsley, 1880 (Alpheidae). (I) *Alpheus* cf. *paracrinitus* Miers, 1881 (Alpheidae). (J) *Alpheus peasei* (Armstrong, 1940) (Alpheidae).

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 harttii* (Verrill, 1868), *M. hispida* (Verrill, 1902), and *Siderastrea stellata* (Verrill, 1868).

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

*Material examined:* 1 m, 20.V.2011, Cairú, Boipeba Island, Moreré Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 38 p.s.u., on dead coral rubble, UESC 1437; 1 ovf, 25.IX.2011, Mutá Beach, Porto Seguro, coll. P.S. Santos, G.O. Soledade and A.G.L.M. Pedra, salinity: 40 p.s.u., on dead coral rubble, UESC 1504.

*Distribution:* Western Atlantic: Bermuda, Florida, West Indies, Panama, and Brazil (Fernando de Noronha, Ceará to Rio Grande do Sul). Central Atlantic: Ascension Island. Eastern Atlantic: Cape Verde, Senegal to Gulf of Guinea and Congo-Brazzaville (Crosnier and Forest, 1966; Chace, 1972; Christoffersen, 1979; 1998; Manning and Chace, 1990; Anker *et al.*, 2009a).

*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)

*Material examined:* 2 f, 20.V.2011, Cairú, Boipeba Island, Moreré Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 38 p.s.u., on dead coral rubble, UESC 1435.

*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)

*Material examined:* 3 m, 3 ovf, 22.III.2011, Santa Cruz Cabrália, Coroa Vermelha Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 36 p.s.u., on dead portions of *M. alcicornis*, UESC 1416; 6 m, 8 f (5 ovf), 19.V.2011, Cairú, Boipeba Island, Tassimirim Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 31 p.s.u., on dead portions of *M. alcicornis*, UESC 1431; 3 m, 3 ovf, 25.IX.2011, Porto Seguro, Mutá Beach, coll. P.S. Santos, G.O. Soledade and A.G.L.M. Pedra, salinity: 40 p.s.u., on dead portions of *M. alcicornis*, UESC 1500.

*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*

*al.*, 2008a).

*Alpheus formosus* Gibbes, 1850 (Fig. 3E)

*Material examined:* 1 ovf, 21.III.2011, Santa Cruz Cabralia, Coroa Vermelha Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 32 p.s.u., on dead coral rubble, UESC 1415; 2 m, 6 f, 19.V.2011, Cairú, Boipeba Island, Tassimirim Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 31 p.s.u., on dead coral rubble, UESC 1417; 6 m, 8 f, 20.V.2011, Cairú, Boipeba Island, Moreré Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 38 p.s.u., on dead coral rubble, UESC 1434; 3 m, 3 f (1 ovf), 30.VII.2011, Marauá, 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, Marauá, Taipús de Fora Beach, P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 38 p.s.u., on dead coral rubble, UESC 1474; 1 m, 1 ovf, 01.VIII.2011, Marauá, Algodões Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 38 p.s.u., on dead coral rubble, UESC 1494.

*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, Marauá, 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 1480.

*Distribution:* Western Atlantic: Puerto Rico to Brazil (Piauí to Santa Catarina). Eastern Atlantic: Western Sahara to Gabon (Crosnier and Forest, 1966; Christoffersen, 1979).

*Remarks:* *Alpheus intrinsecus* 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)

*Material examined:* 1 f, 30.VII.2011, Marauá, 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 1463; 1 f, 31.VII.2011, Marauá, Taipús de Fora Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 38 p.s.u., on dead coral, UESC 1478.

*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).

*Remarks:* *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, Marauá, 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, Marauá,

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 1479.

*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, West Indies, Panama, and Brazil (Paraíba and Espírito Santo). Central Atlantic: Ascension Island. Eastern Atlantic: Cape Verde to Gulf of Guinea and Angola. Eastern Pacific and Indo-West Pacific (Crosnier and Forest, 1966; Chace, 1972; 1988; Banner and Banner, 1982; Kim and Abele, 1988; Manning and Chace, 1990; Christoffersen, 1998).

*Remarks:* *Alpheus paracrinitus* is a species complex (Almeida *et al.*, 2012; A. Anker, pers. comm.). Young (1986) reported the species on dead portions of the corals *Mussismilia hispida* and *Siderastrea stellata*. However, because *A. paracrinitus* is a complex, records of this species must be considered with care (see Almeida *et al.*, 2012). It has been reported in crevices of coral rubble from southern Bahia (Almeida *et al.*, 2012).

*Alpheus peasei* (Armstrong, 1940) (Fig. 3J)

*Material examined:* 1 m, 1 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 1462; 2 m, 3 f (2 ovf), 01.VIII.2011, Maraú, Algodões Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 38 p.s.u., on dead coral rubble, UESC 1493.

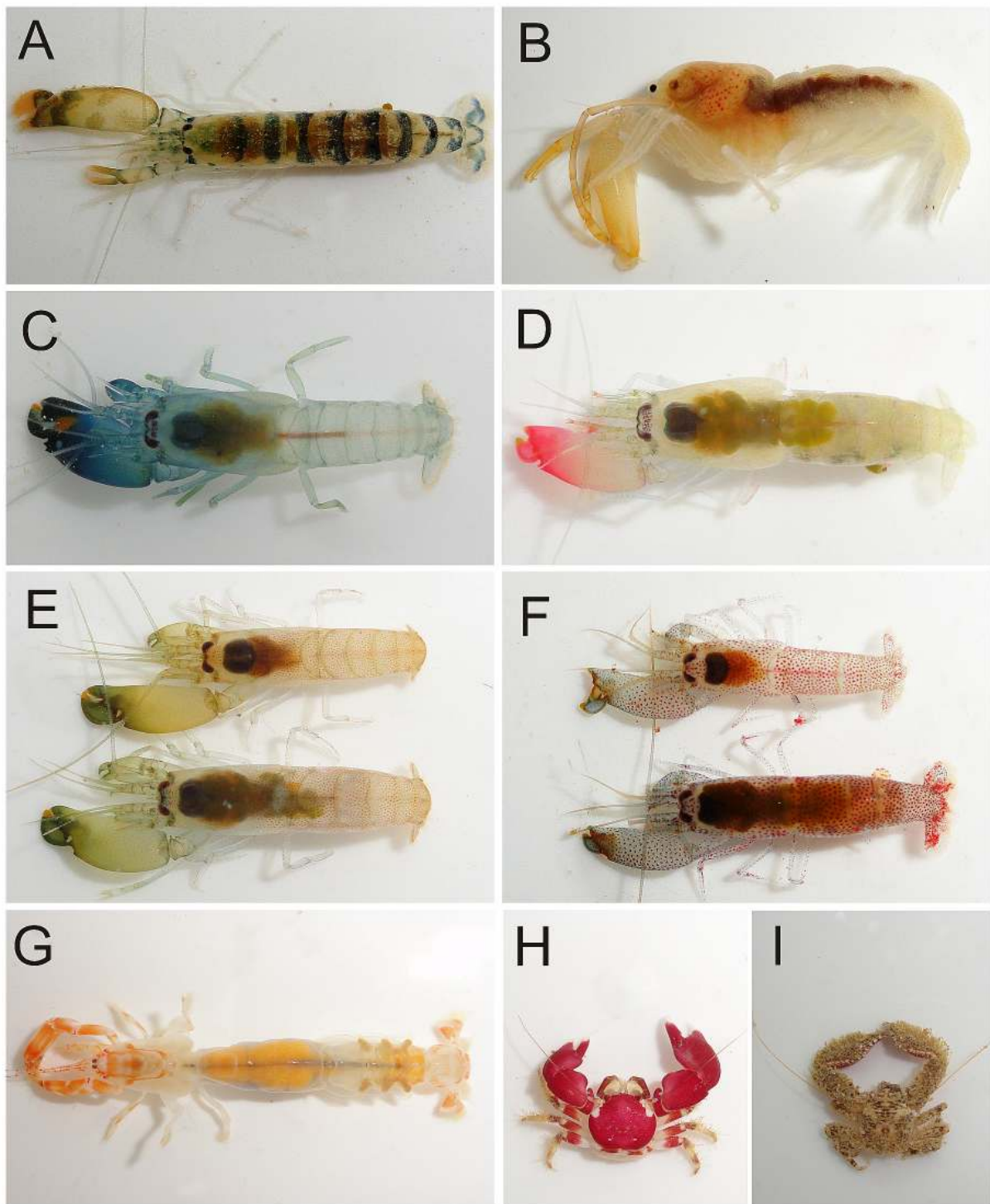
*Distribution:* Western Atlantic: Bermuda and Florida Keys to Tobago, and westward to Providencia Island and the Yucatan Peninsula (Chace, 1972; Rodríguez, 1980).

*Remarks:* *Alpheus peasei* has been reported from Bermuda and the Florida Keys to Tobago (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 Guyanas 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)

*Material examined:* 2 m, 4 f, 21.III.2011, Santa Cruz Cabralia, Coroa Vermelha Beach, P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 32 p.s.u., on dead coral rubble, UESC 1409; 3 f (1 ovf) 22.III.2011, Santa Cruz Cabralia, Coroa Vermelha Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 36 p.s.u., on dead portions of *M. alcornis*, UESC 1410; 5 m, 6 f (5 ovf),





**Figure 4.** Decapod crustaceans collected on dead coral on the coast of the state of Bahia, Brazil. (A) *Alpheus* cf. *rostratus* W. Kim and Abele, 1988 (Alpheidae). (B) *Alpheus simus* Guérin-Méneville, 1855 (Alpheidae). (C-D) Color patterns observed for species of the *Synalpheus brevicarpus* (Herrick, 1891) complex (Alpheidae). (E) *Synalpheus* cf. *fritzmuelleri* Coutière, 1909 (Alpheidae). (F) *Synalpheus scaphoceris* Coutière, 1910 (Alpheidae). (G) *Corallianassa hartmeyeri* Schmitt, 1935 (Callianassidae). (H) *Pachycheles riisei* (Stimpson, 1858) (Porcellanidae). (I) *Petrolisthes marginatus* Stimpson, 1859 (Porcellanidae).

01.VIII.2011, Marauá, Algodões Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 38 p.s.u., on dead coral rubble, UESC 1490; 4 m, 4 f (2 ovf), 30.VII.2011, Marauá, 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 1465.

*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)

*Material examined:* 1 m, 1 f, 22.III.2011, Santa Cruz Cabralia, Coroa Vermelha Beach, P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 36 p.s.u., on dead portions of *M. alcornis*, UESC 1411; 1 f, 25.IX.2011, Porto Seguro, Mutá Beach, coll. P.S. Santos, G.O. Soledade and A.G.L.M. Pedra, salinity: 40 p.s.u., on dead portions of *M. alcornis*, UESC 1503.

*Distribution:* Western Atlantic: Florida, Yucatan, West Indies, Central America, northern South America, and Brazil (Rio Grande do Norte and Bahia) [Chace, 1972, as *Thunor rathbunae* (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. alcornis*. 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. alcornis* 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)

*Material examined:* 1 f, 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. alcornis*, UESC 1403; 2 f, 22.III.2011, Santa Cruz Cabralia, Coroa Vermelha Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 36 p.s.u., on *M. alcornis*, UESC 1404; 1 f, 01.VIII.2011, Marauá, Algodões Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 38 p.s.u., on dead coral rubble, UESC 1497; 2 nov, 1 ovf, 31.VII.2011, Marauá,

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 1481; 2 nov, 1 ovf, 01.VIII.2011, Marauá, Algodões Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 38 p.s.u., on dead coral rubble, UESC 1496; 4 nov, 25.IX.2011, Porto Seguro, Mutá Beach, coll. P.S. Santos, G.O. Soledade and A.G.L.M. Pedra, salinity: 40 p.s.u., on dead portions of *M. alcicornis*, UESC 1502.

*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)

*Material examined:* 7 nov, 2 ovf, 2 ni, 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 1405; 4 nov, 22.III.2011, Santa Cruz Cabralia, Coroa Vermelha Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 36 p.s.u., on dead portions of *M. alcicornis*, UESC 1406; 8 nov, 19.V.2011, Cairú, Boipeba Island, Tassimirim Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 31 p.s.u., on dead coral rubble, UESC 1418; 8 nov, 19.V.2011 Cairú, Boipeba Island, Tassimirim Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 31 p.s.u., on dead portions of *M. alcicornis*, UESC 1432; 8 nov, 3 ovf, 20.V.2011, Cairú, Boipeba

Island, Moreré Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 38 p.s.u., on dead coral rubble, UESC 1433; 1 nov, 1 ovf, 31.VII.2011, Marauá, 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 1473; 3 nov, 2 ovf, 01.VIII.2011, Marauá, Algodões Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 38 p.s.u., on dead coral rubble, UESC 1495; 21 nov, 10 ovf, 25.IX.2011, Porto Seguro, Mutá Beach, coll. P.S. Santos, G.O. Soledade and A.G.L.M. Pedra, salinity: 40 p.s.u., on dead portions of *M. alcicornis*, UESC 1499; 1 nov, 25.IX.2011, Porto Seguro, Mutá Beach, coll. P.S. Santos, G.O. Soledade and A.G.L.M. Pedra, salinity: 40 p.s.u., on dead coral rubble, UESC 1501.

*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 Mariás 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, Marauá, Algodões 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

Beach, coll. P.S. Santos, G.O. Soledade and A.G.L.M. Pedra, salinity: 40 p.s.u., on dead portions of *M. alcicornis*, UESC 1516.

*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)

*Material examined:* 1 ovf, 30.VII.2011, Marau, 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 1467; 2 ovf, 31.VII.2011, Marau, 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 1482.

*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

*Material examined:* 2 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 1414.

*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

*Material examined:* 1 f, 19.V.2011, Cairú, Boipeba Island, Tassimirim Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 31 p.s.u., on dead coral rubble, UESC 1420.

*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)

*Material examined:* 1 m, 31.VII.2011, Marau, 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 1476.

*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

*Pomatogobia operculata* (Schmitt, 1924)

*Material examined:* 1 ovf, 25.IX.2011, Porto Seguro, Mutá Beach, coll. P.S. Santos, G.O. Soledade and A.G.L.M. Pedra, salinity: 40 p.s.u., on dead portions of *M. alcicornis*, UESC 1517.

*Distribution:* Western Atlantic: Florida, Gulf of Mexico, Central America, northern South America, and Brazil (Ceará to Espírito Santo) (Melo, 1999).

*Remarks:* *Pomatogobia operculata* is reported as an inhabitant of massive living corals in Saint Croix (Kleemann, 1984) and Jamaica and Barbados (Scott, 1987), where specimens live in male-female pairs in ramifying galleries. Scott (1987) demonstrated that *P. operculata* is capable of mechanical boring. However, the species inhabits coral rubble and rocks (Scott, 1987; this study) as well as living corals.

Infraorder Anomura MacLeay, 1838

Superfamily Galatheoidea Samouelle, 1819

Family Porcellanidae Haworth, 1825

*Megalobrachium roseum* (Rathbun, 1900)

*Material examined:* 1 m, 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 1375; 4 f (1 ovf), 22.III.2011, Santa Cruz Cabralia, Coroa Vermelha Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 36 p.s.u., on dead portions of *M. alcicornis*, UESC 1376; 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 coral rubble, UESC 1377; 1 f, 19.V.2011, Cairú, Boipeba Island, Tassimirim Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 31 p.s.u., on dead coral rubble, UESC 1423; 2 m, 19.V.2011, Cairú, Boipeba Island, Tassimirim Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 31 p.s.u., on dead portions of *M. alcicornis*, UESC 1425; 1 m, 01.VIII.2011, Maraú, Algodões Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 38 p.s.u., on dead coral rubble, UESC 1491; 3 m, 1 f, 25.IX.2011, Porto Seguro, Mutá Beach, P.S. Santos, G.O. Soledade and A.G.L.M. Pedra, salinity: 40 p.s.u., on dead portions of *M. alcicornis*, UESC 1514.

*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)

*Material examined:* 1 f, 01.VIII.2011, Maraú, Algodões Beach, salinity: 38 p.s.u., on dead coral rubble, UESC 1492; 1 m, 1 ovf, 25.IX.2011, Porto Seguro, Mutá Beach, coll. P.S. Santos, G.O. Soledade and A.G.L.M. Pedra, salinity: 40 p.s.u., on dead coral rubble, UESC 1515; 1 f, 31.VII.2011, Maraú, Taipús de Fora Beach, salinity: 38 p.s.u., on dead coral rubble, UESC 1484.

*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)

*Material examined:* 5 f, 21.III.2011, Santa Cruz Cabralia, Coroa Vermelha Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 32 p.s.u., on dead coral rubble, UESC 1387; 1 m, 1 f, 22.III.2011, Santa Cruz Cabralia, Coroa Vermelha Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 36 p.s.u., on dead coral rubble, UESC 1388; 3 f (1 ovf), 20.III.2011, Porto Seguro, Mutá Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, UESC 1389, salinity: 39 p.s.u., on dead portions of *M. alcornis*; 1 f, 21.III.2011, Santa Cruz Cabralia, Coroa Vermelha Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 32 p.s.u., on dead portions of *M. alcornis*, UESC 1390; 1 m, 2 ovf, 22.III.2011, Santa Cruz Cabralia, Coroa Vermelha Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 36 p.s.u., on dead portions of *M. alcornis*, UESC 1391; 1 m, 2 f (1 ovf), 19.V.2011, Cairú, Boipeba Island, Tassimirim Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 31 p.s.u., on dead portions of *M. alcornis*, UESC 1427; 6 m, 4 f (2 ovf), 25.IX.2011, Porto Seguro, Mutá Beach, coll. P.S. Santos, G.O. Soledade and A.G.L.M. Pedra, salinity: 40 p.s.u., on dead portions of *M. alcornis*, UESC 1510.

*Distribution:* Western Atlantic: Brazil (Pará to Espírito Santo) (Melo, 1999).

*Remarks:* The Brazilian endemic *P. greeleyi*

is found on various types of hard substrata, including corals (Young, 1986; Veloso and Melo, 1993). The species is apparently very abundant in the microhabitats studied on the Bahia coast, where it was previously recorded in crevices of coral rubble by Almeida *et al.* (2010).

*Pachycheles monilifer* (Dana, 1852)

*Material examined:* 3 m, 2 f (1 ovf), 19.V.2011, Cairú, Boipeba Island, Tassimirim Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 31 p.s.u., on dead coral rubble, UESC 1424.

*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-Fransozo, 1999; Nogueira, 2003).

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

*Material examined:* 1 m, 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 1488; 1 m, 1 ovf, 01.VIII.2011, Maraú, Algodões 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 Paraíba to São Paulo) (Melo, 1999; Rodríguez *et al.*, 2005; Tagliafico *et al.*, 2005; Lira *et al.*, 2007).

*Remarks:* *Pachycheles riisei* is found on hard substrata, including corals (Werdling, 1982; Young, 1986, as *P. riispi 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)

*Material examined:* 2 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 1385; 1 ovf, 22.III.2011, Santa Cruz Cabrália, Coroa Vermelha Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 36 p.s.u., on dead coral rubble, UESC 1386; 1 m, 1 ovf, 25.IX.2011, Porto Seguro, Mutá Beach, coll. P.S. Santos, G.O. Soledade and A.G.L.M. Pedra, salinity: 40 p.s.u., on dead portions of *M. alcicornis*, UESC 1509.

*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)

*Material examined:* 2 m, 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 1373; 1 m, 19.V.2011, Cairú, Boipeba Island, Tassimirim Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 31 p.s.u., on dead portions of *M. alcicornis*, UESC 1426; 1 m, 31.VII.2011, Maráu, Taipús de Fora Beach, salinity: 38 p.s.u., on dead coral rubble, UESC 1486; 4 m, 4 f, 25.IX.2011, Porto Seguro, Mutá Beach, coll. P.S. Santos, G.O. Soledade and A.G.L.M. Pedra, salinity: 40 p.s.u., on dead portions of *M. alcicornis*, UESC 1507.

*Distribution:* Western Atlantic: North Carolina to Florida, Gulf of Mexico, West Indies, northern South America, and Brazil (Trindade Island, and from Pará to Rio Grande do Sul). Eastern Atlantic: western coast of Africa. Eastern Pacific: Gulf of California, and from Costa Rica to Peru (Melo, 1999).

*Remarks:* The species is present on living and dead corals, among other hard substrata (Werding, 1982; Grajal and Laughlin, 1984; Young, 1986; Castro *et al.*, 2006). Most of our material was obtained on dead portions of *M. alcicornis* colonies; however, we observed it on living colonies as well. Castro *et al.* (2006) also observed *P. galathinus* on living colonies of *M. alcicornis*, in the Colombian Caribbean.

*Petrolisthes marginatus* Stimpson, 1859  
(Fig. 4I)

*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 1374; 2 f (1 ovf), 25.IX.2011, Porto Seguro, Mutá Beach, coll. P.S. Santos, G.O. Soledade and A.G.L.M. Pedra, salinity: 40 p.s.u., on dead portions of *M. alcicornis*, UESC 1512.

*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 (20°30'S / 29°18'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.

*Petrolisthes rosariensis* Werding, 1982

*Material examined:* 4 m, 3 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 coral rubble, UESC 1396; 2 m, 31.VII.2011, Maraú, Taipús de Fora Beach, salinity: 38 p.s.u., on dead coral rubble, UESC 1483; 1 m, 2 f (1 ovf), 25.IX.2011, Porto Seguro, Mutá Beach, coll. P.S. Santos, G.O. Soledade and A.G.L.M. Pedra, salinity: 40 p.s.u., on dead portions of *M. alcicornis*, UESC 1511.

*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)

*Material examined:* 1 ovf, 22.III.2011, Santa Cruz Cabrália, Coroa Vermelha Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 36 p.s.u., on dead coral rubble, UESC 1398; 1 m, 2 f (1 ovf), 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 1399; 1 m, 19.V.2011, Cairú, Boipeba Island, Tassimirim Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 31 p.s.u., on dead coral rubble, UESC 1421; 1 m, 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 1485.

*Distribution:* Western Atlantic: Bermuda, North Carolina to Florida, Gulf of Mexico, Central America, 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)

*Material examined:* 1 m, 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 coral rubble, UESC 1371; 1 m, 2 ovf, 1 ni, 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 1372; 1 m, 19.V.2011, Cairú, Boipeba Island, Tassimirim Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 31 p.s.u., on dead coral rubble, UESC 1422; 1 f, 19.V.2011, Cairú, Boipeba Island, Tassimirim Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 31 p.s.u., on dead portions of *M. alcicornis*, UESC 1429; 1 m, 2 f, 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 1469; 1 m, 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 1487; 1 m, 25.IX.2011, Porto Seguro, Mutá Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 40 p.s.u., on dead portions of *M. alcicornis*, UESC 1506; 4 m, 1 f, 25.IX.2011, Porto Seguro, Mutá Beach, coll. P.S. Santos, G.O. Soledade and A.G.L.M. Pedra, salinity: 40 p.s.u., on dead coral rubble, UESC 1508.

*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

*Material examined:* 2 m, 2 f, 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 1380; 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 portions of *M. alcicornis*, UESC 1382; 1 m, 1 ni, 22.III.2011, Santa Cruz Cabrália, Coroa Vermelha Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 36 p.s.u., on dead coral rubble, UESC 1383; 1 m, 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 coral rubble, UESC 1384; 3 m, 2 ni, 19.V.2011, Cairú, Boipeba Island, Tassimirim Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 31 p.s.u., on dead portions of *M. alcicornis*, UESC 1430; 5 m, 14 f, 25.IX.2011, Porto Seguro, Mutá Beach, coll. P.S. Santos, G.O. Soledade and A.G.L.M. Pedra, salinity: 40 p.s.u., on dead coral rubble, UESC 1505.

*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).

*Mithrax hemphilli* Rathbun, 1892

*Material examined:* 2 m, 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 1471.

*Distribution:* Western Atlantic: Florida, West Indies, and Brazil (Atol das Rocas, and from Maranhão to Rio de Janeiro) (Melo, 1996).

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

Superfamily Pilumnoidea Samouelle, 1819

Family Pilumnidae Samouelle, 1819

Subfamily Pilumninae Samouelle, 1819

*Pilumnus dasypodus* Kingsley, 1879

*Material examined:* 1 m, 2 f, 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 1393; 1 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 1394; 1 f, 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 1470; 9 m, 5 f, 25.IX.2011, Porto Seguro, Mutá Beach, coll. P.S. Santos, G.O. Soledade and A.G.L.M. Pedra, salinity: 40 p.s.u., on dead portions of *M. alcicornis*, UESC 1513.

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

*Remarks:* *Pilumnus dasypodus* is found on various kinds of hard substrata, including dead corals (Powers, 1977; Young, 1986; Almeida *et al.*, 2010).

*Pilumnus reticulatus* Stimpson, 1860

*Material examined:* 1 m, 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 1392; 1 f, 19.V.2011, Cairú, Boipeba Island, Tassimirim Beach, coll. P.S. Santos, G.O. Soledade and A.O. Almeida, salinity: 31 p.s.u., on *M. alcicornis*, UESC 1428.

*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 Cabralia, 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 Cabralia, 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 hartmeyerii*) 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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