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TOWARDS A REVIEW OF THE DECAPOD CRUSTACEA FROM THE REMOTE OCEANIC ARCHIPELAGO OF TRINDADE AND MARTIN VAZ, SOUTH ATLANTIC OCEAN: NEW RECORDS AND NOTES ON ECOLOGY AND ZOOGEOGRAPHY

MARCOS TAVARES^{1,2}

LEINA CARVALHO^{1,3}

JOEL BRAGA DE MENDONÇA JR.^{1,4}

ABSTRACT

The remoteness of the Trindade and Martin Vaz young volcanic archipelago (TMV) raises questions about the source of its marine benthic fauna and levels of endemism. Addressing these questions requires a comprehensive knowledge of the taxonomic composition of the marine fauna of the islands. A five-year survey in the shallow marine waters (up to 30 m) and a literature review on the data published for TMV have been conducted to document the biodiversity of the benthic fauna. Here we report on ten new records of decapod crustaceans from TMV: Gnathophyllum americanum and Thor amboinensis are circumtropical in distribution, whereas Stenopus hispidus, Gnathophylloides mineri and Parribacus antarcticus are disjunct circumtropical species as their distribution in the Atlantic Ocean is limited eastwardly to TMV or Ascension Island (S. hispidus), therefore, do not extending into the eastern Atlantic. Gnathophyllum circellum and Thor manningi are western Atlantic species, with G. circellum previously known only from the Caribbean Sea. Pontonia manningi, Tuleariocaris neglecta and Enoplometopus antillensis are amphi-Atlantic in distribution. Two of the above species are recorded from the southwestern Atlantic for the first time: Gnathophyllum circellum and Tuleariocaris neglecta. These new records corroborate that the marine benthic invertebrate fauna of the TMV archipelago is actually a mosaic of amphi-Atlantic, eastern Atlantic, central Atlantic (insular), endemic and circumtropical species, with a strong western Atlantic component.

KEY-WORDS: Oceanic islands; Zoogeography; Taxonomy; Marine invertebrates; Benthos.

INTRODUCTION

The remote oceanic islands Trindade and Martin Vaz (TMV) are the aerial parts (aged of about 3-3.5 and 1-1.5 my, respectively) of the Vitória-Trin-

dade submarine volcanic chain (Marques *et al.*, 1999; Santos *et al.*, 2002). Trindade (20°30'S/29°20'W) and Martin Vaz (20°30'S/28°51'W) are only 49 km away from each other, but distant some 1200 km from the Brazilian shore and about 4200 km away from the

¹ Museu de Zoologia, Universidade de São Paulo. Caixa Postal 42.391, CEP 04218-970, São Paulo, SP, Brasil.

² E-mail: mdst@usp.br.

³ E-mail: leinacarvalho@hotmail.com.

⁴ E-mail: joelusu@hotmail.com.

African coast (Fig. 1A-F). Their closest oceanic islands are Fernando de Noronha (1884 km), Atol das Rocas (1915 km), Ascension (2134 km), St. Peter and St. Paul Rocks (2387 km) and St Helena (2546 km). The isolation of TMV raises questions about the source of its marine, benthic fauna and levels of endemism. Underpinning these questions is the need for an in-depth understanding of the faunal composition of TMV based on solid taxonomic foundations.

During a five-year project coordinated by the first author (ProTrindade/CNPq), six campaigns to TMV were conducted between 2012 and 2016, which resulted in a vast material of shallow-water decapod crustaceans among other groups of marine

benthic invertebrates. These collections are under study by a network of taxonomists associated with the ProTrindade Project (e.g., Anker *et al.*, 2016; Martins *et al.*, 2016). In the present study we report on ten new records of decapod crustaceans from Trindade and Martin Vaz as part of an ongoing taxonomic study of the decapod fauna of TMV.

MATERIAL AND METHODS

Sampling consisted mainly of daytime scuba diving (207 dives) down to 30 m and numerous snorkeling dives and intertidal collecting. The specimens were

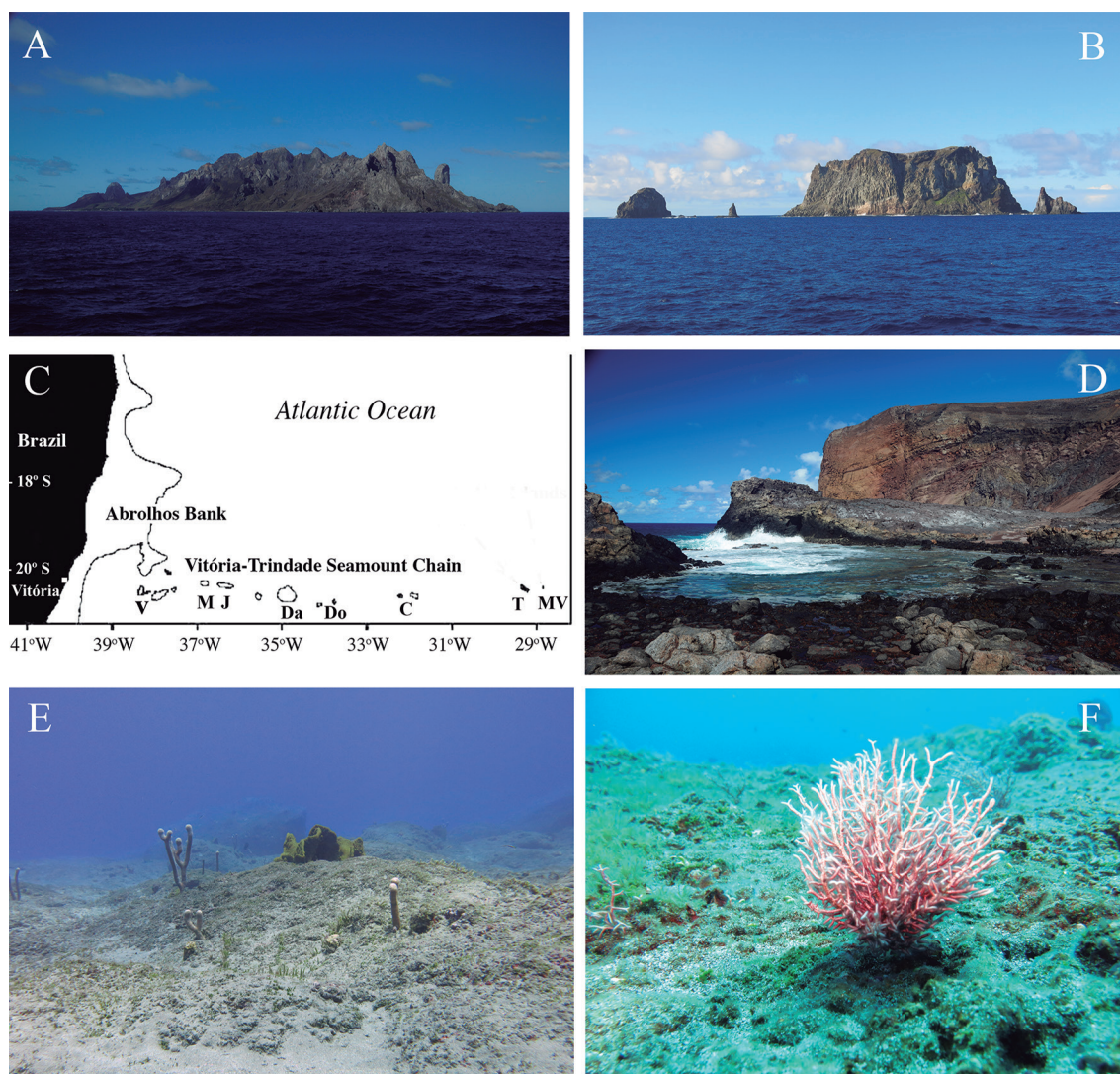


FIGURE 1: Trindade and Martin Vaz Archipelago (TMV). **A-B**, Trindade and Martin Vaz viewed from distance, respectively. **C**, Position of TMV relative to each other, to the Vitória-Trindade Seamount Chain, and to the Brazilian continental shelf. **D-F**, Trindade Island: **D**, Tide pool at Parcel das Tartarugas. **E-F**, Mixed hard-soft bottom near Ilha Sul (about 20 m depth) and Lage da Praia do Príncipe (around 10 m depth), respectively. Note in E live colonies of *Plexaurella* sp. and in F the red seaweed *Galaxaura* sp. Vitória-Trindade Seamount Chain: V, Vitória. M, Montague. J, Jaseur. Da, Davis. Do, Dogaressa. C, Columbia. T, Trindade Island. MV, Martin Vaz Islands. Photographs by JBM.

collected by flipping and breaking up clumps of coral-line algae and coral rocks, from soft and mixed sediment substrates and from other marine invertebrates and algae, as well as from artificial reef substrates placed for 12-15 months in depths of 10 to 20 m. All specimens were preserved in 70% ethanol, some of which were photographed alive prior to preservation.

A list of all decapod species known to date from TMV with the indication of their first record sources for the archipelago and their geographic distribution is given in Table 1. The axiids, squat lobsters and the brachyuran, porcellain and hermit crabs in that list are currently under revision, so that their inclusion in the list does not necessarily imply endorsement by the authors. Whenever possible, specimens from TMV were compared with conspecific specimens from the continental shelf and/or from other oceanic islands of the southwestern Atlantic. The systematic arrangement of the Palaemonidae follows De Grave *et al.* (2015).

Measurements refer to carapace length (cl, in mm) of the largest male and/or female of each species present in TMV taken from the tip of the rostrum to the posterior margin of the carapace midline. All the specimens studied herein are deposited in the collections of the Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil (MZUSP). The spelling of the geographical names follows the National Geographic Atlas of the World, 8th edition, Washington DC. Abbreviations: RV, Research Vessel; Stn, sampling station; CP, beam trawl; DC, Charcot dredge.

RESULTS

Infraorder Stenopodidea Spence Bate, 1888

Family Stenopodidae Claus, 1872

Stenopus hispidus (Olivier, 1811)

(Figure 2A-B)

Material examined: Brazil: Trindade Island, Enseada dos Portugueses, SECON/ECIT, 20°30'20.9"S/29°18'13.7"W, depth: 9 m, J.B. Mendonça coll., 14.v.2014: 1 ovigerous female (MZUSP 35269). Trindade Island, Ponta da Calheta, 20°30'29.5"S/29°18'37.0"W, depth: 16.3 m, J.B. Mendonça coll., 09.vii.2015: 1 ovigerous female (MZUSP 35270). Trindade Island, Ponta da Calheta, 20°30'18.72"S/29°18'31.67"W, depth: 16 m, J.B. Mendonça coll., 11.xii.2015: 2 males (MZUSP 35265). Trindade Island, Praia da Calheta, 20°30'28.30"S/29°18'38"W, depth: 15 m, J.B. Mendonça coll., 09.ii.2012: 2 males (MZUSP 31209). Trindade Island, Ilha Sul, 20°31'34.32"S/29°19'27.96"W,

depth: 17.6 m, J.B. Mendonça coll., 06.xi.2014: 1 female (MZUSP 35268), 1 female (MZUSP 35264). Trindade Island, Parcel das Tartarugas, 20°31'01.3"S/29°17'56.9"W, depth: 13.9 m, J.B. Mendonça coll., 10.vii.2015: 1 male (MZUSP 35267). Trindade Island, Farrilhões, 20°31'29.8"S/29°19'52.0"W, depth: 22.6 m, J.B. Mendonça coll., 22.vii.2015: 1 ovigerous female (MZUSP 35266). Size of largest male: cl 14 mm (MZUSP 35267); largest female: cl 21 mm (MZUSP 35269).

Comparative material examined: Brazil: Fernando de Noronha, Baía de Sancho, R.L. Moura coll., 06.vii.1997: 2 males (MZUSP 32979). Espírito Santo, Vitória-Trindade Seamount Chain, Montague, TAAF MD55 1987, RV "Marion Dufresne", Stn 13, DC26, 20°21'S/36°59'W, depth: 97.5 m, 14.v.1987: 1 male (MZUSP 31678). *Ibidem*, Vitória-Trindade Seamount Chain, Jaseur, TAAF MD55 1987, RV "Marion Dufresne", Stn 17, CP31, 20°26'S/36°16'W, depth: 60 m, 15.v.1987: 1 male, 1 ovigerous female (MZUSP 31975). Cabo Frio, Rio de Janeiro, ship wreck, depth: 3-5 m, R. Gregati coll., xii.2004: 2 females (MZUSP 16202). Size of largest male: cl 11 mm (MZUSP 32979); largest female: cl 17 mm (MZUSP 16202).

Type locality: Not indicated in the original description.

Distribution: Disjunct circumtropical. Western Atlantic: Bermuda, North Carolina to southern Florida, Gulf of Mexico, throughout the Caribbean Sea Brazilian coast (from Ceará to São Paulo. Tropical southern Atlantic oceanic islands: Fernando de Noronha, Vitória-Trindade Seamount Chain (Jaseur) and Trindade – present study). Central Atlantic: Ascension and St Helena islands. Indo-West Pacific: South Africa, Red Sea, Japan, Tuamotu Archipelago, western Australia, eastern Australia, Vanuatu, New Hebrides, New Caledonia, Lord Howe Island, and northern New Zealand. Eastern Pacific: Panama, Galápagos (Williams, 1984; Goy, 1987; Manning & Chace, 1990; Coelho & Ramos-Porto, 1998; Nizinski, 2003; Coelho Filho, 2006; Gregati *et al.*, 2006; Almeida *et al.*, 2007; Alves *et al.*, 2008; Felder *et al.*, 2009; Brown, 2014; De Grave *et al.*, 2014; Goy, 2015; Soledade *et al.*, 2015).

Ecological notes: The banded coral shrimp, *Stenopus hispidus*, is a crevice-dwelling species inhabiting mostly rocky shores, reef formations and gravel bottoms from the intertidal down to deep subtidal waters (Holthuis, 1946; Chace, 1972). Kruczynski & Jen-

ner (1969) collected a male from 75 meters from a reef-like formation off the coast of North Carolina, however, the deepest record is from 210 m (Faxon, 1896). Adults are usually found in reproductive pairs (Chockley & St. Mary, 2003). Gregati *et al.* (2006) reported one mating pair of *S. hispidus* beneath a zoanthid colony inside a cave and a second pair among seaweeds. However, in Trindade *S. hispidus* was always found in rocky bottoms in sciaphilic biotopes during daytime, such as crevices and small caves. The shrimps were often alone or occasionally in pairs. Ready-to-spawn females have blue-green ovaries (Fig. 2B), but the developing eggs are rather transparent. Females can carry about 2500 (Chockley & St. Mary, 2003). The larval duration is of at least 123 days, but the metamorphosis can be delayed up to as many as 210 days (Gurney & Lebour, 1941; Williamson, 1976).

Remarks: *Stenopus hispidus* is widely distributed and common along the western Atlantic shores. In the southern Atlantic the species also managed to establish self-sustaining populations in the remote oceanic islands of Fernando de Noronha, Ascension and St Helena (360 km, 2263 km and 1880 km from the nearest land mass, respectively), with several males and ovigerous females herein reported for the first time from Trindade (some 1200 km from the closest shore). The possible role played by the Vitória-Trindade Seamount Chain (VTSC) as stepping stones to TMV is reflected in the presence of *S. hispidus* in at least two seamounts forming the VTSC (Montangue and Jaseur, present study). The long larval duration in the plankton and the ability to postpone metamorphosis up to 210 days increase the probability of this species to disperse across long distances and establish local populations around remote oceanic islands.

Infraorder Caridea Dana, 1852
Family Hippolytidae Bate, 1888
***Thor amboinensis* (De Man, 1888)**
(Figure 4A-B)

Material examined: Brazil: Trindade Island, Farol, Enseada dos Portugueses, 20°29'52.3"S/29°19'15.6"W, depth: 13.2 m, J.B. Mendonça coll., 08.v.2014: 1 ovigerous female (MZUSP 33416). Trindade Island, Praia do Andrada, 20°30'71.8"S/29°18'24.7"W, depth: 9.9 m, J.B. Mendonça coll., 17.vii.2013: 1 ovigerous female (MZUSP 31194). Trindade Island, Praia do Andrada, SECON/ECIT, 20°30'20.9"S/29°18'43.7"W, depth: 9 m, J.B. Mendonça coll., 12.v.2014: 1 ovigerous female (MZUSP 35276). Trindade, Ponta

da Calheta, 20°30'18.7"S/29°18'31.6"W, depth: 16.6 m, J.B. Mendonça coll., 08.v.2014: 1 male (MZUSP 33417). Trindade, Ponta da Calheta, 20°30'18.72"S/29°18'31.67"W, depth: 15.2 m, J.B. Mendonça coll., 14.v.2014: 1 ovigerous female (MZUSP 35275). Trindade, Praia da Calheta, 20°30'29.5"S/29°18'37.0"W, depth: 15 m, J.B. Mendonça coll., 22.vi.2015: 1 ovigerous female (MZUSP 33431). Trindade, Ponta da Calheta, 20°30'18.7"S/29°18'31.6"W, depth: 16.6 m, J.B. Mendonça coll., 08.v.2014: 1 male (MZUSP 33415). Size of largest male: cl 2.5 mm (MZUSP 33415); largest female: cl 4 mm (MZUSP 35276).

Comparative material examined: Cuba: Isla de la Juventud, Playa Roja, M.L. Johnson coll., v.2014: 1 ovigerous female (MZUSP 34025). Brazil: Maranhão, State Marine Park [of Parcel Manuel Luís, 00°56'22.4"S/44°15'45.3"W], depth: 16 m, Gasparini and Floeter coll., 14.vi.1998: 1 male, 1 ovigerous female (MZUSP 12918). Size of largest male: cl 2.9 mm (MZUSP 12918); largest female: cl 4.5 mm (MZUSP 12918).

Type locality: Ambon, Indonesia.

Distribution: Circumtropical. Western Atlantic: Bahamas, southern Florida, Caribbean Sea (e.g., Antigua, Dominica, Cozumel, Yucatan, Tobago), Brazil (Maranhão – Parcel Manuel Luís, Fernando de Noronha Chain, Trindade Island – present study). Eastern Atlantic: Madeira, Canary Islands, Cape Verde Islands. Indo-West Pacific: (e.g., Kenya, Madagascar, Bay of Bengal, Andaman and Nicobar Islands, Japan, Taiwan, Philippines, Indonesia, Palau Islands, Caroline Islands, Marshall Islands, Australia). Eastern Pacific: Costa Rica (Cocos Islands), Panama (Pearl Islands), Ecuador (Galápagos), Chile (Easter Island) (Patton, 1966; Chace, 1972, 1997; Herrnkind *et al.*, 1976; Fransen 1987, 1989; Bruce, 1989; Wicksten & Hendrickx, 1992; Wirtz, 1994, 1997, 2004; Guo *et al.*, 1996; Wicksten & Hernández, 2000; Coelho Filho, 2006; Hoeksema *et al.*, 2012).

Ecological notes: This small-sized but conspicuously colored shrimp is considered to be a host-generalist symbiotic as it is often found, either alone or in groups of up to 18 individuals, in association with a wide variety of cnidarians including Scleractinia (e.g., *Acropora*, *Heliopungia*, *Millepora*, *Pocillopora*, *Seriatopora*, *Stylophora*), Actinaria (e.g., *Actinodendron*, *Anemonia*, *Antheopsis*, *R. Bunodosoma*, *Entacmaea*, *Condylactis*, *Cryptodendrum*, *Discosoma*, *Heteractis*,

Lebrunia, *Macrodactyla*, *Phymanthus*, *Stoichactis*, *Stichodactyla*, *Telmatactis*), cerianthids, alcyonarians and hydroids (Abele, 1976; Bruce, 1976; Herrnkind

et al., 1976; Criales, 1984; Fransen, 1987, 1989; Guo *et al.*, 1996; Wirtz, 1994, 1997, 2004). In addition, Criales (1984) reported a rather unusual association

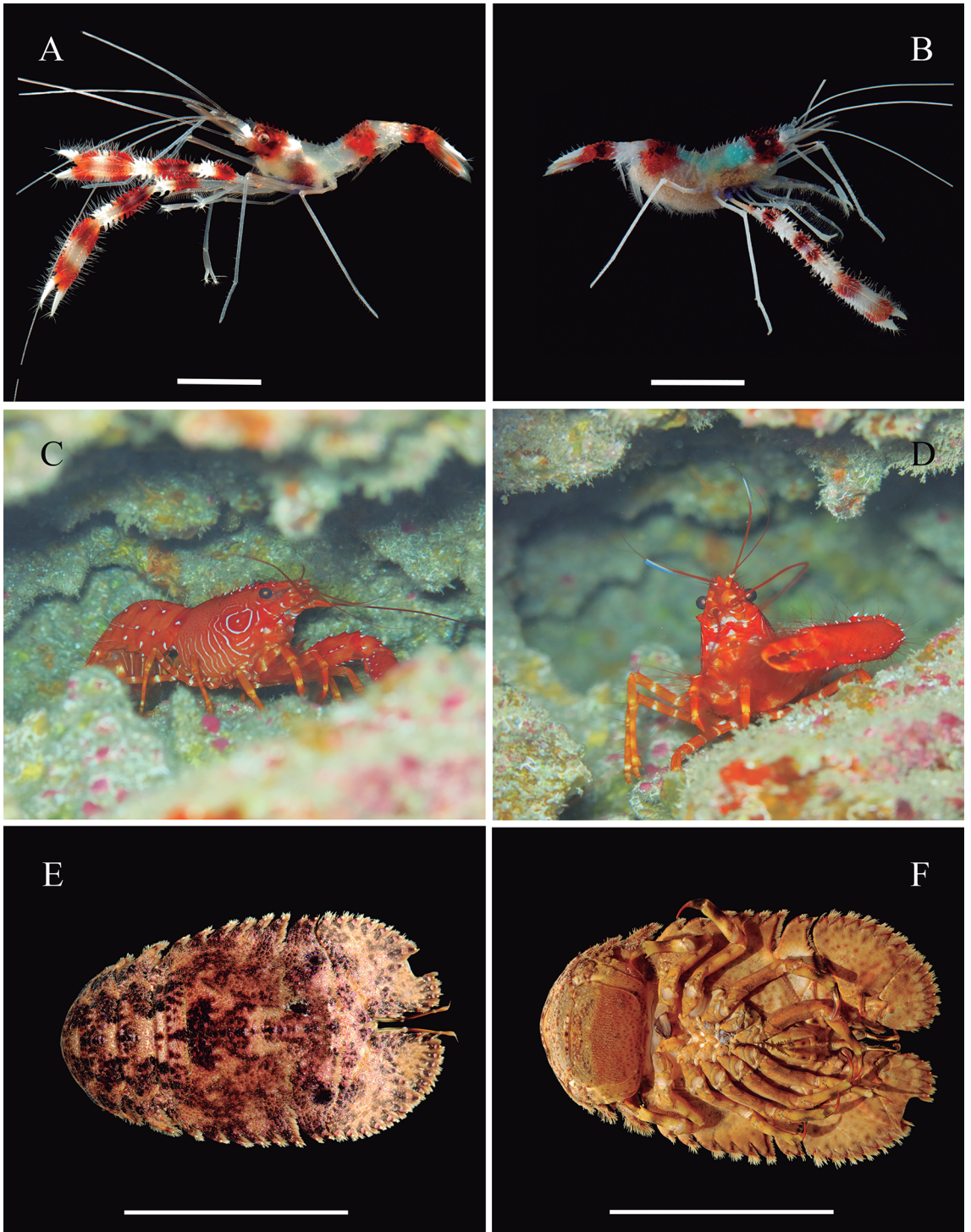


FIGURE 2: A-B, *Stenopus hispidus* (Olivier, 1811). A, Female, cl 12.4 mm, lateral view (MZUSP 35268). B, Ovigerous female, cl 21 mm, lateral view (MZUSP 35269). C-D, *Enoplometopus antillensis* Lütken, 1865, photographed *in situ* in Trindade, but escaped before it could be collected. E-F, *Parribacus antarcticus* (Lund, 1793), male, cl 91 mm, dorsal and ventral views, respectively (MZUSP 35271). Scales: A, 12 mm. B, 21 mm. E-F, 90 mm. Photographs by JBM.

between *T. amboinensis* and the crinoid *Comactinia echinoptera*. Occasionally, *Thor amboinensis* may be found free-living in dead corals, small cracks in rocks, and in biogenic gravels (Chace, 1997; Wirtz, 1997; Coelho Filho, 2006).

Thor amboinensis is attracted to its host anemone mainly by chemical signals, although other sensory modalities might also play a role (Guo *et al.*, 1996). The species was observed sharing the same host (*Condylactis* and *Entacmaea*) with other shrimps (*Periclimenes* spp.) and the spider crab *Mithrax* sp. (Nizinski, 1989; Guo *et al.*, 1996; Khan *et al.*, 2004). During daytime *T. amboinensis* was found associated with the tentacles of the sea anemone *Styrodactyla* and was observed to consume host tentacles and mucus, whereas during nighttime, when the anemone contracted its tentacles, the shrimp moved either to the column or away from the anemone (Khan *et al.*, 2004). Adults of *T. amboinensis* certainly have mechanisms to counter the sting nematocysts of its cnidarian host (see Nizinski, 1989), however, in laboratory conditions the sea anemone *Anthopsis papillosa* was observed consuming larvae of *T. amboinensis* (Sarver, 1979). According to Wicksten & Hernández's (2000) hypothesis, yet to be tested, in the Indo-West Pacific *T. amboinensis* is often associated with hermatypic corals, whereas in the Atlantic and Caribbean Sea anemones are often the hosts. In Trindade *T. amboinensis* was found either associated with anemones (Fig. 4D) or free-living under stones or in crevices, either alone or in small groups of up to four individuals. In Trindade *T. amboinensis* was sometimes found in crevices together with *Gnathophyllum americanum*, and at one occasion with the snapping shrimp *Alpheus rudolphi*.

Remarks: In the southwestern Atlantic *T. amboinensis* was hitherto known only from the oceanic island of Fernando de Noronha (03°51'13.71"S/32°25'25.63"W) and is now recorded for the first time from the oceanic island of Trindade and also from Maranhão (State Marine Park of Parcel Manuel Luís).

***Thor manningi* Chace, 1972
(Figure 4C)**

Material examined: Brazil: Trindade Island, Ponta Norte, 20°29'18.7"S/29°20'18.3"W, depth: 11.3 m, J.B. Mendonça coll., 23.vi.2016: 1 ovigerous female (MZUSP 35277). Trindade Island, Enseada dos Portugueses (Farol), 20°29'52.3"S/29°19'15.6"W, depth: 14.6 m, J.B. Mendonça coll., 10.vii.2012: 7 males, 1 ovigerous female (MZUSP 31151). Trindade Is-

land, Enseada Orelhas, 20°29'40.2"S/29°20'32.9"W, depth: 14 m, J.B. Mendonça coll., 06.vii.2013: 1 male (MZUSP 31202). Trindade Island, Praia da Calheta, 20°30'20.9"S/29°18'43.7"W, depth: 11.6 m, J.B. Mendonça coll., 18.vii.2012: 2 ovigerous females (MZUSP 31192). Trindade Island, Ilha da Racha, 20°30'26.5"S/29°20'48.0"W, depth: 27.1 m, J.B. Mendonça coll., 22.vi.2012: 1 male (MZUSP 31152). Trindade Island, Enseada da Cachoeira (Farrilhões), 20°31'22.4"S/29°19'52.0"W, depth: 17.9 m, J.B. Mendonça coll., 04.vii.2010: 1 male (MZUSP 31161). Trindade Island, Farrilhões (Enseada da Cachoeira), 20°31'22.4"S/29°19'52.0"W, depth: 9.5 m, J.B. Mendonça coll., 08.vii.2013: 2 males (MZUSP 31186). Size of largest male: cl 1.9 mm (MZUSP 33434); largest female: cl 1.4 mm (MZUSP 35277).

Comparative material examined: Panama: Bocas del Toro, A. Anker *et al.*, coll., viii.2008: 1 ovigerous female, cl. 3 mm (MZUSP 33084). Brazil: Banco de Abrolhos, REVIZEE, Comissão Central, Stn VV33, 18°53'26"S/39°13'87"W, depth: 37 m, M. Tavares coll., 28.ii.1996: 1 ovigerous female, cl 2 mm (MZUSP 32048).

Type locality: English Harbour, Antigua.

Distribution: Western Atlantic: Bermuda, North Carolina to Brazil (Seamounts of the North Brazilian Chain, Fernando de Noronha, Ceará to São Paulo, Trindade Island – present study). Central Atlantic: Ascension Island (Chace, 1972; Manning & Chace, 1990; Williams, 1984; Christoffersen, 1998; Coelho Filho, 2006; Almeida *et al.*, 2012; De Grave *et al.*, 2014). The record of *T. manningi* from the eastern Pacific Ocean (Islas Tres Marias, Mexico) actually refers to *T. algicola* Wicksten, 1987 (Chace, 1972; Wicksten, 1987).

Ecological notes: Free-living in seagrass flats, dead corals, clumps of coralline algae, in submerged wood or in association with macroalgae, hydroids, corals (*Millepora*) and occasionally with sea anemones (*Bartholomea*). Lindberg & Stanton (1988) observed *T. manningi* cleaning the brachyuran crab *Pilumnus sayi*; the two species were also associated in the field. From the tide line down to 44 m (Chace, 1972; Williams, 1984; Almeida *et al.*, 2012).

Remarks: *Thor manningi* is a common western Atlantic species also known from the central Atlantic (Ascension Island) and is herein recorded for the first time from Trindade.

Family Palaemonidae Rafinesque, 1815
***Gnathophylloides mineri* Schmitt, 1933**

Material examined: Brazil: Trindade Island, Farol (Enseada dos Portugueses), 20°29'52.3"S/29°19'15.6"W, depth: 12 m, J.B. Mendonça coll., 15.vii.2013: 1 juvenile (MZUSP 31154). *Ibidem*, depth: 13.2 m, J.B. Mendonça coll., 08.v.2014: 1 juvenile (MZUSP 33398), 1 male (MZUSP 35278). *Ibidem*, depth: 15.4 m, J.B. Mendonça coll., 08.vii.2015: 1 male (MZUSP 33435). Trindade Island, Ponta da Calheta, 20°30'37.6"S/29°18'28.1"W, depth: 2-4 m, J.B. Mendonça coll., 13.vi.2012: 1 ovigerous female (MZUSP 31157). Trindade Island, Ponta da Calheta, 20°30'18.72"S/29°18'31.6"W, depth: 17.7 m, J.B. Mendonça coll., 03.viii.2015: 1 male (MZUSP 33437). Size of largest male: cl 2.1 mm (MZUSP 35278); largest female: cl 2.2 mm (MZUSP 31157).

Comparative material examined: Trinidad and Tobago: Tobago, Man O War Bay, House Reef, from *Lytechinus variegatus*, 11°19.221'N/60°33.100'W, depth: 5 m, S. De Grave coll., 18.ix.2003: 2 ovigerous females, largest cl 3 mm (MZUSP 31031). Brazil: Guarapari, Ilha Escalvada, from *Tripneustes ventricosus*, depth: 10 m, P. Wirtz coll., vi.2006: 2 males?, largest cl 1.8 mm, 7 ovigerous females, largest 2.2 mm (MZUSP 17007).

Type locality: Ballena Point, Ensenada, Puerto Rico.

Distribution: Disjunct circumtropical. Western Atlantic: southeastern Florida, Mexico, Caribbean coast of Colombia, Puerto Rico, Tobago and Brazil (Bahia, Espírito Santo and the oceanic island of Trindade – present study). Indo-West Pacific: Zanzibar, Seychelles, Australia (North Solitary Island, New South Wales), Hawaii. Eastern Pacific: Malpelo off Colombia (Castro, 1971; Bruce, 1974, 1988; Abele, 1975; Alves *et al.*, 1995; Ramos-Porto & Coelho, 1998; Álvarez *et al.*, 1999; Felder *et al.*, 2009; Wirtz *et al.*, 2009; Campos *et al.*, 2010).

Ecological notes: *Gnathophylloides mineri* is a small species, free-living (under stones, coral rocks, awash waterlogged teredo-ridden stumps, see Chace, 1972) or, most commonly, in association with sea urchins (e.g., *Heliocidaris*, *Heterocentrotus*, *Lytechinus*, *Pseudoboletia*, *Tripneustes*) on which it is found generally in groups amongst the spines usually near the oral surface. The shrimp has a number of behavioral, morphological and color adaptations, which renders it difficult to be detected on the urchin: arrange itself longitudinally along the urchin spine, head towards the apices of the

spine; claw of second pereopod held parallel to the urchin spine and similar in diameter to the spine; short antennules and antennae held back over the body so that they do not overreach the urchin spine; pereopods dactyli short, furnished with a grasping projection ventrally that seems of help to hold the urchin spine; cryptic coloration to be well camouflaged against the test and spines of the urchin (particularly when associated with *Tripneustes*). *Gnathophylloides mineri* feeds on the epithelium covering the sea urchin spines, although filter feeding has also been reported (Patton *et al.*, 1985). The shrimps can detect its host, e.g., *Tripneustes gratilla*, from a distance using visual and chemical cues (Lewis, 1956; Castro, 1971; Criales, 1984; Patton *et al.*, 1985; Okuno & Tanaka, 2001; Maciá & Robinson, 2009; Williamson *et al.*, 2012).

Remarks: *Gnathophylloides mineri* is disjunct circumtropical in distribution, being absent from the central and eastern Atlantic oceans. The species has been previously reported from the Brazilian shore (Bahia: Ondina and Abrolhos, Espírito Santo) in association with the sea urchin *Tripneustes ventricosus* (Alves *et al.*, 1995; Wirtz *et al.*, 2009), which was found to be the host of the Trindade specimens.

***Gnathophyllum americanum* Guérin-Méneville, 1855**
(Figure 3A-B)

Material examined: Brazil: Trindade Island, Enseada Orelhas, 20°29'40.2"S/29°20'32.9"W, depth: 14 m, J.B. Mendonça coll., 06.vii.2013: 1 male (MZUSP 31190). *Ibidem*, depth: 15.4 m, J.B. Mendonça coll., 24.x.2014: 2 males (MZUSP 33425). Trindade Island, Enseada Orelhas, 20°29'40.2"S/29°20'32.9"W, depth: 12 m, J.B. Mendonça coll., 01.x.2014: 1 male (MZUSP 33426). *Ibidem*, depth: 12.1 m, J.B. Mendonça coll., 18.iv.2014: 1 male (MZUSP 33428). Trindade Island, Farol (Enseada dos Portugueses), 20°29'52.3"S/29°19'15.6"W, depth: 12 m, J.B. Mendonça coll., 15.vii.2013: 1 male (MZUSP 31184). Trindade Island, Praia do Andrada, 20°30'71.8"S/29°18'24.7"W, depth: 9.9 m, J.B. Mendonça coll., 17.vii.2013: 1 ovigerous female (MZUSP 31187). Trindade Island, Ilha da Racha, 20°30'26.5"S/29°20'48.0"W, depth: 30.3 m, J.B. Mendonça coll., 12.vii.2012: 1 male (MZUSP 31178). Trindade Island, Ponta da Calheta, 20°30'18.72"S/29°18'31.67"W, depth: 15.6 m, J.B. Mendonça coll., 30.iv.2014: 5 males (MZUSP 33422), 1 male (MZUSP 33419). *Ibidem*, depth: 16.3 m, J.B. Mendonça coll., 20.v.2014: 1 male, 1 ovigerous

female (MZUSP 33421). *Ibidem*, depth: 16.6 m, J.B. Mendonça coll., 08.v.2014: 1 ovigerous female (MZUSP 33418). *Ibidem*, depth: 16 m, J.B. Mendonça coll., 11.xi.2014: 2 males (MZUSP 33427), 2 ovigerous females (MZUSP 33423). *Ibidem*, depth: 16.6 m, J.B. Mendonça coll., 08.v.2014: 1 male, 1 ovigerous female (MZUSP 33420). *Ibidem*, depth: 17 m, J.B. Mendonça coll., 20.x.2014: 1 male (MZUSP 33429). Trindade Island, Praia do Lixo, 20°31'29.8"S/29°19'43.9"W, depth: 13.7 m, J.B. Mendonça coll., 25.10.2014: 2 males (MZUSP 33424). Trindade Island, Enseada da Cachoeira (Farrilhões), 20°31'22.4"S/29°19'52.0"W, depth: 11.9 m, J.B. Mendonça coll., 16.vi.2012: 1 juvenile (MZUSP 31158). Trindade Island, Enseada da Cachoeira (Farrilhões), 20°31'29.8"S/29°19'52.0"W, depth: 17 m, J.B. Mendonça coll., 23.vii.2015: 1 male (MZUSP 33436). Martin Vaz Island, 20°30'45.7"S/29°18'21.9"W, depth: 13 m, J.B. Mendonça coll., 23.vii.2013: 1 ovigerous female (MZUSP 31169). Size of largest male: cl 3.5 mm (MZUSP 33419); largest female: cl 5 mm (MZUSP 33418).

Comparative material examined: Chile: Isla de Pascua (Easter Island), 15.iii.2016, leg. G. Guzmán: 2 males, 2 ovigerous females (MZUSP 34760). Size of largest male: cl 4 mm; largest female: cl 7 mm.

Type locality: Cuba.

Distribution: Circumtropical. Western Atlantic: Bermuda, Gulf of Mexico, West Indies, Brazil (Rio Grande do Norte, Trindade Island – present study) (Manning, 1963; Chace, 1972; Santos, 1994; Ramos-Porto & Coelho, 1998; Álvarez *et al.*, 1999; Felder *et al.*, 2009). Central Atlantic: Ascension and St. Helena Island (Brown, 2014; De Grave *et al.*, 2014). Eastern Atlantic: Canary Islands, Madeira, São Tomé (Holthuis, 1949; Araújo, 2002; Wirtz, 2003, 2004). Indo-West Pacific: from east Africa and India to Japan, South China Sea, Papua New Guinea, Australia, Tuamotu and French Polynesia. East Pacific: Eastern Island (Fransen, 1987 and this report) (Holthuis, 1949; Fransen, 1987, 1994; Bruce, 1989; Li, 1997; De Grave, 2000; Ahyong, 2003; Prakash *et al.*, 2015)

Ecological notes: *Gnathophyllum americanum* is either free-living (reefs, under stones, coral rubble, seagrass flats, seaweed-covered rocks) or loosely associated with corals (e.g., *Montipora*, *Porites*) and echinoids (e.g., *Diadema*, *Echinometra*, *Lytechinus*) in intertidal rocky pools or subtidally down to 50 meters (Holthuis, 1949; Manning, 1963; Chace, 1972; Bruce, 1989;

Fransen, 1994; Álvarez *et al.*, 1999; De Grave, 2000; Wirtz, 2003; De Grave *et al.*, 2014; Prakash *et al.*, 2015).

Remarks: In Brazil, *G. americanum* has been recorded from Rio Grande do Norte (Extremoz, north of Natal) by Santos (1994) and most probably also occurs in Bahia (Praia de Itapoá) based on a record of "*Gnathophyllum* sp." by Coelho, & Ramos (1972:145). *Gnathophyllum americanum* is recorded herein from TMV, between 9.9 and 30.3 m. In Trindade *G. americanum* was found associated with sea anemones (*Telmatactis* sp.), in the vicinity of *Diadema antillarum* (Fig. 4D) or free-living in crevices and under stones, either as single individuals or in small groups of up to four individuals, sometimes found sharing the same crevice with *T. amboinensis*.

Gnathophyllum circellum Manning, 1963 (Figure 3C-D)

Material examined: Brazil: Trindade Island, Enseada Orelhas (Canto Esquerdo), 20°29'40.2"S/29°20'32.9"W, depth: 10.8 m, J.B. Mendonça coll., 21.v.2014: 1 male (MZUSP 33411). Trindade Island, Ponta da Calheta, 20°30'18.7"S/29°18'31.6"W, depth: 15.6 m, J.B. Mendonça coll., 30.iv.2014: 1 male (MZUSP 33412). *Ibidem*, depth: 16.3 m, J.B. Mendonça coll., 09.vii.2015: 1 male (MZUSP 33433). Trindade Island, Praia da Calheta, 20°30'29.5"S/29°18'37.0"W, depth: 15 m, J.B. Mendonça coll., 22.vi.2015: 1 male (MZUSP 33430). Trindade Island, Ilha Sul (Enseada da Praia do Príncipe), 20°31'34.3"S/29°19'27.8"W, depth: 17.8 m, J.B. Mendonça coll., 21.x.2014: 1 male (MZUSP 33413). Size of largest male: cl 6.5 mm (MZUSP 33430).

Type locality: Southwest of Alligator Reef Light, Monroe County, Florida, USA.

Distribution: Western Atlantic: Bahamas (Great Exuma), Florida, Bonaire (Manning, 1963; Chace, 1972; Abele & Kim, 1986; Camp *et al.*, 1998; RCS, 2009) and Brazil (Trindade Island, present study).

Ecological notes: *Gnathophyllum circellum* has been found in rock ledges, reefs and coral heads (Manning, 1963). In Trindade single individuals were found under stones, between 10 and 18 m.

Remarks: The material from Trindade represents the first record of *G. circellum* from the south Atlantic Ocean and the southern-most record of the species.

It seems likely that *G. circellum* will also be recorded from the continental Brazilian shores when surveys of appropriate biotopes are carried out.

***Pontonia manningi* Fransen, 2000
(Figure 3E)**

Material examined: Brazil: Trindade Island, Ilha da Racha, 20°30'26.5"S/29°20'48.0"W, depth: 21.4 m, J.B. Mendonça coll., 01.vii.2016: 1 male, cl 5.7 mm associated with *Pina* sp. (MZUSP 35286). Trindade Island, Enseada do Príncipe, Pedra da Garoupa, 20°31'35.5"S/29°18'94.0"W, depth: 10.4 m, J.B. Mendonça coll., 16.vii.2013: 1 male, cl 6 mm, 1 ovigerous female, cl 6 mm, associated with the bivalve *Spondylus americanus* (MZUSP 31210).

Comparative material examined: Brazil: Maranhão, RV "Almirante Saldanha", Stn 1751, 00°37'S/44°40'W, calcareous algae-sandy bottom, depth: 44 m, 06.xi.1967: 1 male, cl 5.7 mm (MZUSP 8945).

Type locality: 25 miles North of Isla Margarita, Venezuela.

Distribution: Amphi-Atlantic. Western Atlantic: North Carolina to Caribbean Sea, Gulf of Mexico, Venezuela (Margarita Island) and Brazil (Maranhão, Banco Vitória, Espírito Santo and Trindade Island, present study). Eastern Atlantic: Canary Islands and Cape Verde Islands (Fransen, 2000, 2002; Wirtz & d'Udekem d'Acoz, 2001; Cardoso, 2006; Vieira *et al.*, 2012).

Ecological notes: *Pontonia manningi* lives in association with the bivalves *Aequipecten gibbus*, *Chlamys mildredae*, *Spondylus americanus*, *S. gaederopus*, *S. senegalensis*, *Pecten gibbosus* and *Pteria colymbus*, sometimes in pairs, between 3 and 80 m (Fransen, 2000, 2002; Fransen & Reijnen, 2013; Wirtz & d'Udekem d'Acoz, 2001). In Florida male-female pairs of *P. manningi* were found inside *Pteria colymbus*, some of which brooding embryos. No hosts were colonized by two male or two female. Evidence exists that *P. manningi* is primarily socially monogamous (Baeza *et al.*, 2016). In Trindade Island a male and an ovigerous female were encountered living inside *Spondylus americanus* (fig. 3F); the male was distinctly smaller than the female.

Remarks: The present material is the first record of *P. manningi* from Trindade, all other Brazilian records being on the continental coast and rather scarce. In

the eastern Atlantic *P. manningi* is presently known only from oceanic archipelagos.

***Tuleariocaris neglecta* Chace, 1969
(Figure 4E-F)**

Material examined: Brazil: Trindade Island, Praia dos Cabritos, 20°29'41.3"S/29°19'39.9"W, depth: 8 m, associated with *Diadema antillarum*, J.B. Mendonça coll., 24.vi.2014: 1 ovigerous female, cl 3.5 mm (MZUSP 35282). Trindade Island, Ponta dos Cabritos, 20°29'41.38"S/29°19'39.90"W, depth: 8 m, J.B. Mendonça coll., 24.vi.2016: 1 ovigerous female (MZUSP 35280), 1 ovigerous female (MZUSP 35281), 1 ovigerous female (MZUSP 35282). Trindade Island, Enseada Orelhas, 20°29'40.2"S/29°20'32.9"W, depth: 15.4 m, J.B. Mendonça coll., 24.x.2014: 1 male (MZUSP 35279). Trindade Island, Enseada Orelhas, 20°29'14.84"S/29°20'13.05"W, depth: 15 m, J.B. Mendonça coll., 21.v.2014: 1 ovigerous female (MZUSP 35283). Trindade Island, Ponta do Monumento, 20°30'18.72"S/29°18'31.67"W, depth: 15.9 m, associated with *Diadema antillarum*, J.B. Mendonça coll., 29.iv.2014: 1 ovigerous female (MZUSP 35284). Trindade Island, Ponta do Monumento, 20°30'10.3"S/29°20'36.1"W, depth: 8.4 m, associated with *Diadema antillarum*, J.B. Mendonça coll., 02.iv.2014: 1 male (MZUSP 33414). Trindade Island, Praia da Calheta, 20°30'29.5"S/29°18'37.0"W, depth: 15 m, J.B. Mendonça coll., 22.vi.2015: 1 male (MZUSP 33432). Trindade Island, Praia das Tartarugas, 20°31'01.3"S/29°17'56.9"W, depth: 12 m, J.B. Mendonça coll., 03.vii.2013: 1 ovigerous female (MZUSP 31153). *Ibidem:* Depth: 10.8 m, J.B. Mendonça coll., 17.vii.2013: 2 ovigerous females (MZUSP 31201). Trindade Island, Farrilhões (Enseada da Cachoeira), 20°31'22.4"S/29°19'52.0"W, depth: 9.5 m, associated with *Diadema antillarum*, J.B. Mendonça coll., 08.vii.2013: 1 ovigerous female (MZUSP 31189). Size of largest male: cl 3 mm (MZUSP 33432); largest female: cl 4.5 mm (MZUSP 31189).

Comparative material examined: Brazil: Salvador, Porto da Barra, Banco da Panela, 12.xii.2011: 1 male, cl 4.5 mm, 2 ovigerous females, largest cl 7.5 mm (MZUSP 35263).

Type locality: Barbados.

Distribution: Western Atlantic: Florida, Caribbean Sea (Honduras, Panama, Colombia, Puerto Rico, Dominica, Barbados, Curaçao) and Brazil (Salvador,

Bahia and Trindade Island, present study) (Chace, 1969; Castro, 1974; Criales, 1984; Bergreen, 1994; Marin & Anker, 2009; Giribet & Lemer, 2014; Hayes

et al., 2016). Eastern Atlantic: Madeira, Canary Islands, São Tomé and Príncipe, Cape Verde Islands (Chace, 1972; Wirtz *et al.*, 1988, Wirtz, 2004).

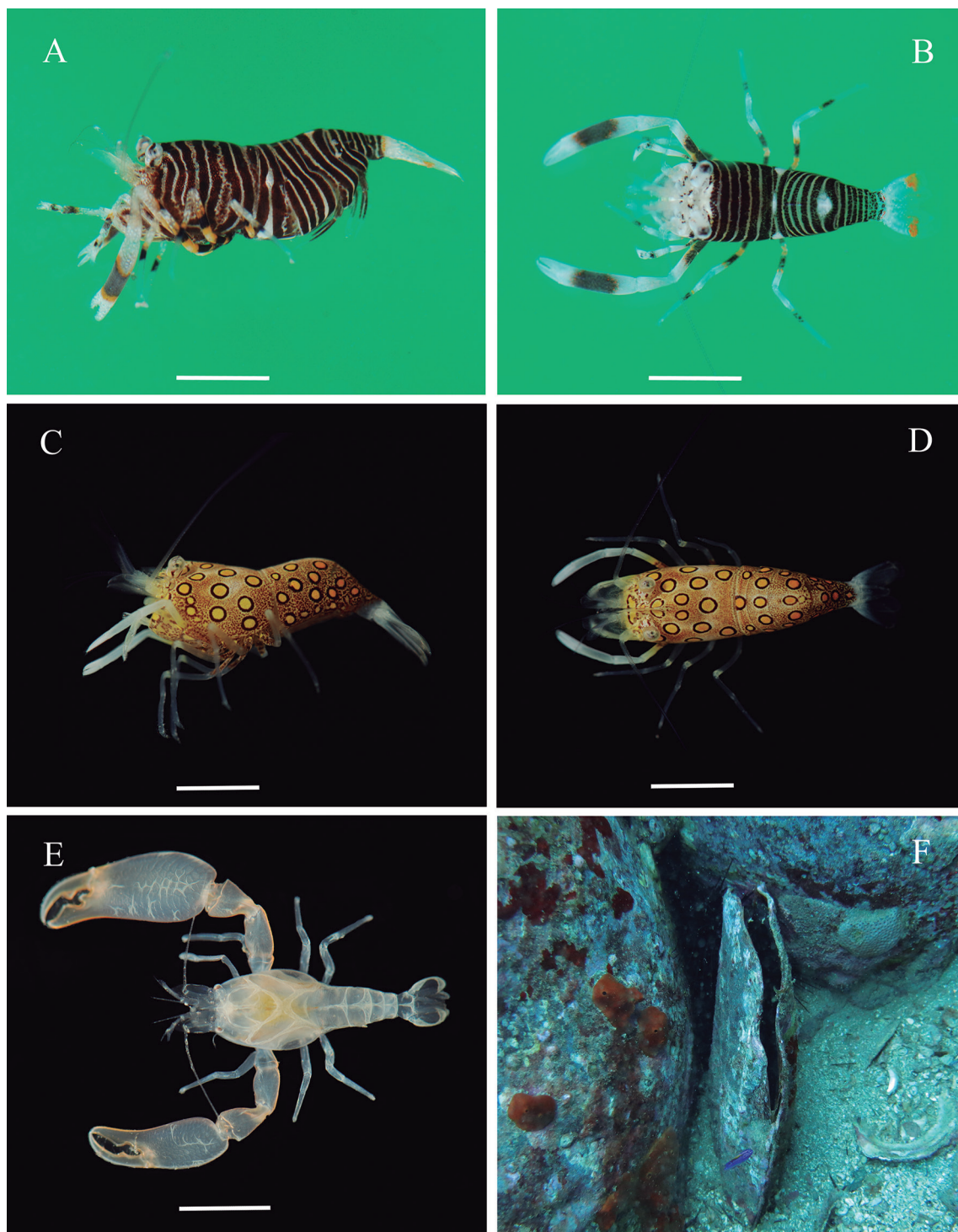


FIGURE 3: A-B, *Gnathophyllum americanum* Guérin-Méneville, 1855. A, Ovigerous female, cl 4.5 mm, lateral view (MZUSP 33418). B, Male, cl 3.5 mm, dorsal view (MZUSP 33419). C-D, *Gnathophyllum circellum* Manning, 1963, male, cl 4.2 mm, lateral and dorsal views, respectively (MZUSP 33411). E, *Pontonia manningi* Fransen, 2000, male, cl 5.7 mm (MZUSP 35286). F, Trindade Island, Farol, Enseada dos Portugueses, 10 m. *Pina* sp., bivalve usually hosting *P. manningi*. Scales: A-B, 4.5 mm. C-D, 4 mm. E, 5.5 mm. Photographs by JBM.

Ecological notes: *Tuleariocaris neglecta* is an echinoid-associated species living in the spines of *Diadema antillarum*, fig. 4D (Chace, 1969; Wirtz *et al.*, 1988; Wirtz, 2004; Wirtz & d'Udekem d'Acoz, 2008), and occasionally in the sea urchin *Astropyga magnifica* (Castro, 1974). The shrimp typically positions itself aligned to the axis of the spine, with the head pointing towards the base of the spine, fig. 4F (contrary to *Gnathophyllodes mineri*, which holds itself along the spine, head outwards) (Chace, 1969; Castro, 1974). *Tuleariocaris neglecta* swims from one host to the other, always with the head directed downward. In controlled experiments, *T. neglecta*, when given a choice, consistently prefers to associate with *Diadema antillarum* instead of *Echinometra*, *Lythechinus* and *Tripneustes* (Castro, 1974; Hayes *et al.*, 2016). In Trindade, *T. neglecta* was always found in association with *Diadema antillarum* (Fig. 4D), with larger sea urchins often colonized by more than one shrimp. The shrimps were observed to move up and down along the spines and from one spine to the next.

Remarks: *Tuleariocaris neglecta* is an amphi-Atlantic species and the only representative of this echinoid-associated genus in the Atlantic Ocean. This is the first record of this species from the southwestern Atlantic (Salvador, Bahia and oceanic island of Trindade, off the southeastern Brazilian coast). In the eastern Atlantic, *T. neglecta* is presently known only from remote oceanic islands (Madeira, Canary Islands, São Tomé, Príncipe and Cape Verde Islands). In contrast, in the western Atlantic it also occurs as a coastal species in the Gulf of Mexico, Caribbean Sea and Brazil.

Infraorder Astacidea Latreille, 1802
Family Enoplometopidae Claus, 1872
Enoplometopus antillensis Lütken, 1865
 (Figure 2C-D)

Type locality: West Indies.

Distribution: Amphi-Atlantic. Western Atlantic: Bermudas, Florida, Bahamas, Caribbean Sea (Panama, Colombia, Guadeloupe, Bonaire, Venezuela, Brazil (Ceará, Atol das Rocas, Fernando de Noronha, Rio Grande do Norte, Pernambuco, Rio de Janeiro, Trindade Island – present study) (Fausto Filho, 1970a, 1970b; Manning & Camp, 1989; Manning & Chace, 1990; Scelzo & Rodriguez, 1991; Poupin, 2003; Ceballos *et al.*, 2005; Coelho Filho, 2006; Gregati *et al.*, 2006; Chan & Ng, 2008). Central Atlantic: Ascension Island, St. Helena (Gordon, 1968; Holthuis,

1983; Manning & Chace, 1990; Poupin, 2003; Alves *et al.*, 2008; Chan & Ng, 2008; Brown, 2014). Eastern Atlantic: Madeira, Canary Islands, Cape Verde Islands, Gulf of Guinea (Wirtz, *et al.*, 1988; Wirtz & Herrera, 1995; Manning & Chace, 1990; Poupin, 2003; Chan & Ng, 2008)

Ecological notes: Very little is known about the ecology of *Enoplometopus antillensis*. It inhabits hard bottoms in sciaphilic biotopes in depths between 5 and 201 m. At night, however, this species can be found in the open. While *E. antillensis* is not of particular interest to commercial fisheries, in Ascension and St. Helena it is occasionally consumed by fishermen when caught in fish and lobster traps (Poupin, 2003). However, like other reef lobsters, *E. antillensis* is quite popular in the marine aquarium trade. In Trindade (Enseada Orelhas) in daytime *E. antillensis* was found in crevices in rocky bottoms in depths of about 13 m (Fig. 2C-D).

Remarks: This is the first record of *Enoplometopus antillensis* from the oceanic island of Trindade. This species is also known in the southwestern Atlantic from the oceanic island of Fernando de Noronha and from Atol das Rocas, as well as from a number of coastal localities.

Enoplometopus antillensis was observed and photographed *in situ* in Trindade at a depth of about 13 m (Fig. 2C-D), but escaped before it could be collected. However, the distinctive colour pattern leaves no doubts that the photographed animal is indeed *E. antillensis*. This species is the only representative of the genus in the western Atlantic, although it also occurs in the central and eastern Atlantic, from where it is so far known only from remote oceanic islands (see above). A second species occurs in the eastern Atlantic, *Enoplometopus callistus* Intès and Le Louff, 1970, from which *Enoplometopus antillensis* differs in color pattern in having the lateral walls of the carapace with large circular marking (Fig. 2C) (versus carapace covered with many red spots in *E. callistus*) and many white spots on tergites and pleura (versus white spots only on pleura in *E. callistus*) (González Pérez, 1995; Chan & Ng, 2008; Brown, 2014).

Infraorder Achelata Scholtz and Richter, 1995
Family Scyllaridae Latreille, 1825
Parribacus antarcticus (Lund, 1793)
 (Figure 2E-F)

Material examined: Brazil: Trindade Island, Enseada Orelhas, 20°29'40.2"S/29°20'32.9"W, depth:

13.9 m, J.B. Mendonça coll., 06.xi.2014: 1 male, cl 91 mm (MZUSP 35271). *Ibidem*, depth: 14.6 m, J.B. Mendonça coll., 23.vii.2015: 1 male, cl 94 mm

(MZUSP 35272). *Ibidem*, depth: 7 m, J.B. Mendonça coll., 21.xii.2014: 1 ovigerous female, cl 11.5 mm (MZUSP 35288).

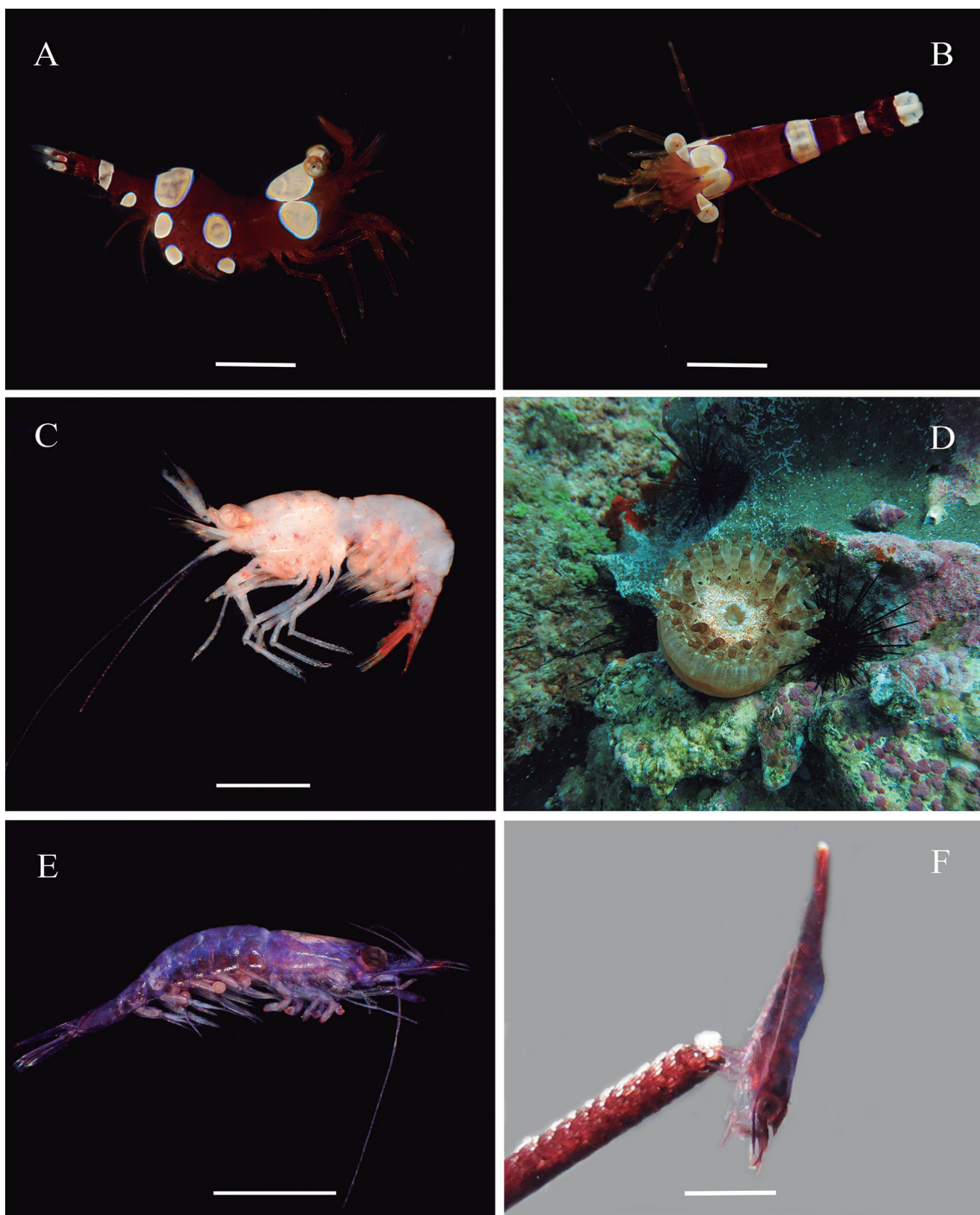


FIGURE 4: **A-B**, *Thor amboinensis* (De Man, 1888). **A**, Ovigerous female, lateral view, cl 4 mm (MZUSP 35276). **B**, Male, cl 1.9 mm, dorsal view (MZUSP 33434). **C**, *Thor manningi* Chace, 1972, ovigerous female, cl 1.4 mm, lateral view (MZUSP 35277). **D**, Sea anemone *Telmatactis* sp. and sea urchin *Diadema antillarum* (under a stone flipped upside down) to which *T. amboinensis* and *Tuleariocaris neglecta* are usually attracted. **E-F**, *Tuleariocaris neglecta* Chace, 1969, lateral views. **E**, Ovigerous female, cl 3.5 mm (MZUSP 35282). **F**, Live male, cl 2 mm (MZUSP 33414). Note in **F** the shrimp holding itself to the spine of a sea urchin, head towards the base of the spine. Scales: **A**, 4 mm. **B**, 2 mm. **C**, 1.5 mm. **E**, 3.5 mm. **F**, 2 mm. Photographs by JBM.

Comparative material examined: Brazil: Tamandaré, Pernambuco, 08°49'S/35°02'W, depth: 25-27 m, R.L. Moura and F. Filho coll., 22.i.1999: 1 male, cl 84 mm (MZUSP 13731). Ilha Rasa de Fora, Guarapari, Espírito Santo, J.L. Gasparini and V.C. Vidal coll.: 1 female, cl 81 mm (MZUSP 12932).

Type locality: Ambon, Indonesia.

Distribution: Disjunct circumtropical. Western Atlantic: Florida, Caribbean Sea (Honduras, Nicaragua, Colombia, Cuba, Jamaica, Virgin Islands, Dominica, Martinique, Curaçao, Bonaire, Barbados), Venezuela, Guianas, Suriname, Brazil (Amapá, Pará, Ceará, Rio Grande do Norte, Pernambuco, Alagoas, Bahia, Trindade Island – present study) (Fausto Filho *et al.*, 1966; Holthuis, 1985, 1991; Coelho *et al.*, 2007; Webber & Booth, 2007). Indo-West Pacific: from East Africa to Taiwan, Hawaii, Australia and French Polynesia (Holthuis, 1985, 1991; Webber & Booth, 2007; Poupin & Juncker, 2010).

Ecological notes: *Parribacis antarcticus* inhabits both hard (coral, rocky reefs and reef flats) and soft-mixed bottoms (sand, gravel) down to at least to 20 m. It is primarily a nocturnal species, which during daytime hides in sciaphilic biotopes, alone or in small groups. In Trindade *P. antarcticus* was found in small caves, resting with the head downward on the cave wall. Although the species is broadly consumed, there is no commercial fishery for it (Holthuis, 1985, 1991; Lavalli *et al.*, 2007).

Remarks: This is the first record of *Parribacis antarcticus* from the remote island of Trindade, from where no other scyllarid lobster has been observed or collected. This species is disjunct circumtropical in distribution, being absent from the central and eastern Atlantic. Noteworthy, in the central Atlantic islands (Ascension and St. Helena), two other scyllarids occur, *Scyllarides delfosi* Holthuis, 1960 (Ascension) and *S. obtusus* Holthuis, 1993 (St. Helena and Tristan da Cunha) (Manning & Chace, 1990; Holthuis, 1993; Brown, 2014; De Grave *et al.*, 2014). Curiously, *S. delfosi*, which was described from Suriname and is common along the north coast of South America (Venezuela to Ceará, Brazil) (Holthuis, 1991; Melo 1999) has never been recorded from Trindade. Brown's (2014) photographic record of *S. obtusus* from Ascension Island deserves further investigation as it may actually be a misidentification for *S. delfosi*.

DISCUSSION

Zoogeographical notes

Until recently, only 36 species of decapod crustaceans were known from the remote oceanic archipelago of Trindade and Martin Vaz (TMV), 31 of which were recorded only from Trindade, five from both Trindade and Martin Vaz and one known from Martin Vaz but not from Trindade (see Table 1). Martin Vaz is far much smaller an island and much more difficult to access than Trindade and, therefore, data acquisition from Martin Vaz is more limited (Fig. 1B-C). At any rate, however, the benthic marine fauna of TMV is very poorly known as evidenced by the small amount of existing primary literature per taxon (e.g., Borradaile, 1916; Moreira, 1920; Andrade Ramos, 1950, 1951; Besnard, 1951; Oliveira, 1951; Krau, 1952; Lima-Verde, 1969; Brito, 1971; Coelho, 1957, 1974; Guille & Albuquerque, 1987; Guille & Ramos, 1987; Leal & Bouchet, 1991 and references therein; Tavares, 1999; Paiva, 2006; Moraes, 2011 and references therein; Martins *et al.*, 2016 and references therein. See also Table 1). Even a brief review of the current literature reveals that most subsequent references to marine benthic invertebrates of TMV marine benthic invertebrates essentially reproduce the taxonomic information contained in earlier accounts. For most groups, the available taxonomic information, either from the primary or secondary literature, has not been challenged by thorough taxonomic reviews or validated by taxonomic comparisons with conspecific taxa also occurring elsewhere. The lack of solid taxonomic information precludes further research on very important topics about the origin of the TMV fauna, including: (i) quantifying the extent of the western Atlantic faunistic component to the formation of the benthic invertebrate fauna of TMV (relatively to the eastern Atlantic, amphi-Atlantic, endemic and circumtropical components); (ii) quantifying the faunistic similarities between TMV and other tropical remote south Atlantic oceanic islands (St. Peter and St. Paul Rocks, Atol das Rocas, Fernando de Noronha, Ascension Island, St. Helena, Cape Verde Islands, and the islands of the Gulf of Guinea – São Tomé, Príncipe, Annobón); and (iii) quantifying the distance from the South American continental shelf when the eastern Atlantic faunistic component starts to become predominant (relatively to the western Atlantic component). Indeed, determining patterns of species distribution and faunistic composition is central to the understanding of the faunistic relationships and connections between TMV, the western and

TABLE 1: List of the decapod Crustacea recorded to date from Trindade and Martin Vaz. AA, amphi-Atlantic; CA, central Atlantic; CT, Circumtropical; DC, Disjunct circumtropical; EN, Endemic; EP, eastern Pacific; ME, Mediterranean; WA, western Atlantic. (*) Species first recorded from TMV. (**) Species identity under revision, inclusion in this list does not necessarily imply endorsement by the authors. (***) Doubtful record.

Taxon	First record	Distribution
Stenopodidae		
<i>Stenopus hispidus</i> * (Olivier, 1811)	Present study	CT
Gnathophyllidae		
<i>Gnathophylloides mineri</i> * Schmitt, 1933	Present study	DC
<i>Gnathophyllum americanum</i> * Guérin-Méneville, 1855	Present study	CT
<i>Gnathophyllum circellum</i> * Manning, 1963	Present study	WA
Palaemonidae		
<i>Brachycarpus biunguiculatus</i> (Lucas, 1849)	Ferreira <i>et al.</i> , 2010	CT
<i>Pontonia manningi</i> Fransen, 2000	present study	AA
<i>Pontonia mexicana</i> Guérin-Méneville, 1855	Fransen, 2002	WA
<i>Tuleariocaris neglecta</i> * Chace, 1969	Present study	WA
Alpheidae		
<i>Alpheopsis aequalis</i> Coutière, 1897	Anker <i>et al.</i> , 2016	DC
<i>Alpheopsis chalciope</i> De Man, 1910	Anker <i>et al.</i> , 2016	DC
<i>Alpheus agilis</i> Anker, Hurt & Knowlton, 2009	Anker <i>et al.</i> , 2009	AA
<i>Alpheus amblyonyx</i> Chace, 1972	Serejo <i>et al.</i> , 2007	WA
<i>Alpheus cristulifrons</i> Rathun, 1900	Serejo <i>et al.</i> , 2006	WA
<i>Alpheus crockeri</i> (Armstrong, 1941)	Anker <i>et al.</i> , 2016	DC
<i>Alpheus formosus</i> Gibbes, 1850	Anker <i>et al.</i> , 2016	WA
<i>Alpheus packardii</i> Kingsley, 1880	Anker <i>et al.</i> , 2016	WA
<i>Alpheus paracrinitus</i> Miers, 1881	Anker <i>et al.</i> , 2016	CT
<i>Alpheus peasei</i> (Armstrong, 1940)	Anker <i>et al.</i> , 2016	WA
<i>Alpheus rudolphi</i> Almeida & Anker, 2011	Anker <i>et al.</i> , 2016	WA
<i>Alpheus vanderbilti</i> Boone, 1930	Anker <i>et al.</i> , 2016	AA
<i>Automate dolichognatha</i> De Man, 1888	Anker <i>et al.</i> , 2016	CT
<i>Metalpheus rostratipes</i> (Pocock, 1890)	Anker <i>et al.</i> , 2016	CT
<i>Parabetaeus hummelincki</i> (Schmitt, 1936)	Anker, 2007	AA
<i>Prionalpheus gomezi</i> Martínez-Iglesias & Carvacho, 1991	Anker <i>et al.</i> , 2016	WA
<i>Salmoneus setosus</i> Manning & Chace, 1990	Anker <i>et al.</i> , 2016	WA, CA
<i>Synalpheus agelas</i> Pequegnat & Heard, 1979	Anker <i>et al.</i> , 2016	WA
<i>Synalpheus antillensis</i> Coutière, 1909	Anker <i>et al.</i> , 2016	WA
<i>Synalpheus fritzmulleri</i> Coutière, 1909	Anker <i>et al.</i> , 2016	WA, CA
<i>Synalpheus sanctithomae</i> Coutière, 1909	Anker <i>et al.</i> , 2016	WA
<i>Synalpheus townsendi</i> Coutière, 1909	Anker <i>et al.</i> , 2016	WA
<i>Synalpheus trinitatis</i> Anker, Tavares & Mendonca, 2016	Anker <i>et al.</i> , 2016	EN
Lysmatidae		
<i>Lysmata grabhami</i> (Gordon, 1935)	Kassuga <i>et al.</i> , 2015	DC
Processidae		
<i>Processa brasiliensis</i> Christoffersen, 1979	Serejo <i>et al.</i> , 2007	WA
Thoridae		
<i>Thor amboinensis</i> * (De Man, 1888)	Present study	CT
<i>Thor manningi</i> Chace, 1972	Present study	WA
Enoplometopidae		
<i>Enoplometopus antillensis</i> * Lütken, 1865	Present study	AA
Axiidae		
<i>Coralaxius abelei</i> ** Kensley & Gore, 1980	Serejo <i>et al.</i> , 2006	WA
Palinuridae		
<i>Panulirus echinatus</i> Smith, 1869	Coelho & Ramos, 1983	AA
<i>Panulirus guttatus</i> (Latreille, 1804) **	Oliveira, 1951	WA
Scyllaridae		
<i>Parribacac antarcticus</i> * (Lund, 1793)	Present study	DC
Munidopsidae		
<i>Munidopsis</i> sp. nov.**	Serejo <i>et al.</i> , 2006	EN

Taxon	First record	Distribution
Diogenidae		
<i>Calcinus tibicen</i> ** (Herbest, 1971)	Moreira, 1920 [as <i>Calcinus sulcatus</i> H.M. Edw., 1836]	WA
Porcellanidae		
<i>Petrolisthes amoenus</i> ** (Guérin-Méneville 1855)	Moreira, 1920 [as <i>Petrolisthes galathinus</i>]	WA
<i>Petrolisthes marginatus</i> ** Stimpson, 1859	Ferreira, 2009	AA
<i>Pachycheles riisei</i> ** (Stimpson, 1858)	Moreira, 1920 [as <i>Pisosoma risei</i> (sic)]	WA
Raninidae		
<i>Ranilia muricata</i> ** H. Milne-Edwards, 1837	Serejo <i>et al.</i> , 2006	WA
Goneplacidae		
<i>Nanoplax xanthiformis</i> ** (A. Milne-Edwards, 1880)	Serejo <i>et al.</i> , 2006	WA
Leucosiidae		
<i>Randallia laevis</i> ** (Borradaile, 1916)	Borradaile, 1916 [as <i>Persephona laevis</i>]	EN
Majidae		
<i>Mithraculus forceps</i> ** (A. Milne-Edwards, 1875)	Serejo <i>et al.</i> , 2006	WA
<i>Mithrax</i> sp. **	Serejo <i>et al.</i> , 2006	—
Portunidae		
<i>Laeonectes vocans</i> (A. Milne-Edwards, 1878) **	Serejo <i>et al.</i> , 2006	WA
<i>Portunus anceps</i> (de Saussure, 1858) **	Serejo <i>et al.</i> , 2006	WA
Panopeidae		
<i>Eurypanopeus abbreviatus</i> ** (Stimpson, 1860)	Moreira, 1920	WA
Xanthidae		
<i>Paractaea rufopunctata nodosa</i> ** (Stimpson, 1860)	Serejo <i>et al.</i> , 2006	WA
<i>Platypodiella spectabilis</i> ** (Herbst, 1794)	Melo, 1996	WA
<i>Xanthodius americanus</i> ** (de Saussure, 1858)	Coelho & Ramos, 1972	WA
<i>Cataleptodius parvulus</i> ** (Fabricius, 1793)	Moreira, 1920 [as <i>Xanthodius parvulus</i>]	WA
Gecarcinidae		
<i>Johngartia lagostoma</i> H. Milne-Edwards, 1837	Borradaile, 1916 [as <i>Gecarcinus lagostoma</i>]	CA
Grapsidae		
<i>Geograpsus lividus</i> ** (H. Milne-Edwards, 1837)	Moreira, 1920	WA
<i>Goniopsis cruentata</i> *** (Latreille, 1803)	Moreira, 1920	WA
<i>Grapsus grapsus</i> ** (Linnaeus, 1758)	Oliveira, 1951	WA/EP
<i>Pachygrapsus gracilis</i> ** (de Saussure, 1858)	Melo, 1996	AA
<i>Pachygrapsus transversus</i> ** (Gibbes, 1850)	Melo, 1996	EP/AA/ME
Plagusiididae		
<i>Plagusia depressa</i> ** (Fabricius, 1775)	Moreira, 1920	AA
Varunidae		
<i>Cyclograpsus integer</i> ** H. Milne-Edwards, 1837	Moreira, 1920	AA

eastern Atlantic continental shelves and other remote tropical oceanic islands of the south Atlantic, and their possible causes.

The Brazilian oceanic islands (and seamount chains) are yet to be intensively sampled. Whereas previous accounts on the decapod crustaceans listed a total of just seven species of caridean shrimps from TMV, four of which were alpheid shrimps (Table 1), recent surveys in the framework of the ProTrindade Project resulted in a vast material of shallow-water decapod crustaceans among other groups of benthic invertebrates (see also Martins *et al.*, 2016). For instance, the recent study of the alpheid shrimps amassed during the ProTrindade Project revealed the presence of eight genera and 23 species in TVM (Table 1), 19 of which were new records for TMV and one species was new to science (Anker *et al.*, 2016).

In the present study, ten additional decapod species are recorded herein for the first time from TMV. *Gnathophyllum americanum* and *Tuleariocaris amboinensis* are circumtropical in distribution, whereas *Stenopus hispidus*, *Gnathophylloides mineri* and *Parribacus antarcticus* are disjunct circumtropical species as their distribution in the Atlantic Ocean is limited in the east to Trindade (*G. mineri* and *P. antarcticus*) or to Ascension Island (*S. hispidus*), therefore, do not extending into the eastern Atlantic. *Gnathophyllum circumcellum* and *Thor manningi* are purely western Atlantic species, with the former species previously known only from the Caribbean Sea. The eastern-most occurrence of these two species is Trindade. *Pontonia manningi*, *T. neglecta* and *Enoplometopus antillensis* are amphiatlantic in distribution. The new records herein increase the number of decapod species known from

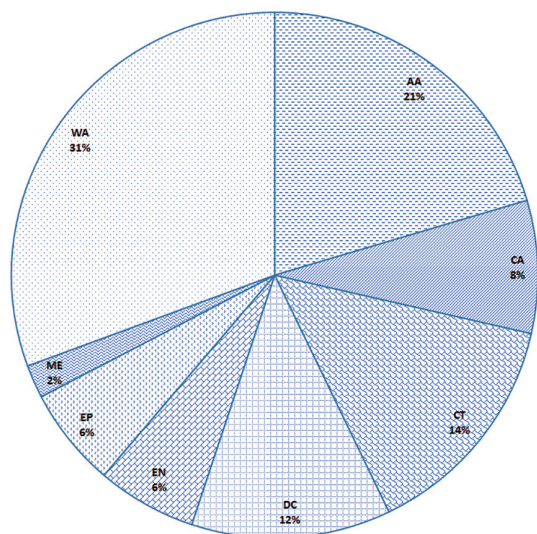


FIGURE 5: Preliminary assessment of the zoogeographical components of the decapod Crustacea fauna of the Trindade and Martin Vaz Archipelago. Source: Table 1. WA, western Atlantic. AA, amphi-Atlantic. CA, central Atlantic. CT, circumtropical. DC, disjunct circumtropical. EN, endemic. EP, eastern Pacific. ME, Mediterranean.

TMV from 55 to 65 (Table 1). In comparison, Ascension Island harbors 75 species to date, 11 of which endemic (Manning & Chace, 1990; De Grave *et al.*, 2014), whilst St. Helena harbors 36 species (Chace, 1966; De Grave, 2007). The remaining decapod collections from TMV secured by the ProTrindade Project (Brachyura, Galatheoidea, Paguroidea, Axiidea and non-alpheid Caridea) are currently being revised and we expect the total number of species known from TMV to rise sharply and surpass that of Ascension Island. Conversely, endemism level is expected to remain higher in Ascension than in TMV. Indeed, according to Gasparini & Floeter (2001) Trindade has a richer shorefish fauna than Ascension, but has lower levels of endemism than the latter island.

Thus, based on current taxonomic knowledge, the benthic marine invertebrate fauna of TMV appears to be a mosaic of western Atlantic, eastern Atlantic, amphi-Atlantic, central Atlantic (insular), endemic and circumtropical species (Fig. 5) (see also Martins *et al.*, 2016). The benthic invertebrate fauna of TMV is chiefly derived from the tropical western Atlantic edges. The reef fish fauna of TMV also points to the same direction (Floeter & Gasparini, 2000; Gasparini & Floeter, 2001).

RESUMO

O grande isolamento geográfico do jovem arquipélago vulcânico Trindade e Martin Vaz (TMV) suscita ques-

*tionamentos sobre a origem e os níveis de endemismo de sua fauna. Entretanto, a abordagem destas questões requer o conhecimento abrangente da composição taxonômica da fauna bentônica marinha de TMV. Com o intuito de documentar a biodiversidade em TMV foram efetuadas amostragens da fauna de invertebrados bentônicos durante cinco anos consecutivos do entre-marés até profundidades de 30 m. Nesta oportunidade apresentamos dez novos registros de crustáceos Decapoda para TMV, juntamente com comentários ecológicos e notas zoogeográficas. *Gnathophyllum americanum* e *Thor amboinensis* são espécies circumtropicais, enquanto que *Stenopus hispidus*, *Gnathophylloides mineri* e *Parribacus antarcticus* são espécies circumtropicais disjuntas na medida em que sua distribuição no oceano Atlântico encontra-se limitada à leste pelas ilhas TMV ou Ascensão (*S. hispidus*), conseqüentemente, não se estendendo ao Atlântico oriental. *Gnathophyllum circellum* e *Thor manningi* são espécies do Atlântico ocidental; *G. circellum* era conhecida previamente apenas do Mar do Caribe. *Pontonia manningi*, *Tuleariocaris neglecta* e *Enoplometopus antillensis* são espécies anfi-Atlânticas. Estes novos registros para TMV corroboram a ideia de que a fauna marinha bentônica de TMV constitui-se em um mosaico de espécies atlântico-ocidentais, atlântico-orientais, centro-atlânticas (insulares), anfi-Atlânticas, endêmicas e circumtropicais. O componente atlântico ocidental tem forte influência na formação faunística de TMV.*

PALAVRAS-CHAVE: Ilhas oceânicas; Zoogeografia; Taxonomia; Invertebrados marinhos; Bentos.

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