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Nikoides schmitti Manning & Chace, 1971 (Caridea: Processidae) in the South Atlantic Ocean, with an updated list and key for processid shrimps of Brazil

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Abstract

The shrimp *Nikoides schmitti* Manning & Chace, 1971 (Decapoda: Caridea: Processidae) is reported for the first time from the South Atlantic Ocean, based on four specimens dredged on soft bottoms of the continental shelf of the Camamu Basin, Bahia, Brazil (13°28'–13°30'S; 38°47'–38°49'W), at a depth range of 38–49 m depth. The Brazilian material is illustrated and an updated list of the Brazilian processid shrimps and a key for their identification are provided.

Key words: Decapoda, Caridea, shrimp, Processidae, range extension, Brazil

Introduction

The processid shrimp genus *Nikoides* Paulson, 1875 currently comprises 10 species: *N. boraboraensis* Burukovsky, 2002, *N. danae* Paulson, 1875, *N. gurneyi* Hayashi, 1975 (possibly synonym of *N. danae*, see Noël 1986), *N. longicarpus* Noël, 1986, *N. maldivensis* Borradaile, 1915 (synonym: *Processa jacobsoni* De Man, 1918), *N. multispinatus* Hayashi, 1981, *N. plantei* Burukovsky, 2007, *N. schmitti* Manning & Chace, 1971, *N. sibogae* De Man, 1918, and *N. steinii* (Edmonson, 1935) (synonym: *N. nanus* Chace, 1955) (see Manning & Chace 1971; Hayashi 1975, 1981; Noël 1986; Chace 1997; Burukovsky 2002, 2007). All but *N. schmitti* are distributed in the Indo-West Pacific, *N. schmitti* being the only representative of the genus in the western Atlantic. No species of *Nikoides* are currently known from the eastern Pacific and the eastern Atlantic.

Nikoides schmitti was originally described from the Dry Tortugas, off southern Florida, and has been subsequently reported from North Carolina throughout the Caribbean to Surinam (Manning & Chace 1971; Chace 1972; Heck 1977; Carvacho 1979; Williams 1984; Martínez Iglesias *et al.* 1986; Román-Contreras & Martínez-Mayén 2007). During a sea bottom survey carried out by a private corporation off the central coast of Bahia, eastern Brazil, four incomplete specimens of a processid shrimp were dredged and donated to the first author. They were recognised as members of the genus *Nikoides*, by the absence of a chela on the left first pereiopod (both first pereiopods are chelate in species of *Ambidexter* Manning & Chace, 1971) and the presence of well-developed exopods on both first pereiopods (absent in species of *Processa* Leach, 1815). A more detailed examination of these specimens showed that they match all diagnostic characters of *N. schmitti*. Therefore, we provide the first record and illustrations of *N. schmitti* from Brazil and South Atlantic Ocean, thus substantially extending the geographical range of this species. In addition, we provide an updated list of the processid shrimps known from the Brazilian coast and a key for their identification.

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Material and methods

The present samples were taken by a mini box-corer (30 x 30 x 50 cm) in the Camamu Basin, a sedimentary Cretaceous basin approximately 10,000 km^2 in submerged area (Bruhn & Moraes 1989), situated on the continental shelf of central-eastern coast of Bahia, Brazil, in January 2008. The bottom in this area is composed by two types of sediment: sandy and muddy siliciclastic, restricted to the coastal area and inner shelf, and carbonate sediments, found mainly in the middle and outer shelf and on the continental slope (Freire & Dominguez 2006). Interest in studying the Camamu Basin has increased in recent years due to the discovery of the Manati gas field. Moreover, the shelf of the central coast of Bahia contains the second-largest offshore oil field in Brazil, including shallow waters adjacent to the relatively pristine Camamu Bay, one of the largest bays on the Brazilian coastline. The petroleum industry has already started operations in this area (Freire & Dominguez 2006; Hatje *et al*. 2008).

The material of *N. schmitti* is deposited in the crustacean collection of the Museu de Zoologia, Universidade Estadual de Santa Cruz, Ilhéus, Bahia, Brazil (MZUESC). The drawings were made under a stereo-microscope with the aid of a drawing tube. Carapace length (CL, in mm) was measured with a digital vernier caliper (0.01 mm), from the tip of the rostrum to the posterior margin of the carapace. Other abbreviations: (f) non-ovigerous female; (ovf) ovigerous female; (ni) sex not determined.

Taxonomy

Family Processidae Ortmann, 1896

Genus *Nikoides* Paulson, 1875

Nikoides schmitti Manning & Chace, 1971
(Fig. 1)

Nikoides schmitti Manning & Chace, 1971: 8, figs 3–5; Chace 1972: 142; Hayashi 1975: 53 (key); Heck 1977: 338 (table 1); Carvacho 1979: 466; Williams 1984: 141, fig. 99; Abele & Kim 1986: 23, 254 (key), 260, 261 (fig.); Martínez Iglesias *et al*. 1986: 38; Noël 1986: 296 (key); Camp *et al*. 1998: 142; Boschi 2000: 100; Martínez Iglesias & García Raso 1999: 544 (table 1); Nizinski 2003: 109; Román-Contreras & Martínez-Mayén 2007: 126, fig. 1; Felder *et al*. 2009: 1059.
Processa aff. *P. guyanae* – Herbst *et al*. 1979: 990 (table 1) (see Williams 1984).

Material examined. Brazil, Bahia, Camamu Basin: 1 f (CL 4.37 mm), 13°29'20.1"S, 38°47'37.1"W, 11.I.2008, depth 45.5 m, bottom sediment mainly silt (32.4%) and medium sand (18.4%) (MZUESC 1341); 1 ni (CL 5.85 mm), 13°30'33.7"S, 38°47'04.1"W, 19.I.2008, depth 49.2 m, bottom sediment mainly medium (28.2%) and coarse sand (26.2%) (MZUESC 1342); 1 f (CL 9.44 mm), 1 ovf (CL 9.94 mm), 13°28'57.9"S, 38°49'06.3"W, 20.I.2008, depth 38.1 m, bottom sediment mainly clay (37.6%) and silt (18%) (MZUESC 1343).

Diagnosis. Antenal spine present. Stylocerite with lateral spine. Right P1 chelate, left with simple dactyl. Pereiopod 2 strongly asymmetrical, the right being much longer than the left. Right P2 with 23–24 meral and 43–49 articles, left with 5 meral and 17–18 carpal articles. Carpus of P5 longer than propodus. Fifth abdominal segment unarmed posterolaterally. Abdominal sternites unarmed.

Distribution. Western Atlantic: Cape Lookout, North Carolina (Williams 1984); Biscayne Bay and Dry Tortugas, Florida (Manning & Chace 1971); Quintana Roo, Mexico (Román-Contreras & Martínez-Mayén 2007); Cuba (Martínez Iglesias *et al*. 1986); Guadeloupe (Carvacho 1979); Caribbean coast of Panama (Heck 1977); between Guyana and Surinam (Manning & Chace 1971); Camamu Basin, Bahia, Brazil (this study).

Ecology. This species inhabits seagrass meadows, reef lagoons, coral reefs and high-salinity areas of estuaries, at a depth range of 0.4–49 m (Williams 1984; Román-Contreras & Martínez-Mayén 2007; present study); it probably uses temporary burrows as refuges during the day (Román-Contreras & Martínez-Mayén 2007).

Remarks. No new data on morphology and variability of *N. schmitti* have been added since the original description of this species by Manning & Chace (1971). For instance, accounts in Hayashi (1975, key), Williams (1984, diagnostic characters), and Noël (1986, key) are all based on the original description. The Brazilian specimens of *N. schmitti* appear to differ from the type specimens in a few morphological features. All specimens from

Camamu Bay are incomplete, having lost most of their pereiopods in the dredge process. For instance, one ovigerous female (lot MZUESC 1343) has only the left P2, with only 3 meral and 14 distinct carpal articles. P3 are missing. The left P4 merus and ischium bear 4 and 2 spiniform setae, respectively, on the ventrolateral surface. Right P4 is missing. The ventrolateral surface of merus and ischium of both P5 is unarmed, as described by Manning & Chace (1971). P2 are missing in the other non-ovigerous female from the same lot and therefore, it is not possible to determine the variation in the number of carpal articles of P2 in our samples. In this female, the P3 merus and ischium bear 4 and 1 (left P3) or 2 (right P3) spiniform setae, respectively, on the ventrolateral surface. The same pattern is observed on P4. P5 are missing. In the original description, Manning & Chace (1971) reported 4 and 2 spiniform setae on the merus and ischium, respectively, of P3 and P4. The small observed differences in the number of spiniform setae in our material may be related to their partial loss during the dredging.

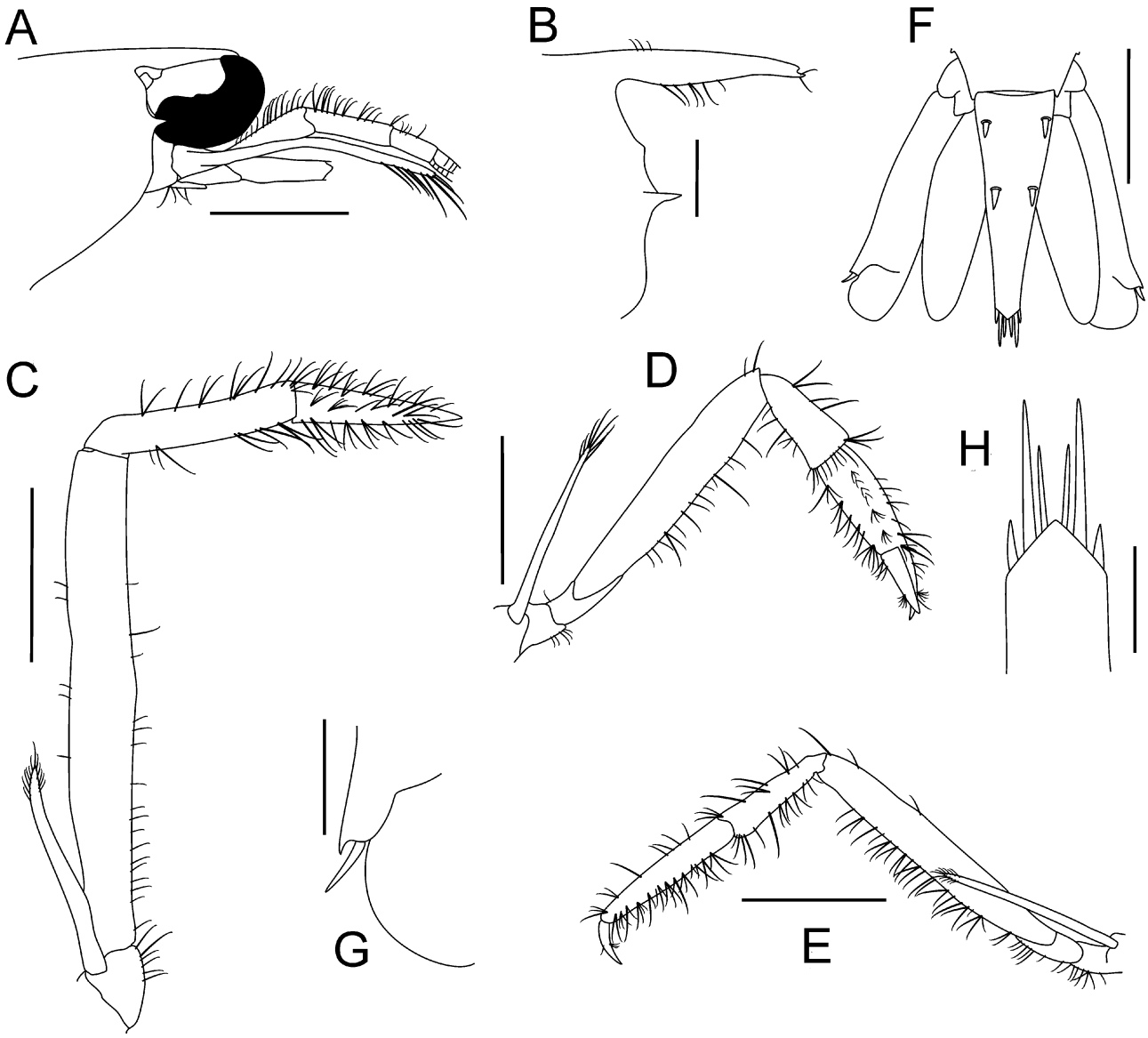

FIGURE 1. *Nikoides schmitti* Manning & Chace, 1971, non-ovigerous female (CL=9.44 mm) (MZUESC 1343), Camamu Basin, state of Bahia, Brazil. (A) head and cephalic appendages, lateral view; (B) rostrum, lateral view; (C) third maxilliped, lateral view; (D) right P1, lateral view; (E) left P1, lateral view; (F) telson and uropods, dorsal view; (G) distolateral spine of left uropodal exopod, dorsal view; (H) tip of the telson, dorsal view. Scale bars: A, C–F = 2 mm; B = 1 mm; G, H = 0.5 mm.

Discussion

The occurrence of *N. schmitti* on the eastern Brazilian coast considerably extends the species' range, from Surinam to the Brazilian state of Bahia, creating a "gap" in the species' distribution, including northern and northeastern Brazil (approximately 20 degrees of latitude) (Fig. 2). Its bathymetric range is also enlarged from 35 m (Williams 1984) to 49 m. In Bahia, *N. schmitti* was collected on various soft bottoms (see Material examined).

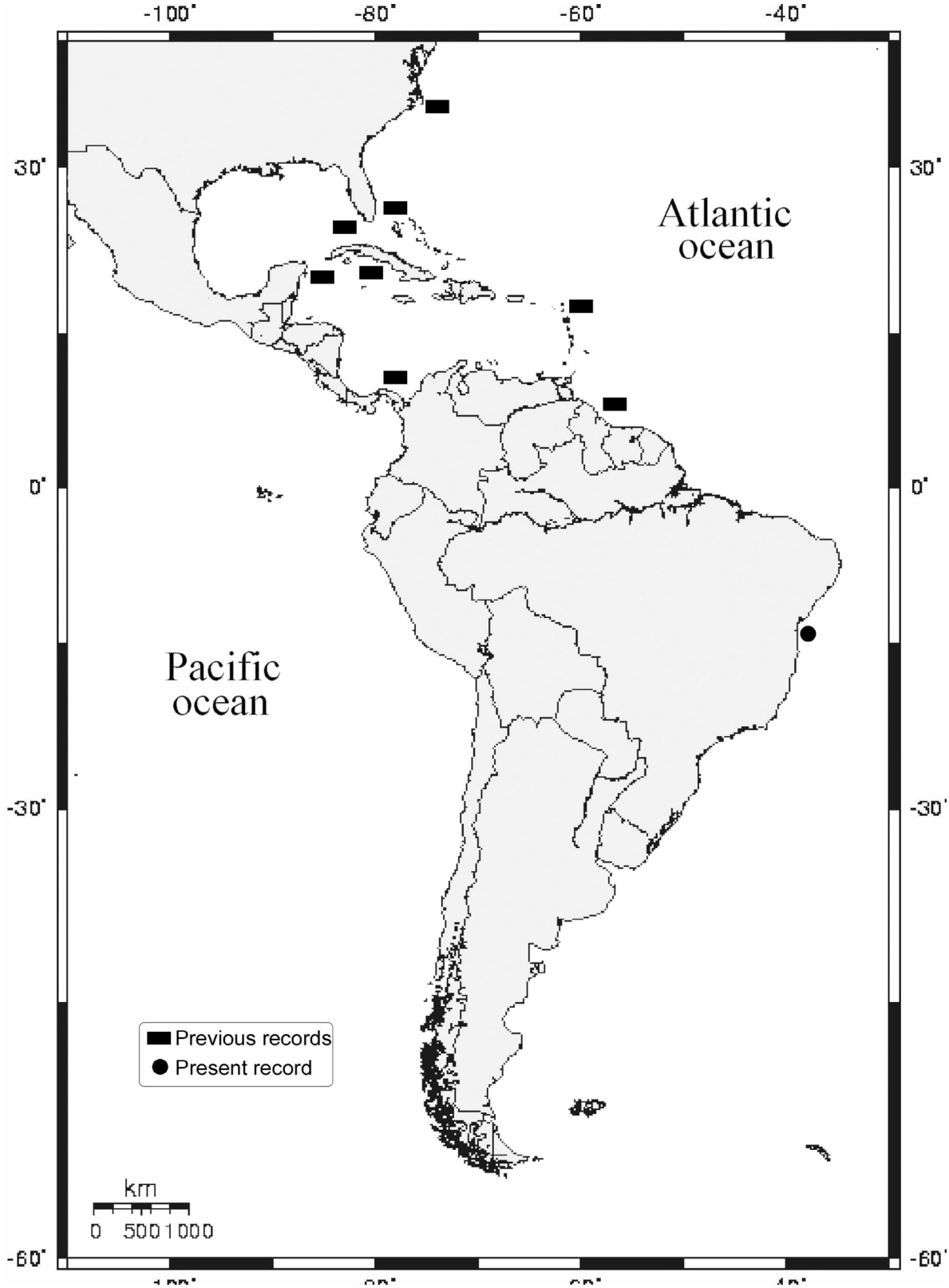

FIGURE 2. Presently known range of the processid shrimp *Nikoides schmitti* Manning & Chace, 1971.

The presently known distribution of *N. schmitti* suggests a Carolinian disjunct distribution for this species, similar to some other western Atlantic decapods (see Melo 1985; Coelho & Ramos 1972). Such a gap in the species distribution may be caused by various ecological factors. The northern population of *N. schmitti* (Cape Lookout to the Guyanas) may be hindered to penetrate further south by vast freshwater discharges from the Orinoco and Amazon rivers. On the other hand, the apparently disjunct distribution of *N. schmitti* may be simply due to the still insufficient knowledge of decapods of the northern and northeastern regions of Brazil. Also to consider is the fact that some western Atlantic species with disjunct distributions may represent pairs of cryptic species, which are common in some marine decapod taxa, especially Alpheidae (see Knowlton 1986, 1993; Anker 2001).

In the western Atlantic, a total of 13 species of the Processidae are known to date: 11 species of *Processa* (accepting that *P. tenuipes* Manning & Chace, 1971 is a junior synonym of *P. guyanae* Holthuis, 1959, as proposed by Christoffersen 1979), 1 species of *Ambidexter*, and 1 species of *Nikoides* (Manning & Chace 1971; Manning 1991; Manning & Hart 1991). *Nikoides schmitti* is the first addition to the list of Brazilian processids since the record of *Processa profunda* Manning & Chace, 1971 (Christoffersen 1982), and is the 9th member of this family reported from Brazil. In Bahia, the only recorded processids are *Processa fimbriata* Manning & Chace, 1971, *P. brasiliensis* Christoffersen, 1979, and *P. bermudensis* (Rankin, 1900) (Christoffersen 1979), with *N. schmitti* being the fourth recorded species. However, more species are likely to be found in Bahia and Brazil in general in the future.

Updated checklist of Brazilian species of the family Processidae

Ambidexter symmetricus Manning & Chace, 1971

Description. Manning & Chace, 1971: 3, figs. 1–2.

Records from Brazil. Coelho & Ramos 1972: 154 (as *Ambidexter* sp.); Ramos-Porto 1977: 806; Ramos-Porto 1980: 304; Coelho & Ramos-Porto 1995: 117; Christoffersen 1998: 352; Coelho-Santos & Coelho 1998: 79; Coelho *et al.* 2002: 438; Coelho *et al*. 2006: 54; Coelho Filho 2006: 11.

Distribution. Western Atlantic: Florida to Brazil (seamounts of North Chain, Pernambuco to Santa Catarina) (Christoffersen 1998, Coelho Filho 2006).

Nikoides schmitti Manning & Chace, 1971

Description. Manning & Chace, 1971: 8, figs 3–5.

Records from Brazil. present study.

Distribution. Western Atlantic: North Carolina to Brazil (Bahia) (Manning & Chace 1971; present study).

Processa bermudensis (Rankin, 1900)

Description. Rankin, 1900: 536, pl. 17, figs. 2, 2a, 2b.

Records from Brazil. Christoffersen 1979: 363; Azambuja Corrêa & Loyola e Silva 1995: 218; Ramos-Porto *et al*. 1996: 222; Christoffersen 1998: 352; Coelho *et al*. 2006: 54; Coelho Filho 2006: 11.

Distribution. Western Atlantic: Bermuda, North Carolina, Florida, Gulf of Mexico, West Indies, Brazil (Piauí to Rio Grande do Norte, Bahia, Rio de Janeiro, and Paraná) (Christoffersen 1979, 1998; Coelho Filho 2006).

Processa brasiliensis Christoffersen, 1979

Description. Christoffersen, 1979: 364, figs. 34–35.

Records from Brazil. Christoffersen 1979: 364, figs. 34–35; Coelho & Ramos-Porto 1995: 117; Christoffersen 1998: 353; Coelho *et al*. 2002: 438; Melo *et al*. 2003: 425; Cardoso 2006: 40; Coelho *et al*. 2006: 54; Coelho Filho, 2006: 11; Serejo *et al.* 2006: 336; Cardoso & Young 2007: 317, figs. 32–35; Serejo *et al*. 2007: 208, unnumbered figure.

Distribution. Western Atlantic: Brazil (Atol das Rocas, seamounts off Fernando de Noronha, Ceará, Pernambuco, Bahia, and Espírito Santo) (Christoffersen 1979, 1998; Cardoso 2006; Coelho Filho 2006; Cardoso & Young 2007).

Processa fimbriata Manning & Chace, 1971

Description. Manning & Chace, 1971: 19, figs 8–10.

Records from Brazil. Richardson 1904: 87 (as *Processa canaliculata* Leach, 1815, host of a bopyrid isopod, *Urobopyrus processae* Richardson, 1904); Schmitt 1935: 169 (in part, as *P. canaliculata*, see Manning & Chace 1971); Manning & Chace 1971: 19, figs. 8–10; Coelho & Ramos 1972: 154; Christoffersen 1979: 367; Markham 1985: 22 (as host of *U. processae*); Coelho *et al*. 1986: 85; Coelho & Ramos-Porto 1995: 117; Christoffersen 1998: 353; Coelho *et al.* 2002: 438; Coelho *et al*. 2006: 54; Coelho Filho 2006: 11; Cardoso & Young 2007: 318, figs. 36–39.

Distribution. Western Atlantic: North Carolina, Florida, Gulf of Mexico, Yucatan, Bahamas, West Indies, and Brazil (Atol das Rocas, seamounts off Fernando de Noronha, and from Rio Grande do Norte to Rio de Janeiro) (Christoffersen 1979, 1998; Coelho Filho 2006; Cardoso & Young 2007).

Processa guyanae Holthuis, 1959

Description. Holthuis, 1959: 115, figs. 18–19.

Records from Brazil. Fausto Filho 1975: 79; Fausto Filho & Sampaio Neto 1976: 68; Fausto Filho 1978: 66; Christoffersen 1979: 368; Fausto Filho 1980: 113; Christoffersen 1998: 353; Barros & Pimentel 2001: 21; Coelho *et al*. 2006: 54; Coelho Filho 2006: 11.

Distribution. Western Atlantic: North Carolina to Uruguay (Brazil: Pará, Ceará to Paraíba, Rio de Janeiro, São Paulo, and Rio Grande do Sul) (Fausto Filho 1975; Christoffersen 1979, 1998).

Processa hemphilli Manning & Chace, 1971

Description. Manning & Chace, 1971: 23, figs 11–12.

Records from Brazil. Christoffersen 1979: 370; Pires-Vanin *et al.* 1997: 36; Christoffersen 1998: 353; Coelho *et al*. 2006: 54.

Distribution. Western Atlantic: North Carolina to Buenos Aires Province (Brazil: from Rio de Janeiro to Rio Grande do Sul) (Christoffersen 1979, 1998).

Processa profunda Manning & Chace, 1971

Description. Manning & Chace, 1971: 25, figs. 13–15.

Records from Brazil. Christoffersen 1982: 101; Christoffersen 1998: 353.

Distribution. Western Atlantic: New Jersey to Uruguay (Brazil: São Paulo and Rio Grande do Sul) (Christoffersen 1982, 1998).

Processa vicina Manning & Chace, 1971

Description. Manning & Chace, 1971: 34, figs. 19–20.

Records from Brazil. Ramos-Porto & Santos 1996: 63 (congress abstract); Coelho *et al*. 2006: 54.

Distribution. Western Atlantic: Bermuda, North Carolina, Florida, Venezuela, and Brazil (Fernando de Noronha, Amapá to Maranhão, Pernambuco) (Manning & Chace 1971; Williams 1984; Ramos-Porto & Santos 1996).

Key for the identification of Processidae from Brazilian waters

(modified from Manning & Chace 1971 and Noël 1986):

1. P1 both chelate and lacking exopods; P2 symmetrical . . . . . *Ambidexter symmetricus*
1'. Only one (usually the right) of P1 chelate, the other P1 ending in a simple dactylus 2
2. P1 with exopods . . . . . *Nikoides schmitti*
2'. P1 without exopods 3
3. Pleura of fifth abdominal segment with posterolateral tooth . . . . . *Processa fimbriata*
3'. Pleura of fifth abdominal segment rounded or angled posterolaterally, lacking distinct posterolateral tooth 4
4. Antennal spine absent 5
4'. Antennal spine present 6
5. P2 asymmetrical; rostrum not markedly deflexed anteriorly; right P2 with 10–15 meral and 19–29 carpal articles, left P2 with 3–4 meral and 13–15 carpal articles . . . . . *Processa bermudensis*

5'. P2 symmetrical; rostrum deflexed anteriorly; right P2 with 5 meral and 10–14 carpal articles. . . . . *Processa vicina*
6. P2 symmetrical . . . . . *Processa hemphilli*
6'. P2 asymmetrical 6
7. Lobe on sixth abdominal segment above articulation of uropod produced into posterior spine . . . . . *Processa profunda*
7'. Lobe on sixth abdominal segment above articulation of uropod unarmed 8
8. Stylocerite truncated obliquely, without a developed tooth or a well-defined outer anterior angle; basicerite unarmed . . . . . *Processa brasiliensis*
8'. Stylocerite truncated transversely, angled, or with a more or less developed outer anterior tooth; basicerite armed with a lateral spine . . . . . *Processa guyanae*

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References

Abele, L.G. & Kim, W. (1986) An illustrated guide to the marine decapod crustaceans of Florida. *Florida Department of Environmental Regulation, Technical Series* 8(1, 2), 760 p.

Anker, A. (2001) Two new species of snapping shrimps from the Indo-Pacific, with remarks on colour patterns and sibling species in Alpheidae (Crustacea: Caridea). *The Raffles Bulletin of Zoology*, 49(1), 57–72.

Azambuja Corrêa, E. & Loyola e Silva, J. (1995) Lista das espécies de Dendrobranchiata e Caridea (Crustacea, Decapoda) do Museu de História Natural Capão da Imbuia, Curitiba e do Centro de Estudos do Mar, Paranaguá, Paraná, Brasil. *Revista Brasileira de Zoologia*, 12(1), 211–220.

Barros, M.P. & Pimentel, F.R. (2001) A fauna de Decapoda (Crustacea) do Estado do Pará, Brasil: lista preliminar de espécies. *Boletim do Museu Paraense Emílio Goeldi, Série Zoologia*, 17(1), 15–41.

Boschi, E.E. (2000) Species of decapod crustaceans and their distribution in the American marine zoogeographic provinces. *Revista de Investigación y Desarollo Pesquero*, 13, 7–136.

Bruhn, C.H.L. & Moraes, M.A.S. (1989) Turbiditos da Formação Urucutuca na bacia de Almada, Bahia: um laboratório de campo para estudos canalizados. *Boletim de Geociências da Petrobrás*, 3(3), 235–267.

Burukovsky, R.N. (2002) A new shrimp of the genus *Nikoides* (Decapoda, Processidae). *Zoologicheskii Zhurnal*, 81(11), 1389–1391 [in Russian].

Burukovsky, R.N. (2007) On some new and rare shrimps from the Indo-Western Pacific. *Zoologicheskii Zhurnal*, 86(12), 1417–1424 [in Russian].

Camp, D. K., Lyons, W.G. & Perkins, T.H. (1998) Checklist of selected shallow-water marine invertebrates from Florida. *Florida Marine Research Institute*, Technical Report 3, 1–328.

Cardoso, I. (2006) Caridea (Crustacea, Decapoda) collected on the Brazilian (13º/22º) continental shelf and slope. *Zootaxa*, 1364, 1–44.

Cardoso, I.A. & Young, P.S. (2007) Caridea (Crustacea, Decapoda: Disciadidae, Palaemonidae, Processidae, Rhynchocinetidae) from Rocas Atoll including two new species of *Periclimenaeus* Borradaile, 1951. *Arquivos do Museu Nacional*, 65(3), 277–337.

Carvacho, A. (1979) Les Crevettes Carides de la mangrove guadeloupéenne. *Bulletin du Muséum National d'Histoire Naturelle*, Paris, 4e sér., 1, section A, 2, 445–470.

Chace Jr., F.A. (1972) The shrimps of the Smithsonian-Bredin Caribbean Expeditions with a summary of the West Indian shallow-water species (Crustacea: Decapoda: Natantia). *Smithsonian Contributions to Zoology*, 98, 1–179.

Chace Jr., F.A. (1997) The Caridean Shrimps (Crustacea: Decapoda) of the Albatross Philippine Expedition, 1907–1910, Part 7: Families Atyidae, Eugonatonotidae, Rhynchocinetidae, Bathypalaemonellidae, Processidae, and Hippolytidae. *Smithsonian Contributions to Zoology*, 587, 1–106.

Christoffersen, M.L. (1979) Decapod Crustacea: Alpheoida. Campagne de la Calypso au large des côtes atlantiques de l'Amérique du Sud (1961-1962). I. 36, *Annales de l'Institut Océanographique, Monaco*, (Suppl.), 55, 297–377.

Christoffersen, M.L. (1982) Geographic distribution of warm water alpheoid shrimp (Crustacea, Caridea) on the continental shelf of eastern South America between 23 and 35º Lat. S. *Boletim do Instituto Oceanográfico*, 31(1), 93–112.

Christoffersen, M.L. (1998) Malacostraca. Eucarida. Caridea. Crangonoidea and Alpheoidea (Except Glyphocrangonidae and Crangonidae). *In*: Young, P.S. (Ed), *Catalogue of Crustacea of Brazil*. Museu Nacional, Rio de Janeiro, p. 351–372.

Coelho, P.A., Almeida, A.O., Souza-Filho, J.F., Bezerra, L.E.A., Giraldes, B.W. (2006) Diversity and distribution of the marine and estuarine shrimps (Dendobranchiata, Stenopodidea and Caridea) from North and Northeast Brazil. *Zootaxa*, 1221, 41–62.

Coelho, P.A., Coelho-Santos, M.A., Torres, M.F.A., Monteiro, B.R. & Almeida, V.A.K. (2002) Reino Animalia: Filo (ou Subfilo) Crustacea no Estado de Pernambuco. *In*: Tabarelli, M. & Silva, J.M.C. (Eds), *Diagnóstico da biodiversidade de Pernambuco*. Massangana, Recife, 2, p. 429–482.

Coelho, P.A. & Ramos, M.A. (1972) A constituição e a distribuição da fauna de decápodos do litoral leste da América do Sul entre as latitudes 5º N e 39º S. *Trabalhos Oceanográficos da Universidade Federal de Pernambuco*, 13, 133–236.

Coelho, P.A. & Ramos-Porto, M. (1995) Distribuição ecológica dos crustáceos decápodos marinhos do nordeste do Brasil. *Trabalhos Oceanográficos da Universidade Federal de Pernambuco*, 23, 113–127. [Dated 1994/95, published 1995]

Coelho, P.A., Ramos-Porto, M. & Calado, T.C.S. (1986) Litoral do Rio Grande do Norte: Decapoda. *Cadernos Ômega da Universidade Federal Rural de Pernambuco, Série Ciências Aquáticas*, Recife, 2, 79–105.

Coelho-Santos, M.A. & Coelho, P.A. (1998) Camarões (Crustacea Decapoda) do litoral de Jaboatão dos Guararapes, Pernambuco – Brasil. *Trabalhos Oceanográficos da Universidade Federal de Pernambuco*, 26(1), 63–83.

Coelho Filho, P.A. (2006) Checklist of the Decapods (Crustacea) from the outer continental shelf and seamounts from Northeast of Brazil – REVIZEE Program (NE III). *Zootaxa*, 1184, 1–27.

Fausto Filho, J. (1975) Quinta contribuição ao inventário dos crustáceos decápodos marinhos do nordeste brasileiro. *Arquivos de Ciências do Mar*, 15(2), 79–84.

Fausto Filho, J. (1978) Os crustáceos estomatópodos e decápodos dos substratos de lama do Nordeste brasileiro. *Arquivos de Ciências do Mar*, 18(1/2), 63–71.

Fausto Filho, J. (1980) Crustáceos estomatópodos e decápodos dos substratos de cascalho do Nordeste brasileiro. *Ciência Agronômica*, 10(1), 109–124.

Fausto Filho, J. & Sampaio Neto, J.B.S. (1976) Observações sobre alguns crustáceos estomatópodos e decápodos do norte do Brasil. *Arquivos de Ciências do Mar*, 16(2), 65–71.

Felder, D.L., Álvarez, F., Goy, J.W. & Lemaitre, R. (2009) Decapoda (Crustacea) of the Gulf of Mexico, with comments on the Amphionidacea. *In*: Felder, D.L. & Camp, D.K. (Eds), *Gulf of Mexico Origin, Waters, and Biota*. Volume 1, Biodiversity. Texas A&M University Press, College Station, p. 1019–1104.

Freire, A.F.M. & Dominguez, J.M.L. (2005) A sequência holocênica da plataforma continental central do Estado da Bahia. *Boletim de Geociências da Petrobrás*, 14(2), 247–267.

Hatje, V., Barros, F., Magalhães, W., Riatto, V.B., Amorim, F.N., Figueiredo, M.B., Spanó, S., Cirano, M. (2008) Trace metals and benthic macrofauna distributions in Camamu Bay, Brazil : sediment quality prior oil and gas exploration. *Marine Pollution Bulletin*, 56, 348–379.

Hayashi, K.-I. (1975) The Indo-West Pacific Processidae. *The Journal of the Shimonoseki University of Fisheries*, 24(1), 47–145.

Hayashi, K.-I. (1981) *Nikoides multispinatus* sp. nov., a new processid shrimp from the Pacific Ocean. *Annotationes Zoologicae Japonenses*, 54(1), 53–58.

Heck, K.L., Jr. (1977) Comparative species richness, composition, and abundance of invertebrates in Caribbean seagrass (*Thalassia testudinum*) meadows (Panama). *Marine Biology*, 41, 335–348.

Herbst, G.N., Williams, A.B. & Boothe, B.B., Jr. (1979) Reassessment of northern geographic limits for decapod crustacean species in the Carolinian Province, USA: some major range extensions itemized. *Proceedings of the Biological Society of Washington*, 91(4), 989–998.

Holthuis, L.B. (1959) The Crustacea Decapoda of Suriname (Dutch Guyana). *Zoologische Verhandelingen*, 44, 1–296, plates I–XVI.

Knowlton, N. (1986) Cryptic and sibling species among the decapod Crustacea. *Journal of Crustacean Biology*, 6(3), 356–363.

Knowlton, N. (1993) Sibling species in the sea. *Annual Review of Ecology and Systematics*, 24, 189–216.

Manning, R.B. (1991) *Processa vossi*, a new caridean shrimp from Florida (Crustacea: Decapoda: Processidae). *Bulletin of Marine Science*, 49(1–2), 552–557.

Manning, R.B. & Chace, Jr., F.A. (1971) Shrimps of the Family Processidae from the Northwestern Atlantic Ocean (Crustacea: Decapoda: Caridea). *Smithsonian Contributions to Zoology*, 89, 1–41.

Manning, R.B. & Hart, Jr., C.W. (1991) A new species of *Processa* from Bermuda (Crustacea: Decapoda: Caridea). *Proceedings of the Biological Society of Washington*, 104(2), 317–321.

Markham, J.C. (1985) A review of the bopyrid isopods infesting caridean shrimps in the northwestern Atlantic Ocean, with special reference to those collected during the Hourglass Cruises in the Gulf of Mexico. *Memoirs of the Hourglass Cruises*, 7(3), 1–156.

Martínez Iglesias, J.C., Carvacho, A. & Ríos, R. (1996) Catálogo de los carídeos marinos (Crustacea, Decapoda, Caridea) de las aguas someras de Cuba. *Avicennia*, 4/5, 27–40.

Martínez Iglesias, J.C. & García Raso, J.E. (1999) The crustacean decapod communities of three coral reefs from the southwestern Caribbean Sea of Cuba: species composition, abundance and structure of the communities. *Bulletin of Marine Science*, 65(2), 539–557.

Melo, G.A.S. (1985) *Taxonomia e padrões distribucionais e ecológicos dos Brachyura (Crustacea, Decapoda) do litoral sudeste do Brasil*. PhD Thesis, Universidade de São Paulo, 216p.

Melo, G.A.S., Campos Jr., O. & Vezzani, R. (2003) Type catalogue of the Crustacea Decapoda in the collections of the Museu de Zoologia da Universidade de São Paulo, Brazil. *Proceedings of the Biological Society of Washington*, 116(2), 423–437.
Nizinski, M.S. (2003) Annotated checklist of decapod crustaceans of Atlantic coastal and continental shelf waters of the United States. *Proceedings of the Biological Society of Washington*, 116(1), 96–157.
Noël, P. (1986) Crustacés Décapodes: Processidae de l'Indo-Ouest-Pacifique. *In*: Résultats des Campagnes MUSORSTOM. I & II. Philippines, Tome 2. *Mémoires du Muséum National d'Histoire Naturelle*, série A, Zoologie, 133, 261–301.
Pires-Vanin, A.M.S., Corbisier, T.N., Arasaki, E. & Möellmann, A.M. (1997) Composição e distribuição espaço-temporal da fauna bêntica no Canal de São Sebastião. *Relatórios Técnicos do Instituto Oceanográfico*, 41, 29–46.
Ramos-Porto, M. (1977) Ocorrência de *Ambidexter symmetricus* Manning & Chace, 1971 no litoral pernambucano. *Ciência e Cultura*, Suppl. 29(7), 806–807.
Ramos-Porto, M. (1980) Estudo ecológico da região de Itamaracá, Pernambuco, Brasil. VII Crustáceos Decápodos Natantes. *Trabalhos Oceanográficos da Universidade Federal de Pernambuco*, 15, 277–310.
Ramos-Porto, M. & Santos, C.A. (1996) Distribuição dos camarões do gênero *Processa* Leach, 1815 (Crustacea – Processidae) em águas do litoral brasileiro. *Resumos do XXI Congresso Brasileiro de Zoologia*, Porto Alegre, 63. [Congress abstract]
Ramos-Porto, M., Torres, M.F.A. & Viana, G.F.S. (1996) Crustáceos decápodos coletados durante as Expedições Nordeste III e Pavasas I (Penaeidea e Caridea). *Trabalhos Oceanográficos da Universidade Federal de Pernambuco*, 24, 211–227.
Rankin, W.M. (1900) The Crustacea of the Bermuda Islands, Notes on the Collections Made by the New York University Expeditions in 1897 and 1898. *Annals of the New York Academy of Sciences*, 12(12), 521–548.
Richardson, H. (1904) Contributions to the Natural History of the Isopoda. *Proceedings of the United States National Museum*, 27(1350), 1–89.
Román-Contreras, R. & Martínez-Mayén, M. (2007) First record of *Nikoides schmitti* Manning & Chace, 1971 (Decapoda, Caridea, Processidae) in Mexican waters. *Crustaceana*, 80(1), 125–127.
Schmitt, W.L. (1935) Crustacea Macrura and Anomura of Porto Rico and the Virgin Islands. *New York Academy of Sciences, Scientific Survey of Porto Rico and the Virgin Islands*, 15(2), 125–227.
Serejo, C.S., Cardoso, I.A., Tavares, C.R., Abreu Jr., C.R., Amâncio, I.C. & Senna, A.R. (2007) Filo Arthropoda, Subfilo Crustacea. *In*: Lavrado, H.P. & Viana, M.S. (Eds), *Atlas de invertebrados marinhos da região Central da Zona Econômica Exclusiva brasileira, parte 1*. Museu Nacional, Rio de Janeiro, p. 165–214.
Serejo, C.S., Young, P.S., Cardoso, I., Tavares, C. & Rodrigues, C. (2006) Filo Arthropoda, Subfilo Crustacea. *In*: Lavrado, H.P. & Ignacio, B.L. (Eds), *Biodiversidade bentônica da região central da Zona Econômica Exclusiva Brasileira*. Museu Nacional, Rio de Janeiro, p. 299–337.
Williams, A.B. (1984) *Shrimps, Lobsters and Crabs of the Atlantic Coast of the Eastern United States, Maine to Florida*. Smithsonian Institution Press, Washington, 550p.