

# Two new species of Amphiuridae (Echinodermata, Ophiuroidea) from the southeastern coast of Brazil

**Maria da Natividade ALBUQUERQUE**

Deceased in 1995

**Lúcia S. CAMPOS-CREASEY**

Universidade Santa Úrsula, Instituto de Ciências Biológicas e Ambientais,  
Laboratório de Equinodermatologia, Rua Jornalista Orlando Dantas 59,  
Botafogo, 22231-010 Rio de Janeiro (Brazil)  
lsc\_creasey@hotmail.com

**Alain GUILLE**

Deceased in 2001

Centre des Sciences de la Mer, T.C.23.03,  
Université Pierre et Marie Curie, Paris VI, 4 Place Jussieu,  
F-75252 Paris cedex 05 (France)

---

Albuquerque M. da N., Campos-Creasey L. S. & Guille A. 2001. — Two new species of Amphiuridae (Echinodermata, Ophiuroidea) from the southeastern coast of Brazil. *Zoosystema* 23 (3) : 591-604.

## ABSTRACT

Two Amphiuridae, *Amphiura* (*Amphiura*) *callida* n. sp. and *Amphiodia* *habilis* n. sp., were collected from the continental shelf off southeastern Brazil during the MD55/Brazil oceanographic cruise. *Amphiura callida* n. sp. differs from other species of the same genus in the leaf-like shape of the distal oral papillae, which curves outwards, and disposition of the number of arm spines through the length of the arm. *Amphiodia habilis* n. sp. is distinguished from other *Amphiodia* especially by the organization of plates on its thick disk. Two identification keys for Brazilian species of *Amphiura* and *Amphiodia* are proposed.

## KEY WORDS

Echinodermata,  
Ophiuroidea,  
Amphiuridae,  
*Amphiura*,  
*Amphiodia*,  
southwest Atlantic,  
oceanographic cruise MD55/Brazil,  
new species.

## RÉSUMÉ

Deux nouvelles espèces d'Amphiuridae (Echinodermata, Ophiuroidea) de la côte Sud-Est du Brésil.

Deux Amphiuridae, *Amphiura* (*Amphiura*) *callida* n. sp. et *Amphiodia* *habilis* n. sp., ont été récoltées sur le plateau continental brésilien, de part et d'autre du Cabo Frio, pendant la campagne océanographique MD55/Brésil, en 1987. *Amphiura callida* n. sp. diffère des autres espèces connues de ce genre par, notamment, la forme de la papille orale distale et l'évolution du nombre de piquants brachiaux, en crochet, le long du bras. *Amphiodia habilis* n. sp. se distingue des autres *Amphiodia*, particulièrement par l'organisation et la grande taille des plaques de son disque épais. Deux clés d'identification pour les espèces brésiennes d'*Amphiura* et *Amphiodia* récoltées sont proposées.

## MOTS CLÉS

Echinodermata,  
Ophiuroidea,  
Amphiuridae,  
*Amphiura*,  
*Amphiodia*,  
sud-ouest Atlantique,  
campagne océanographique  
MD55/Brésil,  
nouvelles espèces.

## INTRODUCTION

A collaboration between the Universidade Santa Úrsula, Rio de Janeiro, and the Muséum national d'Histoire naturelle de Paris resulted in an oceanographic cruise along the Southeast coast of Brazil using the RV *Marion Dufresne* in 1987 (Guille & Ramos 1987; Tavares 1999). The vessel belongs to TAAF (Terres australes et antarctiques françaises).

The Southeast coast presents a physical boundary between species more typically adapted to the tropical northern conditions, and those more typically adapted to the southern conditions. The boundary results from the complex interactions of wind and water masses which generates an offshore surface current flow and upwelling of the cold deep nutrient-rich waters into the euphotic surface layers (Carbonel & Valentin 1999). For this reason, the region has been considered appropriate for verifying the effect on speciation of geographic and reproductive isolation of benthic communities (Guille & Albuquerque 1990; Ventura & Fernandes 1995; Ventura *et al.* 1997).

In general, the diversity of echinoderms is reduced on the submerged bank of Abrolhos south to the islands of Trindade and Martins Vaz, as well as the coastal areas on the continental

shelf that are more influenced by fresh water output, or the South Atlantic Central Waters. Ophiuroidea is the most abundant and diverse echinoderm class collected on the continental shelf and the seamounts summits of the Vitória-Trindade chain (Guille & Albuquerque 1990).

In this region, Albuquerque & Guille (1991) recorded 1217 ophiuroid specimens composed of 37 species from nine different families, from 21 sampling stations, 15 to 105 m depth. But four of those species were only identified down to genera and were not described in that paper. Amongst the four species, two are described here as new species, both from the family Amphiuridae Ljungman, 1867: one of the genus *Amphiura* Forbes, 1843, *Amphiura* (*Amphiura*) *callida* n. sp.; and the other of the genus *Amphiodia* Verrill, 1899, *Amphiodia* *habilis* n. sp. Keys to the Brazilian species of *Amphiura* and *Amphiodia* sampled along the coast of Brazil are also provided.

## ABBREVIATIONS USED

MNHN	Muséum national d'Histoire naturelle, Paris;
USU	Universidade Santa Úrsula, Rio de Janeiro;
UFRJ	Federal University of Rio de Janeiro;
BT	Blake trawl;
Ec, Eq	Echinoderms;
EO	Echinodermata: Ophiuroidea.

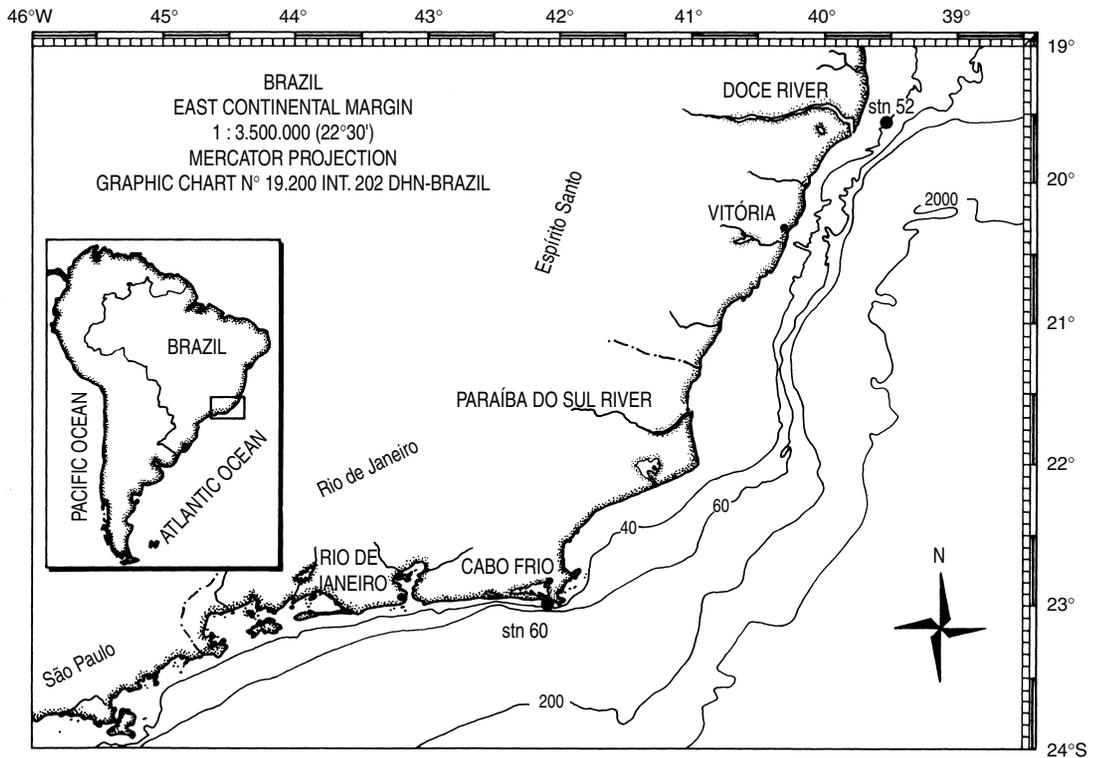


FIG. 1. — Stations where samples of the two new species of Amphiuroidae were collected off the southeastern Brazilian coast: stn 60, *Amphiura (Amphiura) callida* n. sp.; and stn 52, *Amphiodia habilis* n. sp.

## MATERIAL AND METHODS

Samples were taken using a Blake trawl on the continental shelf near the Rio Doce outlet and south of Cabo Frio (Fig. 1). This area was chosen because of its complexity, with two contrasting ecosystems: the more oligotrophic, tropical and sub-tropical, coralline ecosystem to the north; and the more eutrophic ecosystem that converges at Cabo Frio with the upwelling of the South Atlantic Central Waters (SACW) (Valentin 1984; Guille & Albuquerque 1990).

Ophiuroid samples were fixed and stored in 70% alcohol on board ship, examined, dried and photographed in the laboratory under a Leitz Wetzlar stereomicroscope. Holotype and paratype specimens have been kept dry.

The keys suggested here for the genera *Amphiura* and *Amphiodia* species from the Brazilian coast are adapted from the most recent key for Brazilian echinoderms by Tommasi (1999), in partial accordance with a revision of the family Amphiuroidae by A. M. Clark (1970).

## SYSTEMATICS

Order OPHIURIDA Müller & Troschel, 1840

Suborder GNATHOPHIURINA

Matsumoto, 1915

Family AMPHIURIDAE Ljungman, 1867

Genus *Amphiura* Forbes, 1843

Subgenus *Amphiura* Forbes, 1843

KEY OF SPECIES FROM THE GENUS *AMPHIURA* SAMPLED ALONG THE COAST OF BRAZIL

1. Without tentacle scales ..... *A. (Ophionema) intricata* Lütken, 1869  
 — With tentacle scales ..... *A. (Amphiura)* Forbes, 1843 2
2. With one tentacle scale ..... 3  
 — With two tentacle scales ..... 5
3. Arm spines without denticles ..... *A. mülleri* Marktanner-Turneretscher, 1887  
 — Arm spines with denticles ..... 4
4. Three to four arm spines the mid one with denticles; dorsal arm plates flabeliform, wider than long proximally, round distally ..... *A. stimpsonii* Lütken, 1859  
 — Five to eight arm spines, the 2<sup>nd</sup> and 3<sup>rd</sup> with denticles; dorsal arm plates more round proximally, and rectangular distally ..... *A. fibulata* Koehler, 1913
5. Disk partly scaled ..... 6  
 — Disk fully scaled ..... 9
6. Arm spines with denticles ..... 7  
 — Arm spines without denticles ..... 8
7. Six to seven arm spines: the two superior ones very small and flattened, the following two to three larger, with denticles at their extremity and smaller ones laterally, the ventral spine as long as the arm segment; dorsal arm plates longer than wide; disk scales reduced to a border round the radial shields ..... *A. kinbergi* Ljungman, 1872  
 — Seven to eight spines, the last denticle of the 2<sup>nd</sup> arm spine small, hyaline, hook shaped; ventral surface of disk absolutely bare ..... *A. kinbergiensis* Koehler, 1914
8. Five to six arm spines unequal in size: most arm spines flattened, the ventral spine is the largest, the 2<sup>nd</sup> next to the most ventral is modified to a large curved hook from the 8<sup>th</sup> arm segment ..... *A. latispina* Ljungman, 1867  
 — No arm hook shaped spines, five to seven arm spines that are long and pointed ....  
 ..... *A. flexuosa* Ljungman, 1867
9. Granuliform ventral interradial scales ..... *A. princeps* Koehler, 1907  
 — Non-granuliform ventral interradial scales ..... 10
10. Only three blunt arm spines ..... *A. deichmanae* Tommasi, 1965

- Two to more than three arm spines ..... 11
11. Three to four pointed arm spines, one of which from the 6<sup>th</sup> to the 9<sup>th</sup> arm segment has a curved extremity; evident primary plates, other disk plates tiny and imbricated ..... *A. iraciae* Tommasi & Oliveira, 1976
- Five or more arm spines ..... 12
12. Six to seven flattened arm spines, increasing in size ventrally, each with lateral spinules and a curved sub-terminal denticle ..... *A. palmeri* Lyman, 1882
- Subcylindrical arm spines ..... 13
13. Scales of the disk dilated like small, flattened nodules, but sometimes produced vertically almost spiniform; eight arm spines; spiniform distal oral papilla .....  
..... *A. crassipes* Ljungman, 1867
- Scales of the disk flat ..... 14
14. Five to six straight arm spines; disk deeply excavated interradially .....  
..... *A. rosae* Tommasi & Oliveira, 1976
- Presence of hook-like spines ..... 15
15. Two to seven spines throughout the length of the arm; spines cylindrical with an obtuse tip; the second spine from the bottom hook shaped; dorsal arm plates contiguous, flabelliform, wider than long ..... *A. callida* n. sp.
- No variation in the number of arm spines throughout the length of the arm; five to more than five arm spines ..... 16
16. Five to eight arm spines, some curved, hook-like; the second arm spine on the first and second arm segments much smaller than the rest; disk distinctly excavated interradially ..... *A. joubini* (Koehler, 1912)
- Five to seven arm spines of which the second arm spine like a stout hook in shape ..  
..... *A. complanata* Ljungman, 1867

*Amphiura (Amphiura) callida* n. sp.  
(Figs 2; 3)

TYPE MATERIAL. — MD55/Brazil 1987, stn 60, BT 101, 22°58'S, 42°06'W, 50 m depth, 1.VI.1987, holotype d.d. 8 mm (MNHN, EcOS20835).

TYPE LOCALITY. — South of Cabo Frio, Rio de Janeiro.

ETYMOLOGY. — From the Latin verb *callere*: hard skin; to allude to the robustness of the species.

MATERIAL EXAMINED. — MD55/Brazil 1987, stn 60, BT 100, 22°58'S, 42°06'W, 50 m depth, 1.VI.1987, holotype 33-45 mm, (MNHN, EcOs22636), 28 paratypes, d.d. 4.0 to 10.0 mm (USU.EO.III.9.5.1147) et 31 paratypes, d.d. 3.0 to 10.0 mm (MNHN, EcOs22637).

DIAGNOSIS. — Dorsal surface covered with imbricated scales with distinct primary plates. The oral shields are small in relation to the size of the disk. Robust, erect infradental papilla; the second oral papilla is narrow and pointed; the distal is the largest, leaf-shaped, erect, with an acute extremity. The dorsal spines are the

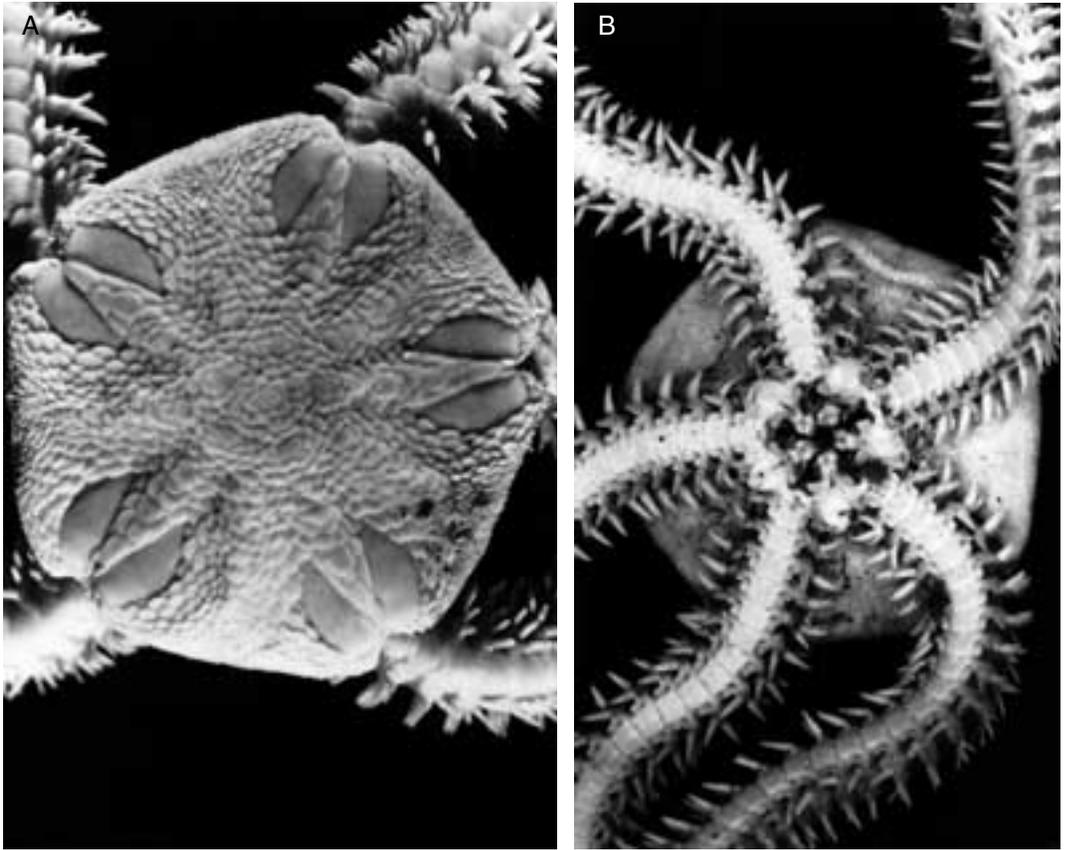


FIG. 2. — *Amphiura* (*Amphiura*) *callida* n. sp., holotype 8 mm disk diameter, 45 mm arm length; **A**, dorsal surface of the disk; **B**, oral surface of the disk.

smallest. Two tentacle scales: the internal scale is slightly larger and supported on the ventral arm plate, and the external is supported on the lateral arm plate.

#### DESCRIPTION

##### *Disk*

8 mm in diameter, sub-circular contour, slightly flattened dorsally, with slight interradiial excavations. Dorsal surface covered with imbricated scales. Distinct primary plates, separated from each other, and slightly larger than the other disk scales. Proximally, in each interradius, there is a scale of the same size as the primary plates. The radial shields correspond to approximately a third of the disk radius, are semicircular in shape, longer than wide and completely separated by a triangular wedge of scales. Two of the

latter are relatively large, surrounded by smaller ones.

Tiny imbricated scales cover the oral surface of the interradii with their free margins orientated distally. These scales invade the interradii dorsally, where they become slightly bigger. The bursal slits are conspicuous, narrow and long, with a row of marginal scales.

The oral shields are small in relation to the size of the disk. They are longer than wide, have a proximal acute angle, and a blunt distal margin. The madreporite is slightly larger than the other oral shields. Sub-triangular adoral shields are joined on the interradiial mid line. Jaws are short and erect. There are three papillae in each half jaw: the infradental is robust, erect and separated from

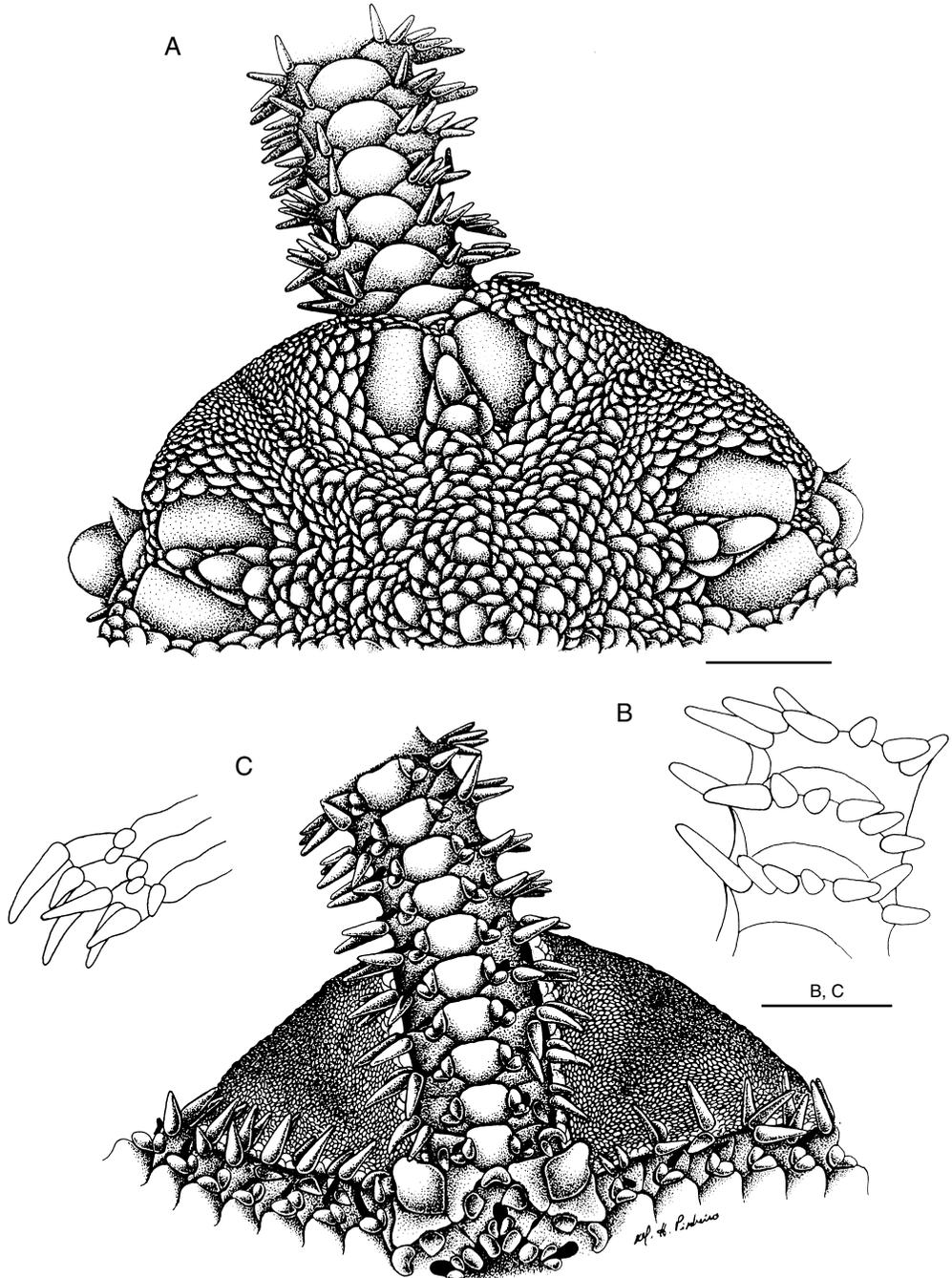


FIG. 3. — *Amphiura (Amphiura) callida*. n. sp., holotype 8 mm disk diameter, 45 mm arm length; **A**, dorsal surface, primary plates away from each other in the radial areas of the disk, a scale approximately the same size as the primary plates in each interradius of the disk; **B**, detail of the arm spines; **C**, detail of the oral shields, distal oral papillae are larger, enlarged, erected, with an acute edge, leaf-like in shape. Scale bars: A, 1.5 mm; B, C, 0.1 mm.

the opposite one with which it forms a pair; the second is narrow and pointed; the distal one is the biggest, larger and erect with an acute extremity in the resemblance of a leaf.

#### Arms

45 mm long and 1.5 mm wide. The dorsal arm plates are contiguous, longer than wide and flabelliform. These plates are reduced in size in the first six segments nearest to the disk. The ventral arm plates are pentagonal, contiguous with slight lateral indentation; the first plate is very small with a concave proximal margin. The lateral arm plates are narrow, separated from each other, and support spines as long as the length of the segment. The dorsal spines are the smallest. The number of spines are distributed as follows on the first seven segments: 2, 3, 3, 4, 4, 5, 6, and 7 from the 8<sup>th</sup> to the 11<sup>th</sup> segment. The number of spines decreases to three distally. Spines are cylindrical with a blunt tip. In ventral view, proximally, the second spine from the bottom upwards has a curved extremity that turns inwards, hook-like. There are two tentacle scales: the internal is slightly larger and is supported on the ventral plate, and the external is supported on the lateral plate.

No variation is observed in the paratypes.

#### Ecology

A total of 61 individuals of *Amphiura callida* n. sp. were collected from a station subject to temperatures of 10 °C or less during upwelling in the spring and summer months. As this species was not sampled in the more typically tropical northern stations during the cruise, it could be that this area represents the northern limit of its range. This area has strong seasonality signals with a nutrient increase in spring and summer, and this has probably resulted in a more typically temperate faunal composition close to the island of Cabo Frio. The collection station had a sandy ooze substrate (Albuquerque & Guille 1991) with a water temperature of 23 °C and salinity of 34. *Amphiura callida* n. sp. have hook-like spines on the second arm segment, which might be used for traction. According to Guille & Albuquerque (1990), the other ophiuran species in the vicinity of Cabo Frio were *Amphilimna olivacea* (Lyman, 1869) and *Amphiura crassipes* Ljungman, 1867. Both species were found in high densities along with fewer numbers of *Ophiothrix rathbuni* Ludwig, 1882, *Nudamphiura carvalhoi* Tommasi, 1965, *Amphiura complanata* Ljungman, 1867, and *Ophiacantha cosmica* Lyman, 1878.

Genus *Amphiodia* Verrill, 1899

#### KEY OF SPECIES FROM THE GENUS *AMPHIODIA* VERRILL, 1899 FOUND IN THE COAST OF BRAZIL

1. One tentacle scale ..... *A. pulchella* (Lyman, 1869)
- Two tentacle scales ..... 2
2. Three acute and thin arm spines, the dorsal one smaller than the others; disk with imbricated scales, and primary scales are evident ..... *A. atra* (Stimpson, 1852)
- Three arm spines, but stout, or robust with a wide and round apex ..... 3
3. Dorsal surface of the disk is covered by large scales, and has a rosette of large primary plates; two arm spines on the first arm segment, and three on the other segments. The dorsal and ventral spines are blunt, flattened dorso-laterally, and slightly longer than the middle spine, which is blunt and subcylindrical .... *A. habilis* n. sp.
- Dorsal surface of the disk covered by small imbricated scales ..... 4

4. Only the central primary scale is most evident; the three arm spines are long and robust with a wide and curved apex ..... *A. planispina* (von Martens, 1867)
- Dorsal primary scales are evident; three stout and short spines, smaller than the arm segment ..... *A. riseii* Lütken, 1969

*Amphiodia habilis* n. sp.  
(Figs 4; 5)

TYPE MATERIAL. — MD55/Brazil 1987, stn 52, CB 90, 19°33'S, 39°34'W, 34 m depth, 29.V.1987, holotype d.d. 3.5 mm (MNHN, EcOs22638).

TYPE LOCALITY. — Opening of the Rio Doce.

ETYMOLOGY. — From the Latin verb *habere*, translated as *habilis*: to have, in allusion to the spirit of the cruise MD55.

MATERIAL EXAMINED. — MD55/Brazil 1987, stn 52, BT 90, 19°33'S, 39°34'W, 34 m depth, 29.V.1987, holotype d.d. 3.5 mm (MNHN, 22638) and 1 paratype (USU.EO.III.9.2.1149), without disk.

DIAGNOSIS. — Disk with inflated circular contour, slightly flattened, dorsally covered by large scales, and ventrally with small imbricated scales, forming a clear border at the edge of the disk. In each jaw, the oral plates protrude ventrally at their point of contact. Three oral papillae, the most distal on adjacent jaws almost sealing the oral opening. Dorsal and ventral arm spines are slightly larger, flattened, blunt, and approximately the same size as the segment itself. The middle spine is smallest, sub-cylindrical and blunt. Two tentacle scales.

DESCRIPTION

*Disk*

Thick, circular contour, slightly flattened dorsally, measuring 3.5 mm in diameter and 1.09 mm in height. Dorsal surface covered by large scales. A rosette of large primary plates is conspicuous; the central plate is pentagonal, and the radial plates are larger and irregular in shape. From the centre of the disk to its border, on each inter-radius, there is a row of scales larger than the ones surrounding the radial shields, the most distal scale is semicircular with the round border towards the centre of the disk. The radial shields are contiguous, wide, slightly smaller than half of the disk radius, and slightly longer than wider.

Smaller imbricated scales forming a distinct border at the edge of the disk cover the ventral inter-radii. Bursal slits are conspicuous.

Oral shields are longer than wide, and almost lozenge-shaped. Adoral shields are triangular, contiguous proximally at the interradial mid line, enclosing the oral shield. In each jaw, the oral plates protrude ventrally at their point of contact. The oral tentacle scale is not present. There are three oral papillae: the paired infradentals are robust and separated by a slight gap; the intermediate papilla is narrower than the distal one. The most distal papillae on adjacent jaws almost seal the oral opening.

*Arms*

20 mm long. Dorsal plates are contiguous, sub-rectangular, and slightly wider than longer. The lateral edges of the dorsal arm plates are rounded, the distal edge is concave. Ventral arm plates are contiguous, the most proximal being smallest, and the others as long as wide, almost square within slightly excavated distal border. The lateral arm plates are inconspicuous dorsally. There are two spines on the first segment, the ventral one being flattened laterally, blunt, and the dorsal one blunt and subcylindrical in shape. There are three spines on the other arm segments: the dorsal and ventral arm spines are slightly bigger, flattened laterally, blunt, and approximately the same size as the segment itself. The middle spine is smaller, subcylindrical and blunt. There are two equal in size, semi-circular tentacle scales: the internal articulates on the ventral arm plate, and the external tentacle scale on the lateral arm plate.

ECOLOGY

Two specimens of *Amphiodia habilis* n. sp. were collected near the Rio Doce outlet. Ophiurid diversity in this area is low. The

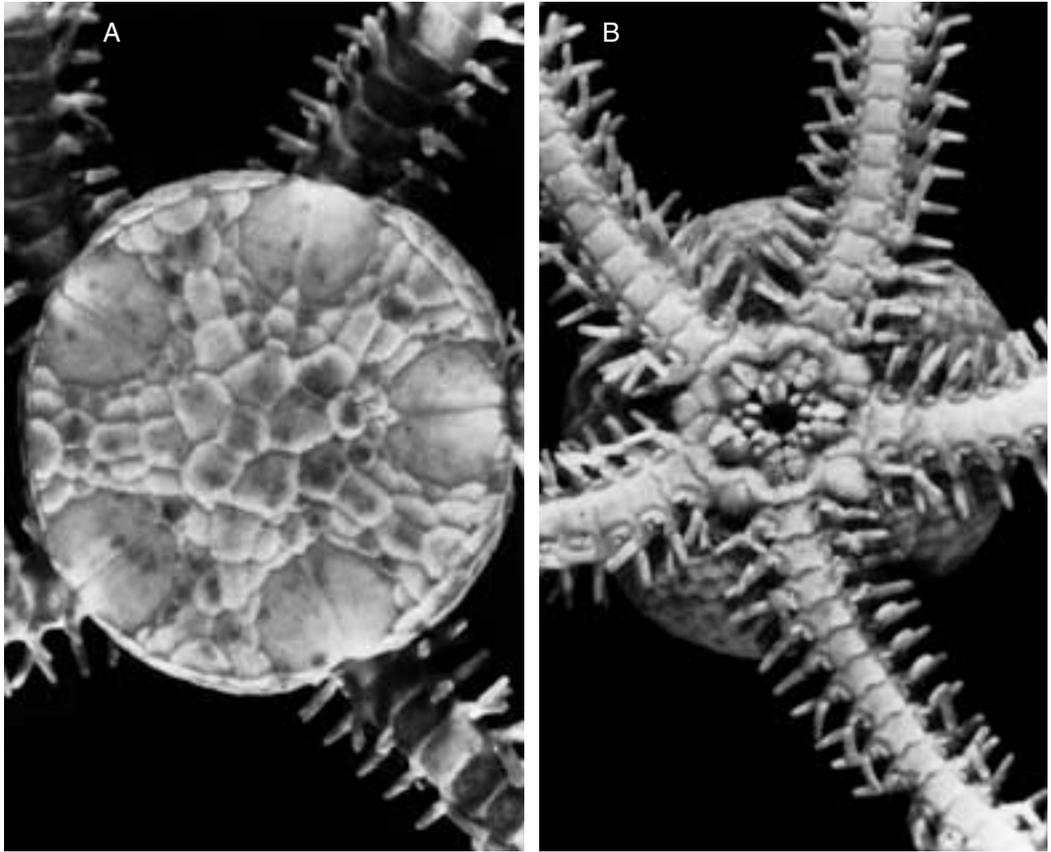


FIG. 4. — *Amphiodia habilis* n. sp., holotype 3.5 mm disk diameter, 20 mm arm length; **A**, dorsal surface of the disk; **B**, oral surface of the disk.

locality has a strong fresh water flow from the river that is reflected by the presence of characteristic ophiuroid fauna (Guille & Albuquerque 1990): notably the populations of three abundant species, *Ophiocnida loveni* (Ljungman, 1866), *Amphiodia atra* (Stimpson, 1852) and *Hemipholis elongata* (Say, 1825). The water temperature and salinity were respectively 25.5 °C and 36 at the time of the sample, reflecting the tropical conditions of the environment (Esteves *et al.* 1987). Nonetheless, this station probably receives large quantities of river discharge and fine particles, evidenced by the substrate composed of organic rich black ooze (Albuquerque & Guille 1991).

## DISCUSSION

Tommasi (1999) has recorded 16 species of *Amphiura* for the Brazilian coast.

*Amphiura (Amphiura) callida* n. sp. has been compared with its most similar species worldwide, including *Amphiura (A.) otteri* Ljungman, 1872 from material of Canada, Gaspésie district (MNHN, EcOSL20805), and material of the Azores (MNHN, EcOSL20806); with *Amphiura (A.) crassipes* Ljungman, 1867, from a collection stored at the Federal University of Rio de Janeiro (UFRJ-Eq1917); with *Amphiura (A.) joubini* Koehler, 1912, from Antarctic (MNHN, EcOSL2074) marked as “typique” and with *Amphiura (A.) grandis* Koehler, 1896, from the

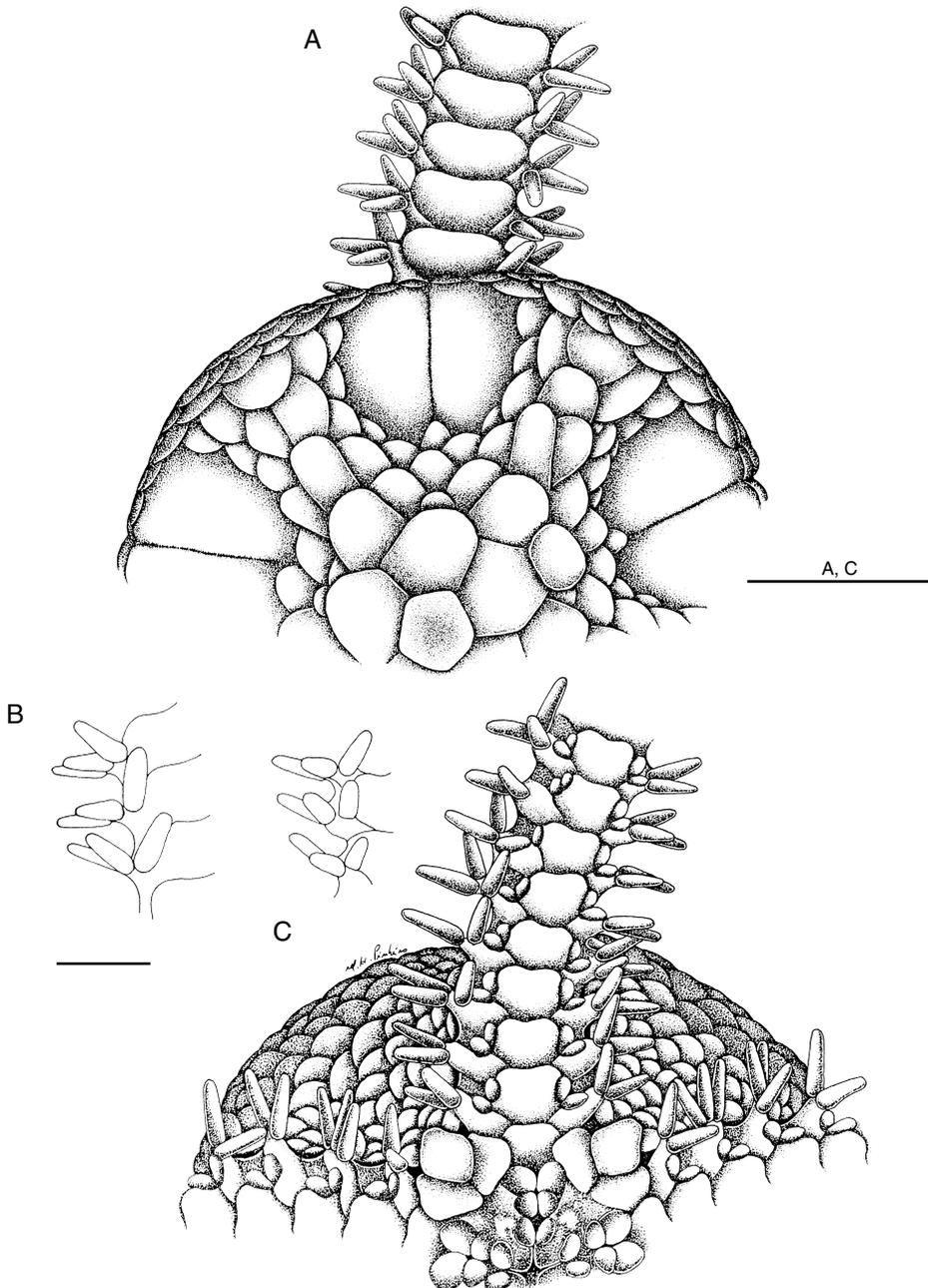


FIG. 5. — *Amphiodia habilis* n. sp., holotype 3.5 mm disk diameter, 20 mm arm length; **A**, dorsal surface; **B**, detail of the arm spines; **C**, oral surface, detail of the oral shields and arm spines, the distal oral papillae of the half jaw touch the neighbouring ones almost closing the oral opening. Scale bars: A, C, 1.0 mm; B, 0.5 mm.

Bay Biscay, which was described and illustrated by Koehler (1909).

*Amphiura* (*A.*) *callida* n. sp. and *Amphiura* (*A.*) *otteri* are distinguished by several characteristics. In *Amphiura* (*A.*) *otteri*: 1) the ventral surface scales are slightly larger; 2) the radial shields are longer and narrower; 3) the oral shields are sub-circular; 4) the first ventral arm plate is trapezoidal; 5) the tip curvature of the second ventral arm spine is accentuated on the proximal segments.

*Amphiura* (*A.*) *crassipes* Ljungman, 1867 is different in that: 1) the disk scales are not imbricated and have raised borders; 2) the distal oral papillae are cylindrical, pointed as in *Amphiura* (*A.*) *joubini* Koehler, 1912; 3) the presence of eight arm spines, although Bernasconi & D'Agostino (1974) recorded seven in some Argentinian specimens.

Amongst the Brazilian *Amphiura*, *Amphiura* (*A.*) *joubini* Koehler, 1912 is the nearest to *Amphiura* (*A.*) *callida* n. sp., but *Amphiura* (*A.*) *joubini* differs in having: 1) smaller disk scales; 2) smaller and narrower radial shields; 3) more distinctly excavated interradii; 4) the tips of the ventral arm spines from the proximal segments close to the disk are curved as in *A. callida*, but also, they can be bifurcated or not.

*Amphiura* (*A.*) *callida* n. sp. resembles *Amphiura* (*A.*) *grandis* Koehler, 1896, but differs in that the latter has up to five arm spines, and is closely related to *Amphiura* (*A.*) *otteri*.

Although *Amphiura* (*A.*) *callida* n. sp. resembles the species with which it has been compared, it differs fundamentally from them in the shape and size of the distal oral papillae. In *Amphiura* (*A.*) *callida* n. sp., the latter is large, erect, with a leaf-like shape. The characteristics that bring *Amphiura* (*A.*) *callida* n. sp. closer to the other species are the general aspect of the disk and the curvature of the second from the ventral arm spine.

Tommasi (1999) reports only three species of *Amphiodia* for the coast of Brazil as follows: *Amphiodia planispina* (von Martens 1867), *Amphiodia pulchella* (Lyman, 1869), and *Amphiodia riisei* Lütken, 1860 (in Lyman 1860). Albuquerque (1986) reports *Amphiodia atra*

(Stimpson, 1852) from 31 stations in the northern and northeastern coast of Brazil. However, Tommasi (1999) transferred *A. atra* (Stimpson, 1852) to *Microphiopholis* Thomas, 1966, although with A. M. Clark (1970) we consider the latter genus uncertain and invalid.

*Amphiodia habilis* n. sp. has been compared with the most similar known congener, *A. riisei* (Lütken 1859), using a specimen stored at the Universidade Santa Úrsula registered as USU.EO.III.9.2.823. In Brazil, *A. riisei* (Lütken 1859) is known from São Paulo to Paraná and Santa Catarina (Tommasi 1970), Rio de Janeiro (H. L. Clark 1915) and several stations from the North and Northeast Brazil (Albuquerque 1986).

*Amphiodia habilis* n. sp. differs from *Amphiodia riisei* in the following characteristics: in *Amphiodia riisei* 1) the dorsal surface of the disk is slightly elevated; 2) the mid-arm spines are slightly longer than the ventral and dorsal ones; 3) all the spines are cylindrical, and characteristically, the mid-spine of the first eight proximal arm segments has a crown of tiny hyaline spines at the apex.

*Amphiodia habilis* n. sp. and *Amphiodia violacea* (Lütken, 1856) are also similar. However, as indicated by Nielsen (1932), the latter species typically has: 1) a protuberance towards the mouth on the first ventral arm plate, and 2) the distal disk scale of the dorsal interradii row is trapezoidal.

*Amphiodia habilis* n. sp. has been compared with *Amphiodia grisea* (Ljungman, 1867). As indicated by Koehler (1926), the latter species differs from *A. habilis* and *A. violacea* (Lütken, 1856), in having a bulge in the shape of a spine on the first arm plate.

*Amphiodia trychna* (H. L. Clark, 1918) differs from *A. habilis* in having: 1) the radial shields are contiguous only in two thirds of its length; 2) a circle of small scales between the central plate and all the other plates of the primary rosette; 3) small intercalated scales on the row of bigger plates in the dorsal interradii; 4) relatively much longer arms; 5) according to the conclusion of Thomas (1962), the dorsal arm spine is longer than the others.

According to A. M. Clark (1970) *Amphiodia violacea* (Lütken, 1856), *Amphiodia riisei* (Lütken, 1859), *Amphiodia grisea* (Ljungman, 1867), *Amphiodia planispina* (von Martens, 1867), *Amphiodia tabogae* Nielsen, 1932, *Amphiodia psara* H. L. Clark, 1935 and *Amphiodia sculptilis* Ziesenhenné, 1940 have an enlarged third oral papillae (i.e., the distal oral papillae) that may be identical to the third operculum-like papillae of *Amphipholis* sensu lato. *Amphiodia habilis* resembles these species in having the same characteristic. However, a revision of the genus *Amphipholis* is needed and this comparison should be regarded with caution (see Hendler *et al.* 1995).

The two stations from where the new species were collected are influenced by two different environmental regimes: 1) *Amphiura callida* n. sp. collected from the south of Cabo Frio, seasonally impacted by the upwelling of cold, nutrient rich, South Atlantic Central Waters originated in the Antarctic; and 2) *Amphiodia habilis* n. sp. collected from a more typically tropical station, but subjected to fresh water and organic rich output from the river 'Rio Doce'.

During the MD55 cruise, the number of species collected was low at both stations where the new species were found. But the number of specimens per species was inversely proportional to the number of species (Guille & Albuquerque 1990). This may indicate that these two areas suffer frequent impact, do not really favour species diversity, and allow only for the prevalence of the more resistant species. If these two new species are amongst the more tolerant, they may occur elsewhere. However, this would have to be confirmed through new studies along the Brazilian coast.

### Acknowledgements

We are grateful to Dr Gordon Hendler and Dr Tim O'Hara for their comments and suggestions to this paper. We thank the French institutions of the oceanographic cruise TAAF MD55/Brazil in 1987: the Muséum national d'Histoire naturelle de Paris, the Universidade Santa Úrsula at Rio de Janeiro, and TAAF (Terres australes et antarctiques françaises) for all their support. We

are especially grateful to Dr Jeanete Maron Ramos (Universidade Santa Úrsula), co-responsible for the mission MD55. We thank Maria Helena Pinheiro and Paulo César Onofre for the drawing figures, and Francisco Gomes Neto for technical assistance with the photographs.

### REFERENCES

- ALBUQUERQUE M. N. 1986. — *Ophiuroidea Gray, 1840 (Echinodermata) da plataforma continental do Norte e Nordeste do Brasil*. Doctorate Thesis, Instituto de Biociências da Universidade de São Paulo, São Paulo, Brazil, 393 p.
- ALBUQUERQUE M. N. & GUILLE A. 1991. — Ophiuroidea (Echinodermata) ao largo do Brasil: Banco dos Abrolhos, Cadeia Submarina Vitória-Trindade e Plataforma Continental Adjacente. *Boletim do Museu Nacional Zoologia* 353, 30 p.
- BERNASCONI I. & D'AGOSTINO 1974. — Ampliación del área de distribución de *Amphiura crassipes* Ljungman, 1867 (Ophiuroidea, Amphiuroidae). *Physis (Buenos Aires) Revista de la Sociedad Argentina de Ciencias Naturales* 33 (86): 135-138, 1 pl.
- CARBONEL H. C. A. A. & VALENTIN J. L. 1999. — Numerical modelling of phytoplankton bloom in the upwelling ecosystem of Cabo Frio (Brazil). *Ecological Modelling* 116: 135-148.
- CLARK A. M. 1970. — Notes on the family Amphiuroidae (Ophiuroidea). *Bulletin of the British Museum of Natural History Zoology* 19 (1): 1-81, figs 1-11.
- CLARK H. L. 1915. — Catalogue of recent ophiurans. *Memoirs of the Museum of Comparative Zoology at Harvard College* 25 (4): 165-376, 20 pls.
- ESTEVEZ P. C., JACQUES G. & PANOUSE M. 1987. — Grands traits de l'hydrologie au large des côtes du Brésil, in GUILLE A. & RAMOS J. M., *Les rapports des campagnes à la mer TAAF MD55/Brésil à bord du Marion Dufresne 6 mai-2 juin 1987*. Technical Report 87-03, Instaprint, La Riche: 29-56.
- GUILLE A. & ALBUQUERQUE M. N. 1990. — Stratégie de dispersion et insularité: Les Ophiures littorales de la chaîne des seamounts Vitória-Trindade (Brésil). Résultats préliminaires, in RIDDER C. DE, DUBOIS C., LAHAYE M. C. & JANGOUX M. (eds), *Echinoderm Research - Proceedings of the Second European Conference on Echinoderms, Brussels, 18-21, September 1989*. A. A. Balkema Publishers, Rotterdam: 125-129, 2 tabs.
- GUILLE A. & RAMOS J. M. 1987. — *Les rapports des campagnes à la mer TAAF MD55/Brésil à bord du Marion Dufresne 6 mai-2 juin 1987*. Technical Report 87-03, Instaprint, La Riche, 198 p.
- HENDLER G., MILLER J. E., PAWSON D. L. & KIER P. M. 1995. — *Sea Stars, Sea Urchins, and Allies -*

- Echinoderms of Florida and the Caribbean*. Smithsonian Institution Press, Washington; London, 390 p.
- KOEHLER R. 1909. — Échinodermes provenant des campagnes du yacht *Princesse Alice* (Astéries, Ophiures, Echinides et Crinoïdes). *Résultat des Campagnes scientifiques accomplies sur son yacht par Albert 1<sup>er</sup> Prince Souverain de Monaco* 34, 128 p.
- KOEHLER R. 1926. — Révision de quelques Ophiures de Ljungman appartenant au Musée d'Histoire naturelle de Stockholm. *Arkiv für Zoologi* 19A (2): 1-29, pls 1-5.
- LYMAN T. 1860. — Descriptions of new Ophiuridae, belonging to the Smithsonian Institution and to the Museum of comparative Zoology at Cambridge. *Proceedings of the Boston Society of Natural History* 7 (13): 193-205.
- NIELSEN E. 1932. — Ophiurans from the gulf of Panamá, California, and the Strait of Georgia. *Videnskabelige meddelelser fra Dansk Naturhistorisk Forening i Kobenhavn* 91: 241-346, figs 1-42.
- SAY T. 1825. — On the species of the Linnean genus *Asterias* inhabiting the coast of the United States. *Journal of the Academy of Natural Science Philadelphia* 5: 141-154.
- TAVARES M. 1999. — The cruise of the *Marion Dufresne* off the Brazilian coast: account of the scientific results and list of stations. *Zoosystema* 21 (4): 597-605.
- THOMAS L. P. 1962. — The shallow water Amphiuroidae brittle stars (Echinodermata: Ophiuroidea) of Florida. *Bulletin of Marine Science of the Gulf Caribbean* 12 (4): 633-694, figs 1-23.
- THOMAS L. P. 1965. — The rediscovery of *Amphiura kinbergi* Ljungman, 1871. *Bulletin of Marine Science of the Gulf Caribbean* 15 (3): 638-641.
- TOMMASI L. R. 1970. — Os ofiuróides recentes do Brasil e de regiões vizinhas. *Contribuições do Instituto Oceanográfico da Universidade de São Paulo série Oceanografia Biológica* 20: 1-146.
- TOMMASI L. R. 1999. — Echinodermata recentes e fósseis do Brasil. Published in the internet in *Invertebrados Marinhos Registrados no Litoral Brasileiro*, site [www.bdt.org.br/zoologiaechinodermata/](http://www.bdt.org.br/zoologiaechinodermata/)
- VALENTIN J. L. 1984. — Analyse des paramètres hydrobiologiques dans la remontée de Cabo Frio (Brésil). *Marine Biology* 82: 259-276.
- VENTURA C. R. R. & FERNANDES F. C. 1995. — Bathymetric distribution and population size structure of paxillosid seastars (Echinodermata) in the Cabo Frio upwelling ecosystem of Brazil. *Bulletin of Marine Science* 56 (1): 268-282.
- VENTURA C. R. R., FALCÃO A. P. C., SANTOS J. S. & FIORI C. S. 1997. — Reproductive cycle and feeding periodicity in the starfish *Astropecten brasiliensis* in Cabo Frio upwelling ecosystem (Brazil). *Invertebrate Reproduction and Development* 31 (1-3): 135-141.

Submitted on 17 July 2000;  
accepted on 26 February 2001.