

**Comments on brazilian *Halichondria* Fleming
(Halichondriidae, Halichondrida, Demospongiae), with the
description of four new species from the São Sebastião
Channel and its environs (Tropical Southwestern Atlantic)**

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ABSTRACT. Over 70 species of *Halichondria* Fleming, 1828 are known world-wide, but only five from the Brazilian Coast. Brazilian records have their status re-evaluated here, and four new species are described for the São Sebastião Channel area, in the Tropical Southwestern Atlantic, viz. *H. cebimarensis* sp. n., *H. sulfurea* sp. n., *H. migoltea* sp. n. and *H. tenebrica* sp. n.

KEY WORDS. Porifera, *Halichondria*, taxonomy, Brazilian coast, Southwestern Atlantic, new species

Halichondria Fleming, 1828 is a genus which poses special challenges to the porifera taxonomist due to a shortage of conspicuous anatomical characters. Species may have one or more categories of oxeas, frequently hard to tell apart, distributed in a criss-crossed pattern, where spicular tracts are seldom visible. Such absence of a pattern is known as the halichondroid architecture.

There are nevertheless over 70 species described for the whole world, and the detailed study of these records has gained some momentum with the discovery of biologically active metabolites in some *Halichondria* (e.g. MUNRO *et al.* 1994). For the Brazilian coast, six species were cited previously (DE LAUBENFELS 1956; JOHNSON 1971; HECHTEL 1983; MURICY *et al.* 1991; LERNER 1996; MURICY & MORAES 1998), viz. *Halichondria* ("Menanetia") sp.; *Halichondria* sp.; *H. brazilensis* Hechtel, 1983; *H. panicea* (Pallas, 1766); *H. lutea* Alcolado, 1984 and *H. magniconulosa* Hechtel, 1965. The status of these records will be discussed below. It is the purpose of this article to describe four new species found in the São Sebastião Channel area.

MATERIAL AND METHODS

Specimens were studied *in situ* whenever possible. The underwater photographs were taken by the senior author with a Nikonos V underwater camera and a close-up kit (close-up lens or extension tubes). Size classes for the range of possible spicule lengths were obtained by using the classic Sturges' algorithm ($1 + 3.3 \log \Delta$, where " Δ " is the range between largest and smallest lengths). They were collected with a diver's knife through scuba diving or wading at low tide. Preparations of

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dissociated spicules and thick sections slides follow the usual procedures as described elsewhere (MOTHES-DE-MORAES 1985; HOOPER 1997) for study under light microscopy. Figure 1 shows the collecting localities in the São Sebastião area, and the latter's position with regard to the Southeastern Brazilian coastline and the Southwestern Atlantic.

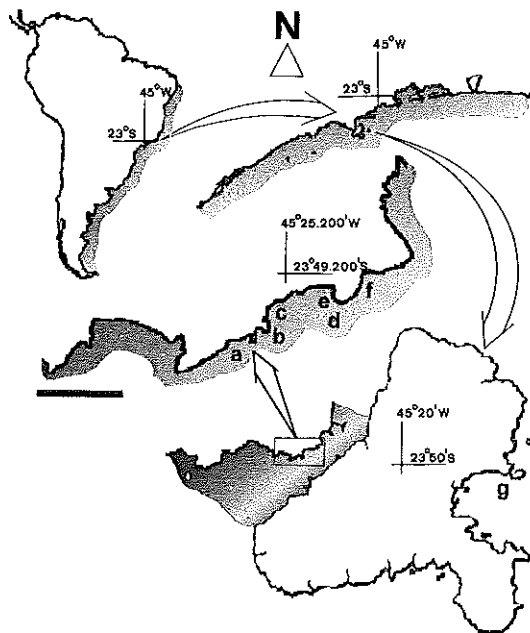


Fig. 1. Map showing South America, a section of the Southeastern Brazilian coastline, Ilha de São Sebastião; and, in detail, the continental face of São Sebastião Channel, with the collecting localities indicated. (a) Saco Grande, $23^{\circ}49.715'S - 45^{\circ}25.480'W$, next to Ponta do Baleeiro; (b) Ponta do Jarobá, $23^{\circ}49.676'S - 45^{\circ}25.278'W$; (c) Rocky coast between Praia does Cabelo Gordo and Praia das Pitangueiras, $23^{\circ}49.564'S - 45^{\circ}25.303'W$; (d) Farol do Moleque, $23^{\circ}49.831'S - 45^{\circ}24.754'W$; (e) Ponta Recife, $23^{\circ}49.501'S - 45^{\circ}24.796'W$; (f) Praia Preta, $23^{\circ}49.247'S - 45^{\circ}24.435'W$; (g) Celada, $23^{\circ}50.563'S - 45^{\circ}14.402'W$. Scale bar = 1 km (a-f), 5 km (g).

Abbreviations used are: (BMNH) The Natural History Museum, London, U.K.; (CEBIMar/USP) Centro de Biologia Marinha, Universidade de São Paulo, São Sebastião, SP, Brazil; (MCNZ) Museu de Ciências Naturais, Fundação Zoobotânica do Rio Grande do Sul, Porto Alegre, RS, Brazil; (MNRJ) Museu Nacional, Universidade do Brasil, Rio de Janeiro, Brazil; (YPM) Yale Peabody Museum, New Haven, CT, U.S.A.; (UFRJPOR) Universidade do Brasil, Porifera Collection – also at Museu Nacional; (UESC) Universidade Estadual de Santa Cruz, Ilhéus, Bahia, Brazil; (UNICAMP) Universidade Estadual de Campinas, Campinas, São Paulo, Brazil; (USNM) National Museum of Natural History, Smithsonian Institution, Washington D.C., U.S.A.; (ZMA) Zoologisch Museum, Amsterdam, The Netherlands.

RESULTS

Halichondrida Vosmaer, 1885

Halichondriidae Vosmaer, 1887

Halichondria Fleming, 1828

Diagnosis. Massive-amorphous; ectosomal skeleton with thin, tangential peel, clearly detachable, composed of single, or vague bundles of smaller oxeote spicules, supported by choanosomal columns of oxeas traversing subdermal spaces; choanosome has the appearance of a disordered loose reticulation ("halichondroid" structure), and spicule tracts are poorly defined, directionless; oxeote spicules of intermediate to relatively small size, sometimes modified to quasistylote or even true styles; ectosomal structure may be secondarily lost; microscleres absent or may include raphides occurring singly or in bundles (trichodragmata) in "*Raspaigella*"; larvae are incubated and tufted-ciliate (HOOPER 1997). Type species: *Spongia panicea* Pallas, 1766).

Halichondria cebimarensis sp. n.

Figs 2, 5, 9a-b, 10a-b, 14; Tab. I

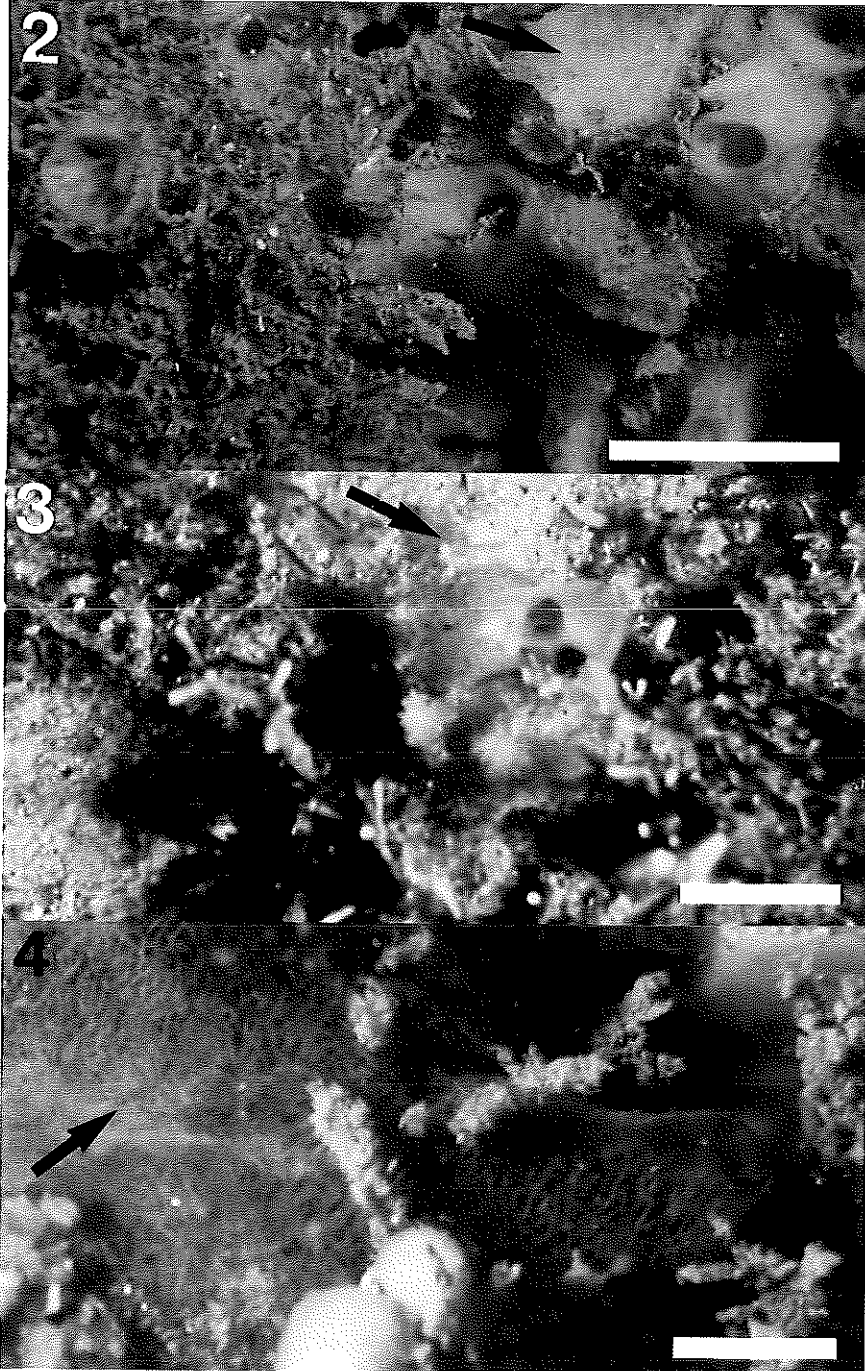
Holotype: MNRJ 2030, Ponta do Jarobá, Canal de São Sebastião, SP, 2 m depth, E. Hajdu leg., 28/I/1999. Schyzotypes from holotype: BMNH 1999.5.12.1, ZMA 13629.

Paratypes: MNRJ 269, Ponta Recife, Canal de São Sebastião, São Sebastião, SP, 2 m depth, E. Hajdu leg., 22/I/1996; MNRJ 372, Farol do Moleque, Canal de São Sebastião, São Sebastião, SP, E. Hajdu leg., 29/I/1996; MNRJ 374, Ponta do Jarobá, Canal de São Sebastião, São Sebastião, SP, 2 m depth, E. Hajdu leg., 29/I/1996; MNRJ 709, Praia Preta, Canal de São Sebastião, São Sebastião, SP, 1.5 m depth, E. Hajdu leg., 3/II/1996; MNRJ 1301, 1328, Praia Preta, Canal de São Sebastião, São Sebastião, SP, 1-2 m depth, E. Hajdu & Colls leg., 22/XII/1997; MNRJ 1943, 1944, Praia Preta, Canal de São Sebastião, São Sebastião, SP, ca. 2 m depth, E. Hajdu & Colls leg., 27/XI/1998.

Comparative material. *Halichondria corrugata* Diaz et al., 1993 – USNM 23566 (holotype), Gulf Coast of Florida, 3 m depth. *Halichondria panicea* (Pallas, 1766) – MNRJ 1150, 1155, Canal de l'Île Vert (Roscoff, France), det. EH, C. Lévi & R.W.M. van Soest

Diagnosis. *Halichondria cebimarensis* sp. n. is set apart from other Tropical Western Atlantic *Halichondria* species by its turquoise colour alive, and oxeas in a single category mostly larger than 300 µm in length and 10 µm thick, and by the absence of grooves on oscular chimneys.

Description. Many specimens were seen in the field. The largest one, collected for screening for natural products was about 15 cm long and wide, and about 7 cm high. The holotype was 8 cm long, 5.5 cm wide and 2.5 cm high (Fig. 5). Shape is often massive, cushion-like, only seldom incrusting (MNRJ 269). Shape is very often irregular, with no clear pattern of projections (e.g. oscular chimneys),



which is partly explained by the species' common association to varied organisms, as well as to the possible inclusion of abundant large-sized (over 1 cm in diameter) debris (MNRJ 372; MNRJ 2030, Fig. 2). Volcaniform projections, 1-3 cm high, topped by oscula are conspicuous in a single specimen (MNRJ 374). Oscula (0.5 mm across) are often spread randomly. Consistency is firm, but easily torn. Texture is mostly rough. The surface appears reticulated to the naked eye, and is easily detached. Live colour is typically a light-green, often bluish (turquoise, Fig. 2).

Skeleton. The ectosomal skeleton (Fig. 9a) comprises a confused (para) tangential reticulation of oxeas, where primary and secondary tracts are only barely discernible. The choanosomal network (Fig. 9b) is confused, halichondroid, crossed by large acquiferous channels (up to 3 mm across).

Spicules (Figs 10a-b, 14, Tab. I). Oxeas, fusiform, slightly curved, rarely straight, mostly tapering gradually but sometimes slightly hastate, malformations very rare. Dimensions: 164.9 to 630.5 μm in length and 3.6 to 18 μm thick.

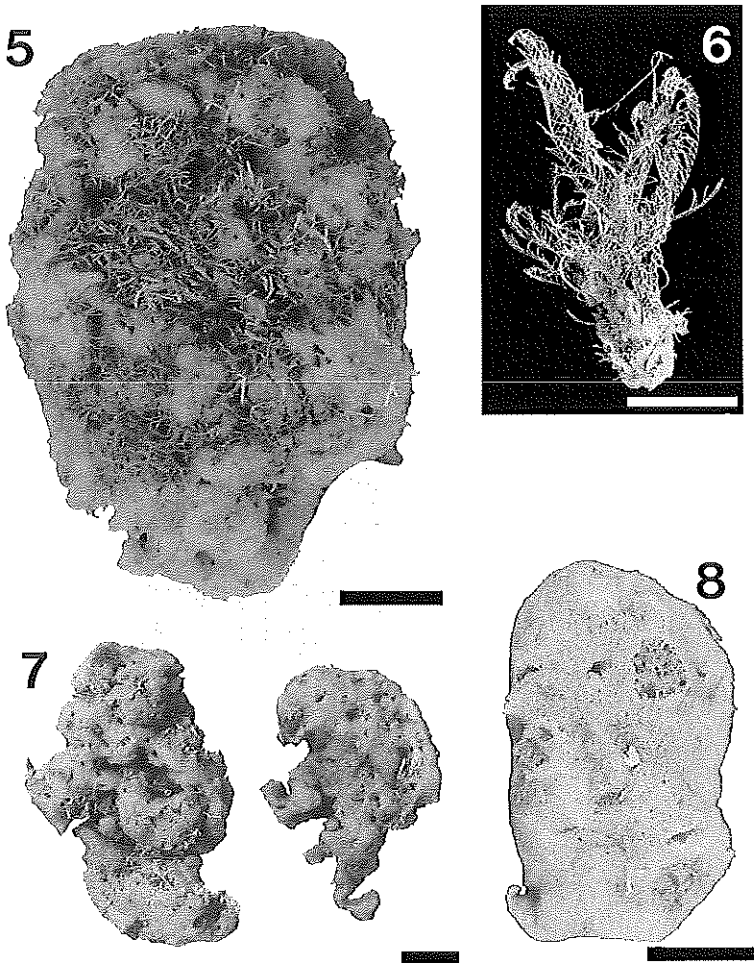
Ecology. The species has been found under small overhangs, or associated to algae (e.g. *Sargassum*) in photophilous habitats. Among the most commonly found associates are ophiuroids (two species, 136 specimens in the largest *Halichondria* – this sponge has been collected for marine natural products' research), tubeworms, ectopods and calcareous algae.

Table I. *Halichondria cebimarensis* sp. n. Comparative micrometric data for the holotype and paratypes. *H. corrugata*. Micrometric data for the holotype. Measures are given as smallest length – mean length – largest length/ smallest width – mean width – largest width, in micrometers. N = 100 for length measures and N = 20 for width measures unless stated otherwise.

Specimens	Oxeas-l
<i>Halichondria cebimarensis</i> sp. n.	
Holotype MNRJ 2030 – total	(110-260)330-461.2-620/5.9-1-13.7
Holotype MNRJ 2030 – surface	180-437.3-580 (N=50)/7.2-10.5-14.4
Holotype MNRJ 2030 – base	370-461.6-610 (N=50)/6-10.1-16.8
Paratype MNRJ 269	329-447.7-582/3.6-8.8-16.8
Paratype MNRJ 372	310-453.2-612/4.8-10.4-18
Paratype MNRJ 374	281-436.1-592/3.6-8.6-14.4
Paratype MNRJ 709	(165) 296-448.4-597/4.8-11.0-18
Paratype MNRJ 1301	(175) 315-488.3-631/3.6-10.9-16.8
Paratype MNRJ 1328	320-466.4-621/3.6-9.7-15.6
Paratype MNRJ 1943	260-433.6-580/3.7-8.3-13.7
Paratype MNRJ 1944	310-431.3-560/3.7-9.1-13.7
<i>Halichondria corrugata</i>	
Original description	130-370-520/5.9-12
Holotype here remeasured	155-406.1-572/4.8-6-13

Fig. 2-4. 2. *Halichondria cebimarensis* sp. n., holotype (MNRJ 2030). Specimen seen alive at Ponta do Jarobá. Note its turquoise colour. The new species is overgrown by algae, and by the green sponge, *Amphimedon viridis* Duchassaing & Michelotti, 1864 (arrow). Scale bar = 2 cm. (3) *Halichondria sulfurea* sp. n., paratype (MNRJ 478). Specimen seen alive between Praia do Cabelo Gordo and Ponta do Jarobá. Scale bar = 2 cm. (4) *Halichondria tenebrica* sp. n., holotype (MNRJ 521). Specimen seen alive between Praia do Cabelo Gordo and Ponta do Jarobá. Scale bar = 2 cm.

Etymology. The species is named after the Centro de Biologia Marinha (CEBIMar), of the University of São Paulo, at São Sebastião, both a historical monument of brazilian marine biology in the past half century, and a sure partner in developments to come. All the fieldwork conducted in the São Sebastião Channel area by the senior author in the last 10 years has depended heavily on the lab's facilities.



Figs 5-8. (5) *Halichondria cebimarensis* sp. n., holotype (MNRJ 2030). Specimen in its current state of preservation, after fixation in ethanol. (6) *Halichondria migottea* sp. n., holotype (MNRJ 1333) in its current state of preservation, after fixation in ethanol. Note association to the hidroid *Dentitheca* sp. (7) *Halichondria sulfurea* sp. n., holotype (MNRJ 1034) in its current state of preservation, after fixation in ethanol. (8) *Halichondria tenebrica* sp. n., holotype (MNRJ 521) in its current state of preservation, after fixation in ethanol. Scale bars = 1 cm.

Remarks. *Halichondria cebimarensis* sp. n. is distinguished from typical European *H. panicea* by its only rare possession of small oxeas (ca. 100 μm long), and by the considerably larger mean length of its oxeas (433-488 μm vs. ca. 300 μm). An interpretation on the status of records of *H. panicea* for the Brazilian Coast is furnished in the Discussion.

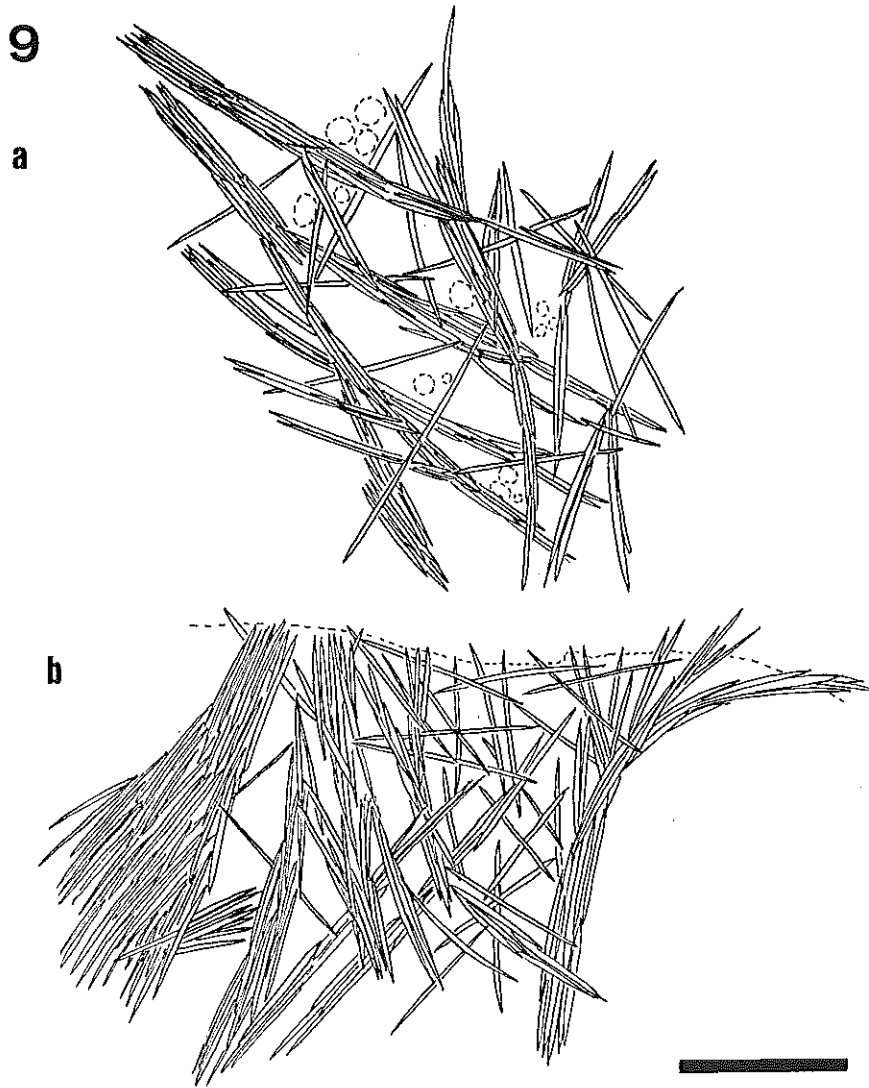


Fig. 9. *Halichondria cebimarensis* sp. n. (a) Ectosomal skeleton, pores are indicated as dashed rounded areas; (b) choanosomal skeleton. Scale bar = 400 μm .

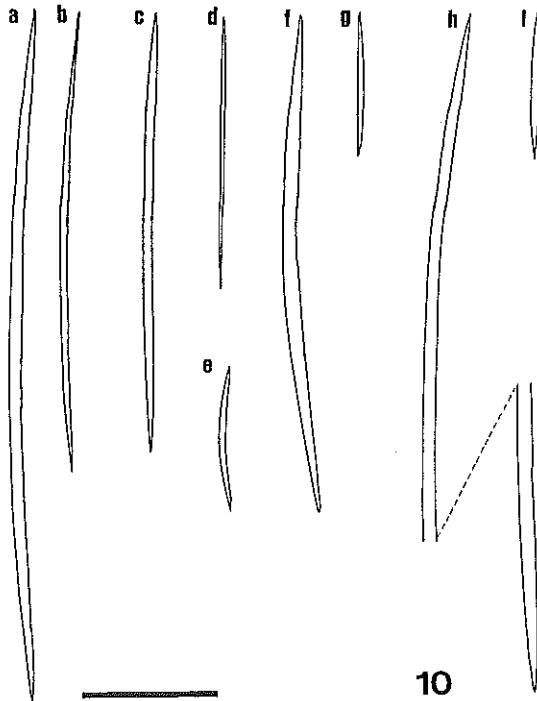


Fig. 10. (a-b) *Halichondria cebimarensis* sp. n.: (a) larger and (b) smaller oxeas; (c-e) *Halichondria migottea* sp. n.: (c) oxeas I, (d) oxeas II, (e) oxeas III; (f-g) *Halichondria sulfurea* sp. n.: (f) larger and (g) smaller oxeas; (h-i) *Halichondria tenebrica* sp. n.: (h) larger and (i) smaller oxeas. Scale bar = 100 μ m.

The new species approaches *H. corrugata* very closely. Overall sponge morphology and spicule dimensions are partly very similar. Both species differ though in some traits: viz. presence of small oxeas frequent (ca. 150 μ m long), presence of grooves on oscular chimneys and occurrence of greenish-brown and pink specimens in *H. corrugata*. These traits coupled to both species' allopatric occurrences are considered solid enough to warrant their recognition as distinct, possibly sister-species.

Oxeas under 200 μ m in length were found in the holotype of *H. cebimarensis* sp. n., 2030 (N = 3/200), and in two paratypes, 709 (N = 4/100) and 1301 (N = 2/100). The small oxeas in the paratypes could be allochthonous, possibly of haplosclerid origin (slightly 'cigar-shaped'), but those found in the holotype appear to be proper, although very rare.

Halichondria migottea sp. n.

Figs 6, 10c-e, 11a-b; 14; Tab. II

Holotype. MNRJ 1333, Saco Grande, next to Ponta do Baleeiro, Canal de São Sebastião, São Sebastião, SP, 1.5-2 m depth, A.E. Migotto *leg.*, 3/IX/1996.

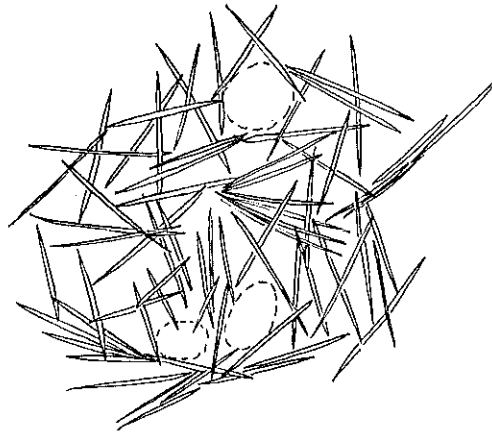
Diagnosis. *H. migottea* sp. n. is the only Tropical Western species of *Halichondria* with greyish-brown live colour, and three size categories of oxeads with mean lengths around 100, 200 and 300 μ m.

Description. Thickly encrusting, compressible, with an irregular surface. The holotype is 15 x 6 x 4 mm (length, width, thickness, Fig. 6). Live colour is greyish-brown, turning yellowish-white in spirit.

Skeleton. The ectosomal skeleton (Fig. 11a) is mostly confused, but a few loose, sinuous tangential tracts (2-3 spicules across) are visible. The choanosomal architecture (Fig. 11b) is essentially halichondroid. Round embryos (250-290 μ m in diameter) are present.

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a



b

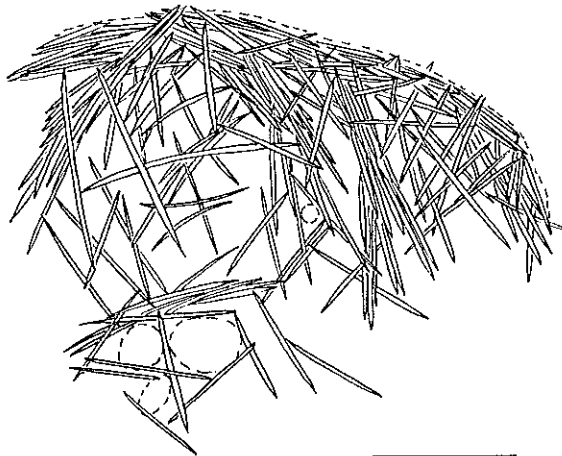


Fig. 11. *Halichondria migottea* sp. n. (a) Ectosomal skeleton, pores are indicated as dashed rounded areas; (b) choanosomal skeleton, acquiferous canals are indicated as dashed rounded areas. Scale bar = 200 μ m.

Spicules (Figs 10c-c, 15, Tab. II). Oxeas I – fusiform, mostly slightly curved, seldom straight, tapering gradually. Oxeas II – slender, tapering gradually. Oxeas III – more robust than -II, fusiform, slightly curved, tapering gradually.

Table II. *Halichondria migottea* sp. n. Micrometric data for the holotype. *H. sulfurea* sp. n. Micrometric data for the holotype and paratypes. *H. magniconulosa*. Micrometric data for the holotype. *H. tenebrica* sp. n. Micrometric data for the holotype and paratype. Measures are given as smallest length – mean length – largest length/ smallest width – mean width – largest width, in micrometers. N = 100 for length measures and N = 20 for width measures.

Specimens	Oxeas-I	Oxeas-II	Oxeas-III
<i>Halichondria migottea</i> sp. n.			
Holotype MNRJ	262-329.8-417/4.8-7.1-9.6	194-214.5-233/2.4-2.8-3.6	102-112.8-121/3.6-4.9-6
<i>Halichondria sulfurea</i> sp. n.			
Holotype MNRJ 1034	107-276.9-446/4.8-8.7-12		
Paratype MNRJ 342	100-312.2-460/3.7-8.4-12.5		
Paratype MNRJ 478	97-222.1-349/2.4-5.8-10.8		
Paratype MNRJ 506	101-305.7-388/4.8-8.1-12		
MNRJ 508	210-341.5-582/2.5-7.7-11.2		
<i>Halichondria magniconulosa</i>			
Original description	108-369/3-7		
Sensu DIAZ <i>et al.</i> (1993)	200-500/5-10	100-250/2-5	40-110/2-4
Holotype here remeasured	87-234.4-349/1.2-4.7-8.4	Not found	Not found
<i>Halichondria tenebrica</i> sp. n.			
Holotype MNRJ 521	116-368.0-650/4.8-10.2-16.8		
Paratype MNRJ 1316	126-351.0-708/5.0-11.4-17.5		

Ecology. The only collected specimen is epibiontic over the hydroid *Dentitheca*, and was collected at 1.5-2 m depth.

Etymology. The species is named after Prof. Dr. Alvaro Esteves Migotto of the Centro de Biologia Marinha, of the University of São Paulo, at São Sebastião. The name is dedicated to both the fact that he is the collector of the species, as well as to his commitment to the marine biology of the São Sebastião Channel area.

Remarks. There are another two shallow-water *Halichondria* from the Tropical Western Atlantic with three categories of oxeas mentioned. One of them, *H. magniconulosa* (cf. DIAZ *et al.* 1993), has a tendency to exhibit size frequency peaks, but no true category is found, as intermediate sizes are plentiful. Additionally, the restudy of its holotype revealed only two such peaks, as opposed to three, clearly separated ones in the new species described here (Fig. 14). *Halichondria* sp. was described by JOHNSON (1971) from the NE Brazilian coast. Her dry specimen was dull-white, possessing oxeas which, in general, are much larger than those found in *H. migottea* sp. n. (325-875 vs. 102-417 µm in length, respectively).

Halichondria sulfurea sp. n.

Figs 3, 7, 10f-g, 12a-b, 15; Tab. II

Holotype. MNRJ 1034, Rocky-coast between Praia do Cabelo Gordo and Praia das Pitangueiras, Canal de São Sebastião, São Sebastião, SP, 0.5-1 m depth, R.G.S. Berlinck *leg.*, 27/II/1995.

Schizotypes. BMNH 1999.5.12.2, ZMA 13630.

Paratypes. MNRJ 342, Celada, Baía de Castelhanos, 5-16 m depth, E. Hajdu & G. Muricy *leg.*, 25/I/1996; MNRJ 478, Rocky-coast between Praia do Cabelo Gordo and Ponta do Jarobá, Canal de São Sebastião, São Sebastião, SP, 0.5-1 m depth, E. Hajdu *leg.*, 16/VI/1997; MNRJ 506, small beach at the Southern end of Praia do Araçá, Canal de São Sebastião, São Sebastião, SP, intertidal, E. Hajdu *leg.*, 23/VI/1997.

Additional material. MNRJ 508, small beach at the Southern end of Praia do Araçá, intertidal, Canal de São Sebastião, São Sebastião, SP, E. Hajdu *leg.*, 23/VI/1997.

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Fig. 12. *Halichondria sulfurea* sp. n. (a) Ectosomal skeleton, sand grains are indicated as irregular rounded outlines; (b) choanosomal skeleton, sand grains are indicated as irregular rounded outlines. Scale bar = 200 μ m.

Comparative material. *Halichondria magnicomulosa* Hechtel, 1965- YPM 5039 (holotype), Rasta's wreck, on wood pilings, Port Royal, Jamaica. UFRJPOR 4021 (Tamandaré, Pernambuco State, Brazil; cf. MURICY & MORAES 1998).

Diagnosis. *Halichondria sulfurea* sp. n. is set apart from other Tropical Western Atlantic *Halichondria* species by its yellow colour; and oxeas in a single diverse category ranging from 97 to 460(582?) μm in length, where no tendency for the occurrence of size category peaks in their size frequency distribution is observed. Oxeas are 2.4-12.5 μm thick.

Description. The holotype comprises two fragments: the largest one is 59 x 37 x 12 mm (length, width, height), the smallest 49 x 32 x 10 mm (Figs 3, 7). Cushion-shaped, compressible, irregular surface with small lobate projections (0.5-1 cm high). Oscules are spread over the surface (ca. 1 mm in diameter). Live colour is yellow, turning beige in alcohol.

Skeleton. The ectosomal skeleton of the holotype is composed by primary tangential tracts (2-10 spicules across) to which abundant spicules strewn at random are added. Some sediment grains are present (Fig. 12a). Primary tangential tracts are not discernible in specimen 342. The choanosome is cavernous. The choanosomal network is made by loose tracts running to the surface, where many perpendicular brushes are seen laying side by side. Scattered spicules are very common everywhere (Fig. 12b).

Spicules (Figs 10f-g, 15, Tab. II). Oxeas smooth, slightly curved (seldom straight, often in MNRJ 342), mostly slightly fusiform, often tapering abruptly. Uncommon styloid modifications in MNRJ 342. Dimensions. 97-460(582?) μm in length and 2.4-12.5 μm thick.

Ecology. The holotype is associated to calcareous algae. MNRJ 342 is associated to barnacles and ophiuroids. Specimens MNRJ 506 e 508 were collected in an intertidal tunnel, where water currents can be strong.

Etymology. The species is named *sulfurea* (from sulfureus – latin for sulfur-yellow), due to its yellow live colour.

Remarks. The new species approaches *H. magnicomulosa* Hechtel, 1965. They are both yellow, and share oxeas in a comparable size range [97-460 (582?) vs 40-500 μm , *sensu* DIAZ *et al.* 1993; 87-349, holotype remeasured]. Important distinctive features are *H. magnicomulosa*'s tendency to exhibit size categories. DIAZ *et al.* (1993) point to two or three size categories, but we failed to find them in the holotype. There is a length distribution peak at ca. 130 μm and another at ca. 300 μm , but intermediary sizes are plentiful. Additionally, the width of the oxeas measured in the new species (2.4-8.6-12.5 μm) is nearly double that of the holotype of *H. magnicomulosa* (1.2-4.7-8.4 μm) as remeasured here. HECHTEL (1965) considered a distinctive feature of the latter species its darkening in spirit, which is not paralleled by *H. sulfurea* sp. n.

Halichondria cristata Sarà, 1978 and *H. prostrata* Thiele, 1905 were both described as yellowish (yellowish-white and light-yellow, respectively), thus approaching *H. sulfurea* sp. n. in this respect. They differ nevertheless in that their smaller oxeas are in the 250-300 μm range, while the new species has common oxeas

approaching 100 μm . Additional evidence for the new species' recognition as such stems from the very low similarity of the faunas in both Paulista/Brazilian and Patagonian/Magallanic biogeographic provinces (e.g. PALACIO 1982).

Halichondria tenebrica sp. n.

Figs 4, 8, 10h-i, 13a-b, 15; Tab. II

Holotype. MNRJ 521, Rocky-coast between Praia do Cabelo Gordo and Ponta do Jarobá, Canal de São Sebastião, São Sebastião, SP, 0.5-1 m, E. Hajdu *leg.*, 16/VI/1997.

Paratype. MNRJ 1316, Ponta do Jarobá, Canal de São Sebastião, São Sebastião, SP, 2 m, E. Hajdu & Colls *leg.*, 21/XII/1997.

Diagnosis. *H. tenebrica* sp. n. is the only Tropical Western Atlantic species of *Halichondria* with dark-greyish-green live colour, and one size category of oxeas with mean length around 350 μm , common smaller spicules (ca. 120 μm), and larger spicules beyond 600 μm .

Description. Thickly encrusting, compressible, with an irregular microhispid surface. Bumps and volcaniform projections occur. A clear subectosomal network was visible on the holotype alive. The holotype is 35 x 21 x 14 mm (length, width, thickness, Figs 4, 8). Live colour is dark-greyish-green or purple, turning greyish-purple in spirit.

Skeleton. The ectosome is made up of a dense tangential reticulation of multispicular tracts of oxeas (30-140 μm). Paucispicular, seemingly secondary tracts are seen here and there. There are large pore areas among the tracts (e.g. 300 μm across), with up to 30 pores (20-60 μm across) grouped. Spicules strewn in confusion vary widely in abundance from area to area (Fig. 13a). The choanosomal skeleton is densely reticulated by multispicular ascending tracts (48-223 μm). Tracts diverge a bit when approaching the surface (Fig. 13b).

Spicules (Figs 10h-i, 15; Tab. II). Oxeas smooth, nearly straight, fusiform, tapering gradually to very sharp endings. Dimensions: 116-708 μm in length and 4.8-17.5 μm thick.

Ecology. Both specimens were collected at shallow-waters, at very low energy habitats.

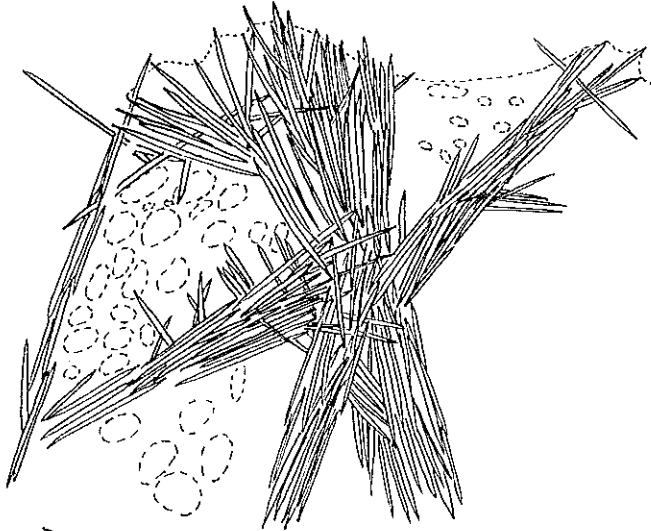
Etymology. The species is named after its dark colour (tenebrosus, tenebricus = latin for dark)

Remarks. *Halichondria tenebrica* sp. n. approaches *H. cebimarensis* sp. n., described above, and *H. corrugata*. Oxeas smaller than 200 μm abound, thus making *H. tenebrica* sp. n. even closer to *H. corrugata* in this respect, than *H. cebimarensis* sp. n. Distinguishing features are the grooved oscular chimneys, light greenish-brown or pink color, and the thinner and more abruptly sharpened oxeas of *H. corrugata*. Besides, the size frequency distribution of oxeas has a marked peak at ca. 500 μm (holotype remeasured, Fig. 15), not mirrored by *H. tenebrica* sp. n., where peaks are nearly indistinguishable (holotype), or near the smaller spicules (ca. 150 μm , paratype). We believe the distinctive features just quoted, coupled to

both species seemingly allopatric distribution, confirm their status as two valid species. *H. tenebrica* sp. n. differs from *H. cebimarensis* sp. n. by its much darker live-colour, darker colour in spirit, abundance of oxeas smaller than 200 μm , and a much denser and conspicuous reticulation of tracts of megascleres.

13

a



b

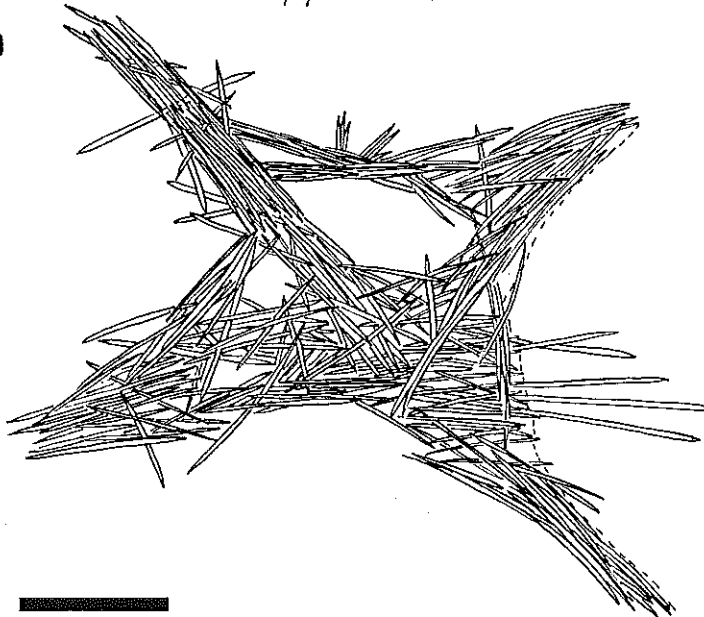


Fig. 13. *Halichondria tenebrica* sp. n. (a) Ectosomal skeleton, pores are indicated as dashed rounded areas; (b) choanosomal skeleton. Scale bar = 200 μm .

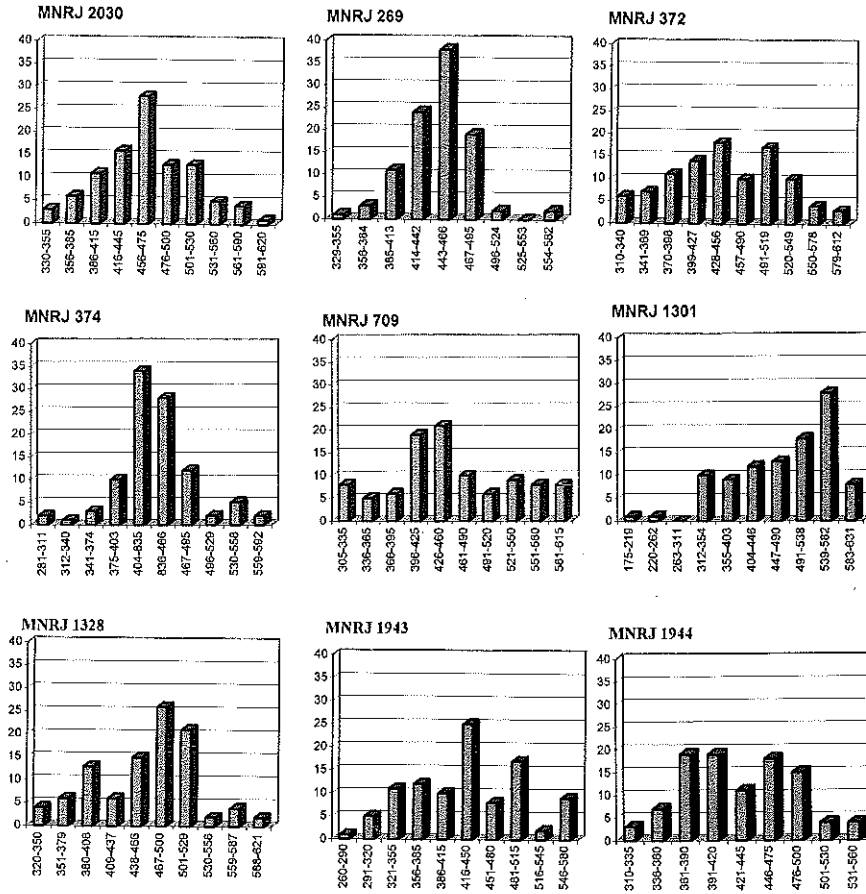


Fig. 14. Distribution frequency of the size-classes of the oxeas of *Halichondria cebimarensis* sp. n. holotype (MNRJ 2030) and paratypes (MNRJ 269, 372, 374, 709, 1301, 1328, 1943, 1944).

DISCUSSION

In the context of this article, *H. panicea* (Pallas, 1766) has been circumscribed to those populations occurring in the Boreal Eastern Atlantic and Mediterranean sea, and perhaps in the Boreal Western Atlantic, and both sides of the Boreal Pacific. VETHAAK *et al.* (1982), studying a population from the Oosterschelde (Dutch Delta) characterised this species as being of orange-yellow (with or without shades of green) colour, with oxeas in the 190 – 482/2.4 -13.6 μm range (length/ thickness). These authors considered the oxeas to be classed in slightly smaller ectosomal ones (190-282.2-475/2.4-6.4-13.3 μm) and correspondingly larger choanosomal ones (171-318.8-482/2.8-7.5-13.6 μm), thus corroborating earlier findings by HARTMAN (1958). VETHAAK *et al.* (1982) conducted a thorough comparison of specimens and

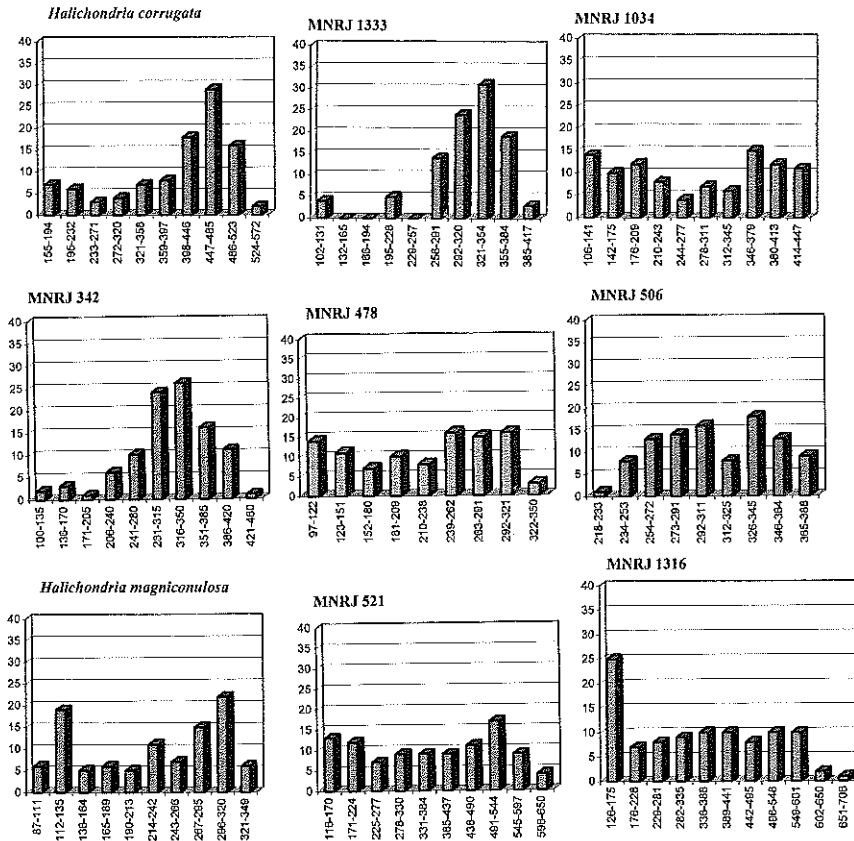


Fig. 15. *Halichondria corrugata* holotype (USNM 23566); *Halichondria migottea* sp. n. holotype (MNRJ 1333), *Halichondria sulfurea* sp. n. holotype (MNRJ 1034) and paratypes (MNRJ 342, 478, 506). *Halichondria magniconulosa* holotype (YPM 5039); *Halichondria tenabraca* sp. n. holotype (MNRJ 521) and paratype (MNRJ 1316).

literature records of the species for various parts of the world, and after discarding those records or specimens which appeared too different from European records, still found slightly smaller oxeas in specimens from the Northwestern Atlantic (HARTMAN 1958 – 127 μm), and from the Northeastern Atlantic too (VETHAAK *et al.* 1982 – 124 μm , Ireland). Slightly larger oxeas occurred only in New Zealand specimens (BERGQUIST 1970 – 490 μm ; VETHAAK *et al.* 1982 – 523 μm).

SCHÖNBERG & BARTHEL (1997) found a mean annual length for the oxeas of *H. panicea* in the Western Baltic Sea at 276.8 μm , with overall minima and maxima over their sampling period, 76 and 437 μm , respectively. These authors

observed temporal variation in mean spicule length and width though. Mean length varied from 227 to 309 μm , while mean thickness from 6.0 to 9.2 μm .

The alleged variation allowed by *H. panicea* conducted many authors to assemble an outstandingly large distribution for the species. It is beyond the scope of the present study to go over each of these records verifying their correct status, and it is well possible that some will appear indeed very similar to European records of the species. What is of special concern here are those records of *H. panicea* effected for the Southwestern Atlantic (SARÀ 1978; MURICY *et al.* 1991).

SARÀ (1978) worked on several specimens of *Halichondria* from the Tierra del Fuego region (Argentina). Sponges in this area pertain to the Magellan Biogeographic Province and are of antarctic/subantarctic affinities (SARÀ 1978; SARÀ *et al.* 1992; VAN SOEST 1994). These records are very unlikely to be akin to species collected in the generally warm shallow-waters of the São Sebastião Channel, and relate to the present discussion as outsiders only, in the hope of clarifying *Halichondria*'s diversity and distribution in Atlantic South America.

SARÀ (1978) reported oxeads in the 210-320 μm length range, being 6-10 μm thick. These ranges are far more restricted than those reported for North Atlantic specimens (*e.g.* HARTMAN 1958; VETHAAK *et al.* 1982; SCHÖNBERG & BARTHEL 1997), which poses some doubts on the identification of the Magellan material. VETHAAK *et al.* (1982) advanced two hypothesis to explain the supposed wide longitudinal and latitudinal distribution of *H. panicea*, viz. 1) dispersion along the whole Western African continent during glacial maxima followed by subsequent long range dispersal to areas such as Northern New Zealand, and 2) recent introduction by man. A third hypothesis is, of course, that these records are not conspecific, no matter how similar they appear morphologically. In our view, the suggestion made by SARÀ (1978) regarding the likely synonymy of *H. prostrata* to *H. panicea*, is premature. It goes against every likely biogeographic scenario. VETHAAK *et al.* (1982) did not attach much confidence to their hypotheses either. We suggest thus that SARÀ's (1978) record of *H. panicea* for the Tierra del Fuego region is best assigned to *H. prostrata* for the time being, until the conspecificity of both species is made more likely by genetic methods.

MURICY *et al.* (1991) cited *H. panicea* for the Tropical Southwestern Atlantic (Arraial do Cabo, Rio de Janeiro State coastline). Here, five specimens of this collection were re-examined, variously identified as *H. panicea* (UFRJPOR 2650, 2663, 3129) and *Halichondrida* (UFRJPOR 2772, 2972). They appear to be best classed in two separate species. UFRJPOR 2650, 2663, 2772 and 3129, have oxeads ranging from ca. 150 to over 800 μm in length, and a category of smaller styles (ca. 150 μm long), being thus best classed in *Amorphinopsis* Carter, 1887. These specimens are likely to be conspecific with additional material collected in the São Sebastião Channel area, found with a similar colour range (yellow to green), and probably belong to a new species, in view of the highly disjunct distribution of other species of the genus (Indo-west Pacific). UFRJPOR 2972 is not a *Halichondria* either, in view of its ectosomal skeleton which stands between a true palisade and regular brushes, although not very dense. The choanosome is not very dense too, spongin is conspicuous on irregularly ascending tracts, and spicules spread in

confusion are sparse. This sponge is here hesitatingly assigned to the vicinity of *Spongosorites* Topsent, 1896 (*sensu* DIAZ *et al.* 1993), of which it appears to differ by its soft, easily compressible consistency.

The new species described here, *H. cebimarensis* sp. n., approaches *H. panicea* as circumscribed above. The rationale for considering both as distinct species was furnished at the new species' Remarks' section.

DE LAUBENFELS (1956) identified a *Menanetia* sp. collected from Ubatuba (in the vicinity of our study area). VAN SOEST *et al.* (1990) considered *Menanetia* to be a junior synonym of *Halichondria*, and DE LAUBENFELS' (1956) record is thus treated as *Halichondria* sp. We had the opportunity to re-examine de Laubenfels' collection of microscopic preparations (NMNH), but none was identified as *Menanetia* sp. Several microscopic slides were unidentified, but among these we found five (labels: 55022, 55026, 55044, 55050, 55053), all from Ubatuba, possessing a spicule complement of oxeas of variable sizes only, which are best assigned to *Halichondria* sp. We suspect these could have been made from de Laubenfels' *Menanetia* sp. Their oxeas measure: 55022 – 110-305.0-520/2.5-15 μm , 55026 -120-378.5-550/1.3-15 μm , 55044 – 120-435.5-720/2.5-23 μm , 55050 -130-230.5-480/2.5-10 μm , 55053 – 100-275.0-550/2.5-15 μm . All the specimens fit best with the newly described *H. sulfurea* sp. n., but for specimen 55044, which approaches *H. cebimarensis* sp. n. It seems thus that de Laubenfels was dealing with two species instead, but we do not feel confident in proposing formal identifications for these specimens. Their life colour is an important missing character.

JOHNSON'S (1971) *Halichondria* sp. (no specimen studied here) was described with oxeas in three size categories, viz. 325/8 μm , 625/13 μm and 713-875/25 μm . It appears distinct from any other Tropical Western Atlantic species, and is likely to be new. The specimen has to be re-examined in order to allow a formal decision on its status, and is provisionally kept under *Halichondria* sp.

HECHTEL'S (1983) *Halichondria braziliensis* is a junior synonym of *Topsentia ophiraphidites* (De Laubenfels, 1934) according to DIAZ *et al.* (1993), who re-examined the type specimen, and has accordingly been kept away from any further considerations here.

Halichondria lutea Alcolado, 1984 as found in Brazil (LERNER 1996) is not conspecific to the type material, because it has desmas, and is best assigned to *Petromica* (MURICY *et al.* 2001).

MURICY & MORAES (1998) listed *H. magniconulosa* for Brazil's Northeastern coastline (Tamandaré, Pernambuco state). Their material (UFRJPOR 4021) was re-examined, and appears correctly identified. It has oxeas ranging from 110 to 520 μm which appear to pertain to more than one size category. Smaller spicules are very common. Its live-colour was not noted, and the specimen is considerably macerated. There is another specimen from the same locality, UFRJPOR 4041, live-colour reddish-orange, which has oxeas ranging from 70 to 830 μm , with larger spicules very common. This specimen is probably of another species, yet undescribed in the Brazilian coast. It is better referred to as *Halichondria* sp.

The updated list of Brazilian *Halichondria* is thus *H. cebimarensis* sp. n., *H. magniconulosa* Hechtel, 1965, *H. migottea* sp. n., *Halichondria* spp. (= *Menanetia* sp. sensu DE LAUBENFELS 1956; = *Halichondria* sp. sensu JOHNSON 1971; = *Halichondria* sp., UFRJPOR 4041), *H. sulfurea* sp. n. and *H. tenebrica* sp. n.

Identification key for the Brazilian *Halichondria*

Observation. It is recommended that users of the key obtain measures for the length of at least 50-100 oxeas and study their size-frequency distribution prior to starting the identification process.

1. Mean length of the oxeas larger than 400 μm , live sponges of a turquoise colour
..... *H. cebimarensis* sp. n.
- . Mean length of the oxeas smaller than 400 μm 2
2. Oxeas can be larger than 600 μm , live sponges of a dark-grayish-green colour .
..... *H. tenebrica* sp. n.
- . Oxeas always smaller than 600 μm 3
3. Oxeas in three clear-cut size categories (means near 100, 200 and 300 μm),
live-colour grayish-brown *H. migottea* sp. n.
- . Oxeas not so clearly ascribed to more than one varied category ranging from ca.
100 to ca. 500 μm , live-colour yellow 4
4. Sponges turning to a dark colour when preserved, mean oxea thickness around
5 μm *H. magniconulosa*
- . Sponges do not turn into darker colours when preserved, mean oxea thickness
around 9 μm *H. sulfurea* sp. n.

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