

**Shallow-water *Aplysina* Nardo (Aplysinidae, Verongida, Demospongiae) from the São Sebastião Channel and its environs (Tropical southwestern Atlantic), with the description of a new species and a literature review of other brazilian records of the genus**

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**ABSTRACT.** Two species of *Aplysina* Nardo, 1834 are described in this article, *Aplysina caissara* sp. n. and *A. fulva* (Pallas, 1766). Additionally, a possible third species was identified as *A. aff. cauliformis*. Collections were done in the São Sebastião Channel area as an ongoing effort to assess the poriferan biodiversity of the northern sector of the São Paulo State coastline. Specimens were collected by scuba diving, and descriptions of external morphology are based on the observation of populations alive, and on extensive underwater photography. A literature review of other brazilian records of *Aplysina* was undertaken, and an ammended species list is offered.

**KEY WORDS.** Porifera, *Aplysina*, sponges, southwestern Atlantic, taxonomy, Brazil

A qualitative survey of the sponge fauna of the São Sebastião Channel area and its environs has been conducted during the years of 1996 and 1997, revealing over 120 species (HAJDU *et al.* 1996, 1999; HAJDU 1998). Ongoing collecting effort is centered on yielding additional specimens of rare species, photographing intrapopulational variability *in situ*, and furnishing biological material for a program of chemico/pharmacological screening for bioactive natural products.

The genus *Aplysina* Nardo, 1834 is peculiar for its diversity gradient, richer in the Atlantic Ocean than in the Indo-Pacific, coupled to its notorious possession of brominated compounds (*e.g.* BERGQUIST & WELLS 1983). These facts, coupled to uncertainties on the identification of the material originating from the study area, prompted us to start a taxonomic study of those populations.

To date, ten species of *Aplysina* were recorded from the Brazilian coast. Species are *A. archeri* (Higgins, 1875), *A. capensis* Carter, 1881, *A. cauliformis* Carter, 1882, *A. fistularis* (Esper, 1794), *A. fulva* (Pallas, 1766), *A. janusi* (Boury-Esnault, 1973), *A. lacunosa* (Pallas, 1766), *A. longissima* Carter, 1882, *A. pergamentacea* Hechtel, 1983 and *A. tenuissima* (Hyatt, 1875). These records are reevaluated based on the senior author's experience, on discussion with colleagues, on collected,

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but yet undescribed material in both MNRJ and UFRJPOR collections, as well as on descriptions published in the literature. An amended list of species known from the Brazilian coast will be furnished below.

### MATERIAL AND METHODS

Specimens were collected during an ongoing faunistic survey conducted in the area of the São Sebastião Channel and its environs, in the municipalities of São Sebastião and Ilhabela, situated in the northern sector of São Paulo State coastline (between latitudes 23°44'S and 23°58'S, approximately).

Specimens were collected by scuba diving, and photographed *in situ* whenever possible. An enzymatic procedure used to obtain clean preparations of spongin fibres has been used, and is described in detail below.

A sponge fragment with 1-2 cm<sup>3</sup> was incubated in 30 ml digestion buffer (100 mM sodium acetate, pH 5,0; cysteine 5 mM; 5 mM EDTA) during 24 hours at 4°C. Subsequently, 1ml of a 3 % papain solution (freshly made in digestion buffer) was added to the sponge digestion tube and incubated at 60°C for 24 h. Later, the digested fragment was washed with water jets to separate the spongin fibers, included in wax, and cut to the desired thickness (ca. 0.5 mm).

Abbreviations used are: BA (Bahia State), BMNH (The Natural History Museum, London), CE (Ceará State), ES (Espírito Santo State), MCN (Museu de Ciências Naturais, Fundação Zoobotânica do Rio Grande do Sul, Porto Alegre), MNRJ (Museu Nacional, Universidade do Brasil, Rio de Janeiro), PE (Pernambuco State), REVIZEE (Program for the Evaluation of the Sustainable Potential of Life Resources in the Exclusive Economic Zone – Brazil), RJ (Rio de Janeiro State), RN (Rio Grande do Norte State), SC (Santa Catarina State), SP (São Paulo State), UFRJPOR (Museu Nacional, Universidade do Brasil, Rio de Janeiro), ZMA (Zoologisch Museum Amsterdam, Amsterdam).

### RESULTS

#### Verongida Bergquist, 1978

#### Aplysinidae Carter, 1875

Diagnosis. Encrusting, massive, club-shaped and fan-shaped growth forms. Reticulate, anastomosing spongin fibres produce polygonal meshes in the choanosomal skeleton which are not organized into one plane. Fibres have normal bark and pith elements, without foreign detritus, and the collagenous spongin matrix is dense. Choanocyte chambers are small, spherical and diplodal (*sensu* VAN SOEST 1978).

#### *Aplysina* Nardo, 1834

Diagnosis. Marked aerophobic colour change from yellow or green to darker colours; only one kind of fibre is present, without foreign detritus and with a thick pith component; fibres form a regular reticulation with large hexagonal meshes and have no specialised surface arrangement (*sensu* BERGQUIST 1980). Type species: *Aplysina aerophoba* Schmidt, 1862.

*Aplysina caissara* sp. n.

Figs 1-2,4-6, Tab. I

*Aplysina fistularis fulva*; Mothes-de-Moraes, 1987: 133, figs 5, 9.*Aplysina fulva*; Lerner, 1996: 115, figs 24, 26.

Holotype. MNRJ 1988, rocky coast between Prainha and Praia Brava ("Costão do Navio", São Sebastião, 23°50.067'S – 45°29.449'W), 6 m depth, E. Hajdu *leg.*, 29/I/1999.

Paratypes – MNRJ 268, Ponta Recife, (São Sebastião Channel, São Sebastião, 23°49.501'S – 45°24.796'W), 2 m depth, E. Hajdu *leg.*, 22/I/1996. MNRJ 578, southern coast of Ilha de Toque-Toque, (São Sebastião, 23°51.209'S – 45°31.600'W), 11 m depth, E. Hajdu *leg.*, 15/VI/1997. MNRJ 1673, Ponta do Jarobá (São Sebastião, 23°49.679'S – 45°25.278'W), 4.5 m depth, E. Hajdu *leg.*, 22/IV/1998. MNRJ 1675, rocky coast between Prainha and Praia Brava ("Costão do Navio", São Sebastião, 23°50.067'S – 45°29.449'W), 6 m depth, E. Hajdu, *leg.* 24/IV/1998. MNRJ 1989, 2013, rocky coast between Prainha and Praia Brava ("Costão do Navio", São Sebastião, 23°50.067'S – 45°29.449'W), 6 m depth, E. Hajdu *leg.*, 29/I/1999.

Schizotype – BMNH 1999.10.6.1.

Additional material. MCN 383, Ilha de João da Cunha (Porto Belo, SC), 3 m depth, S.M. Pauls *leg.*. MCN 1034 Ilha de João da Cunha (Porto Belo, SC), 0.5 m depth, A.A. Lise *leg.*, 22/X/1977. MCN 1035, Ilha de João da Cunha (Porto Belo, SC), A.A. Lise *leg.*, 06/XI/1981. MCN 2235, Saco da Mulata (Ilha da Galé, Bombinhas, SC), 12 m depth, C.B. Lerner *leg.*, 14/II/1991. MCN 2278, small embayment on the SW (Ilha da Galé, Bombinhas, SC), 8 m depth, C.B. Lerner *leg.*, 29/III/1991.

Diagnosis. *Aplysina caissara* sp. n. is distinguished from every other *Aplysina* known from the Tropical western Atlantic by a combination of bright yellow live-colour, habit with small digits topped by oscula and a delicate skeletal reticulation.

Description. Specimens can have a few (3-4, in young specimens) to many digits (25-30), which are mostly erect (Figs 1-2). Digits can be single or anastomosed, cylindrical (often; fusiform or straight) or slightly vulcaniform (rare), 2-6 cm high, 0.6-1.5 cm wide. Area coverage can be as large as 25 x 15 cm, but is more often about 6 x 6 cm. Consistency is rather compressible (cheesy). Surface is slightly conulose. Oscula are mostly apical (1.5-4 mm), but a few smaller lateral ones (ca. 1 mm in diameter) occur also. Live colour is bright-yellow externally and internally, which turns into deep-purple after preservation in alcohol. The holotype (Fig. 4) bears 10 digits, 1-2 cm high, 0.3-0.8 cm wide, and spreads 3.5 x 4.5 cm over a small boulder.

Skeleton (Tab. I). No ectosomal specialization. Choanosome with a delicate, irregular tridimensional polygonal network (Fig. 5) of pithed spongin fibres (Fig. 6). After preservation and preparation, fibres are yellow to brown, with a pith which is either of the same colour, or much darker, nearly black. The same specimen may have pith of both colours. Fibres are smooth, straight, curved or undulating.

Table I. Micrometric data for the skeletal architecture of *Aplysina caissara* sp. n. holotype, paratypes and additional material studied (including *A. fistularis forma fulva sensu* MOTHES-DE-MORAES 1987; and *A. fulva sensu* LERNER 1996). Measures are in  $\mu\text{m}$  and  $N = 20$ , unless stated otherwise.

Specimen	Fibre width:		Pith width:		Mesh area ( $\text{mm}^2$ ): smallest area (length x width) – mean area – largest area (length x width)
	thinnest – mean – thickest		thinnest – mean – thickest		
Holotype (MNRJ 1988)	26 – 48.9 – 77		17 – 36.5 – 60		0.03 (0.200 x 0.150) – 0.30 – 0.83 (1.040 x 0.800)
Paratype (MNRJ 268)	31 – 43.2 – 53		17 – 25.3 – 36		0.01 (0.407 x 0.320) – 0.19 – 0.84 (1.232 x 0.679)
Paratype (MNRJ 578)	31 – 43.2 – 53		19 – 31.3 – 41		0.06 (0.262 x 0.233) – 0.17 – 0.41 (0.873 x 0.475)
Paratype (MNRJ 1673)	34 – 54.0 – 75		23 – 32.0 – 52		0.09 (0.306 x 0.294) – 0.36 – 0.62 (1.017 x 0.612)
Paratype (MNRJ 1675)	41 – 57.7 – 86		22 – 35.5 – 53		0.06 (0.339 x 0.175) – 0.10 – 0.55 (0.989 x 0.553)
Paratype (MNRJ 1989)	26 – 42.9 – 50		19 – 27.1 – 36		0.03 (0.220 x 0.140) – 0.31 – 0.74 (1.040 x 0.710)
Paratype (MNRJ 2013)	26 – 45.5 – 50		17 – 32.9 – 41		0.09 (0.320 x 0.290) – 0.27 – 0.46 (0.790 x 0.580)
MCN 383	37 – 54.0 – 80		26 – 38.0 – 60		0.05 (0.232 x 0.232) – 0.30 – 0.76 (0.882 x 0.857)
MCN 1034	43 – 56.0 – 89		20 – 34.0 – 66		0.15 (0.422 x 0.367) – 0.18 – 1.31 (1.531 x 0.857)
MCN 1035	34 – 58.0 – 92		20 – 43.0 – 75		0.11 (0.380 x 0.282) – 0.18 – 0.81 (0.919 x 0.882)
MCN 2275	43 – 66.0 – 121		29 – 48.0 – 98		0.10 (0.465 x 0.220) – 0.71 – 0.70 (0.955 x 0.735)
MCN 2278	49 – 69.0 – 101		29 – 49.0 – 78		0.13 (0.429 x 0.306) – 0.36 – 1.09 (1.433 x 0.759)

Ecology. The species has a typically patchy distribution, being often very rare, but reaching reasonable densities at a few spots (e.g. type locality), where specimens can be found every couple of meters. Its known depth distribution is from 0.5 to 12 meters, and the geographical distribution is at present confined between the coasts of São Paulo and Santa Catarina states, from ca. 23°49' to 27°10'S.

Although a few specimens were seen at very shallow depths (0.5-3 m) in places of somewhat restricted water flow, where temperatures may reach 28°C, most of them are located in areas of large water circulation, exposed to the common arrival of Central South Atlantic Waters, when temperatures reach minima around 13°C.

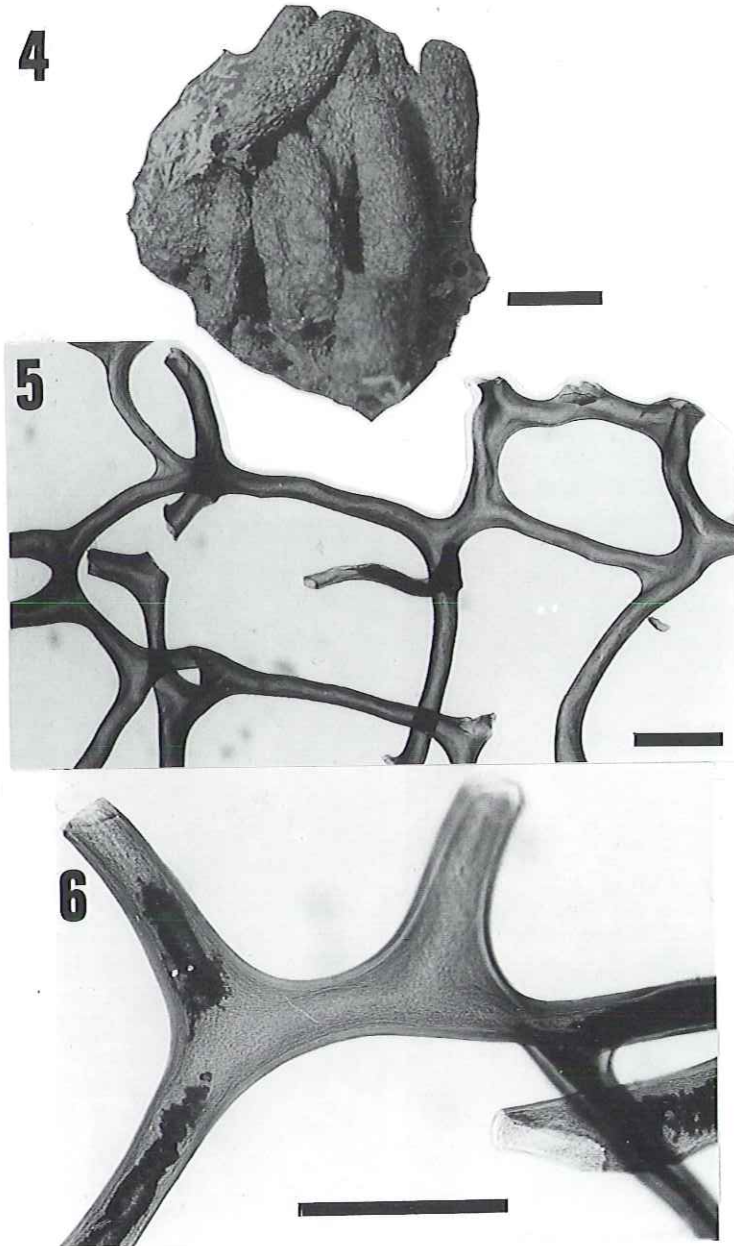
Etymology. The species is named after the people inhabiting the southeastern, and part of the southern Brazilian Coastline, the "caiçaras".

Remarks. Dozens of specimens were seen in the field, especially in the vicinity of the type locality. Many were photographed *in situ* (Figs 1-2), and the images used to help circumscribe the species better.

*Aplysina caissara* sp. n. is the only species in the genus known to combine a collection of small erect digits with apical oscula and a bright yellow colour in life, with an overall small size. Additionally, its reticulation is rather delicate, with slender fibres and smaller meshes, with variably coloured pith. *Aplysina fulva*,

Figs 1-3. *Aplysina* spp. *in situ* in the São Sebastião Channel area. (1-2) *A. caissara* sp. n. (specimens not collected); (3) *A. aff. cauliformis* (MNRJ 1674) – scale bar is 2 cm long.





Figs 4-6. *Aplysina caissara* sp. n. (4) Holotype (MNRJ 1988) after preservation in ethanol – scale bar is 1 cm; (5) skeletal architecture (MNRJ 578, paratype); (6) spongin fibres in greater detail (MNRJ 578, paratype) – scale bars are 200  $\mu$ m.

which can also be light yellow when small and inhabiting shaded spots (Figs 7, 12), attain much larger size, and has oscula which are relatively smaller, as well as scattered over its surface (Figs 8, 9, 10). Its main colour in the SE Brazilian coastline is, nevertheless, brown/ochre (Figs 9, 10). Another bright yellow species is *A. lacunosa*, a typically large Tropical species which has a general tubular shape with a large pseudoosculum on top, and a fully grooved surface.

Specimens described by MOTHES-DE-MORAES (1987) and LERNER (1996) from Santa Catarina State, respectively identified as *Aplysina fistularis fulva* and *A. fulva*, were reexamined and found to be better ascribed to *A. caissara* sp. n. on account of their bright-yellow colour, small dimensions, and apical oscula on digitiform/vulcaniform processes.

### *Aplysina fulva* (Pallas, 1766)

Figs 7-15, Tab. II

Material studied. MNRJ 357, Ponta do Jarobá (Canal de São Sebastião, São Sebastião, 23°49.676'S – 45°25.278'W), 2.5 m depth, E. Hajdu leg., 26/I/1996. MNRJ 445, Ponta do Jarobá (Canal de São Sebastião, São Sebastião, 23°49.676'S – 45°25.278'W), 4 m depth, E. Hajdu leg., 19/II/1997. MNRJ 735, Barequeçaba (Canal de São Sebastião, São Sebastião, 23°49.746'S – 45°26.478'W), 1 m depth, E. Hajdu leg., 08/I/1996. MNRJ 762, Saco do Poço (Ilha de São Sebastião, Ilhabela, 23°45.658'S – 45°14.862'W), 8 m depth, E. Hajdu leg., 09/I/1996. MNRJ 1302, Ponta do Jarobá (Canal de São Sebastião, São Sebastião, 23°49.676'S – 45°25.278'W), 2 m depth, E. Hajdu leg., 21/XII/1997. MNRJ 1990, rocky coast between Prainha and Praia Brava ("Costão do Navio", São Sebastião, 23°50.067'S – 45°29.449'W), 6 m depth, E. Hajdu leg., 29/I/1999.

Comparative material. MNRJ 047, Praia do Forno (Arraial do Cabo, RJ). MNRJ 686, Praia das Tartarugas (Búzios, RJ). UFRJPOR 1204, Prainha (Arraial do Cabo, RJ). UFRJPOR 1206, Boqueirão (Arraial do Cabo, RJ). UFRJPOR 2879, Pedra Vermelha (Arraial do Cabo, RJ). UFRJPOR 2917, Pedra Vermelha (Arraial do Cabo, RJ). UFRJPOR 2940, Pedra Vermelha (Arraial do Cabo, RJ). UFRJPOR 2962, Pedra Vermelha (Arraial do Cabo, RJ). UFRJPOR 3582, Urca do Tubarão (04°50'S -36°27'W, RN). UFRJPOR 4210, Praia da Ribeira (Itacaré, Ba). UFRJPOR 4804, Ilha Rata (Fernando de Noronha Archipelago, PE). UFRJPOR 4819, "Pirapama" shipwreck (off Recife, PE).

Diagnosis. Specimens are more often brownish-yellow (ochre) to purplish-brown outside, and bright-yellow inside when alive, but yellow specimens do occur. Shape is varied, but cylindrical projections are common (frequently over 15 cm high), variably thick (frequently over 3 cm), with an irregular outline. Oscula are spread over the sponge surface, being only seldom over 3 mm across, and only seldom aligned.

Description of São Paulo State specimens. Specimens are usually very small, mostly lower than 8 cm, with only one to a few (3-6) digitiform processes. Processes are smooth or slightly conulose, with scattered oscula (0.5-2 mm wide), and irregular outlines. Processes are often less than 5 cm high and 1.5 cm thick. Anastomoses

occur. MNRJ 1990 is repent (Fig. 7). Consistency is compressible (cheesy). Live colour varied from bright light-yellow (Fig. 7) to bright-yellow (Fig. 8), turning beige (internally) to brownish-purple (externally) in spirit (Fig. 13).

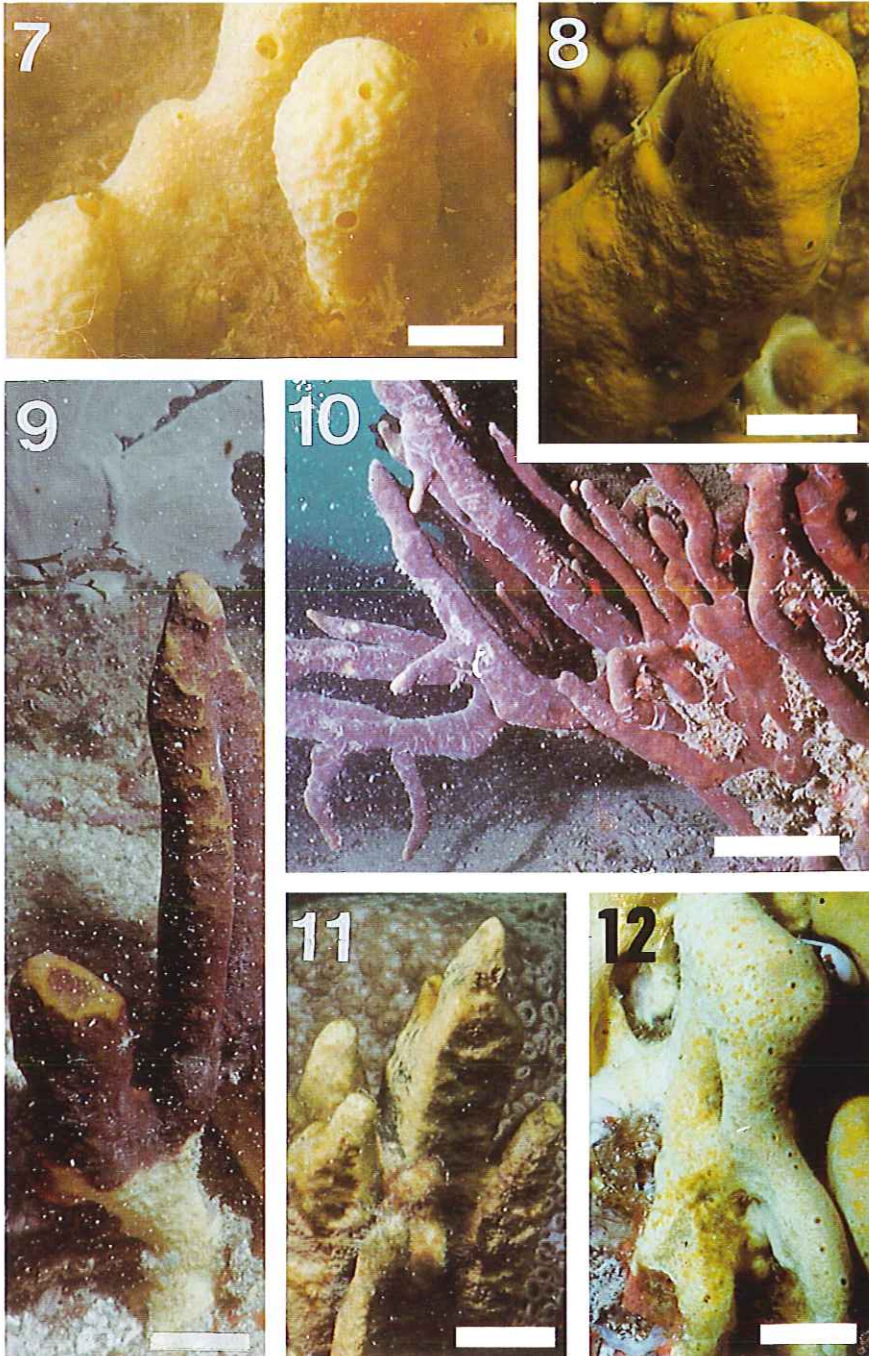
Skeleton (Tab. II). No ectosomal specialization. Choanosome with a delicate (not so strikingly as in *A. caissara* sp. n.), irregular tridimensional polygonal network (Fig. 14) of pithed spongin fibres (Fig. 15). After preservation and preparation, fibres are yellow to brown, with a pith which is either of the same colour, or much darker, nearly black. The same specimen may have pith of both colours. Fibres are smooth, straight, curved or undulating.

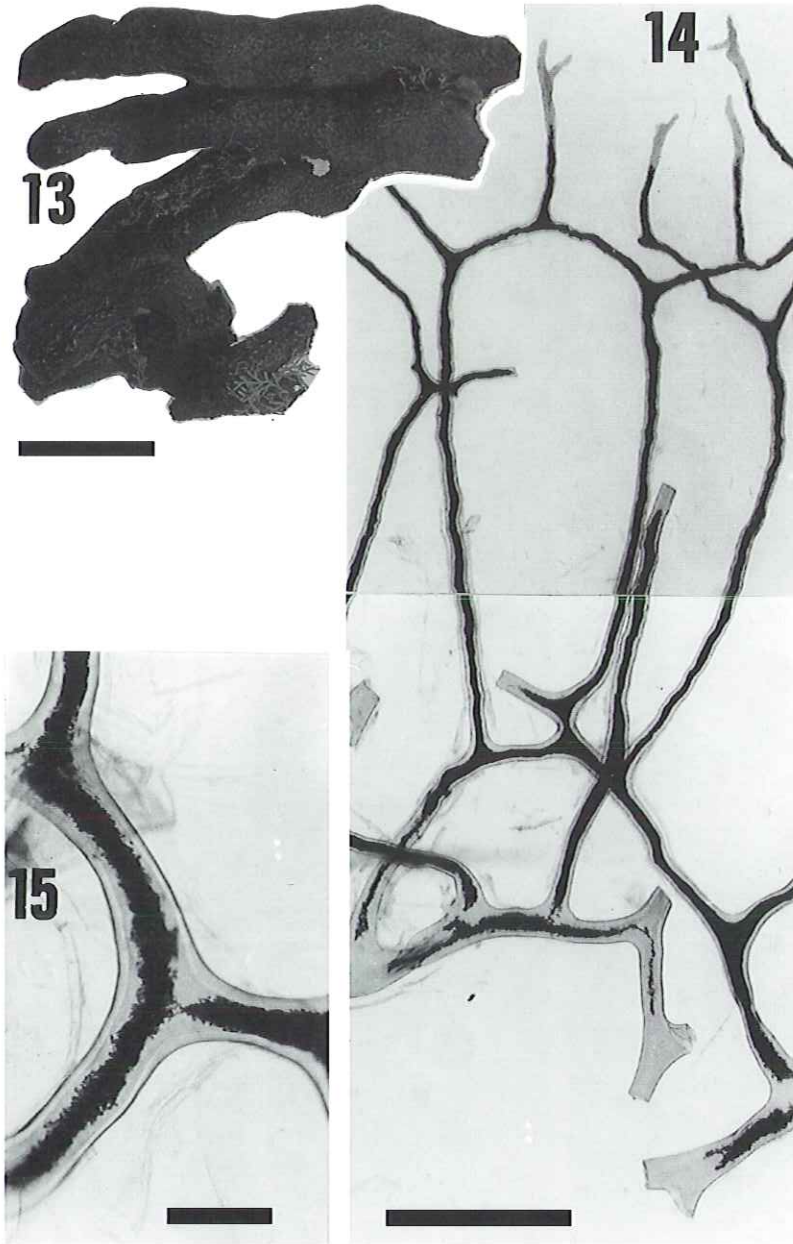
Table II. Micrometric data for the skeletal architecture of *Aplysina fulva* (specimens from the study area, the Cabo Frio Region and elsewhere along the northeastern Brazilian Coast). Measures are in  $\mu\text{m}$  and  $N = 20$ , unless stated otherwise.

Specimen	Locality	Fibre width:		Pith width:		Mesh area ( $\text{mm}^2$ ): smallest area (length x width) – mean area – largest area (length x width)
		thinnest – mean – thickest	thinnest – mean – thickest	thinnest – mean – thickest	thinnest – mean – thickest	
MNRJ 357	São Sebastião	21 – <u>36.0</u> – 48	14 – <u>18.2</u> – 31	0.14 (0.446 x 0.310) – <u>0.17</u> – 0.69 (0.941 x 0.737)		
MNRJ 445	São Sebastião	26 – <u>43.3</u> – 77	17 – <u>31.2</u> – 62	Not available		
MNRJ 735	São Sebastião	36 – <u>46.4</u> – 70	17 – <u>30.5</u> – 53	0.17 (0.475 x 0.359) – <u>0.34</u> – 0.44 (0.776 x 0.572)		
MNRJ 762	Ilhabela	36 – <u>52.9</u> – 77	17 – <u>31.9</u> – 48	0.06 (0.252 x 0.223) – <u>0.32</u> – 0.45 (0.795 x 0.563)		
MNRJ 1302	São Sebastião	29 – <u>44.1</u> – 67	19 – <u>27.7</u> – 48	0.05 (0.310 x 0.165) – <u>0.23</u> – 0.55 (0.795 x 0.698)		
MNRJ 1990	São Sebastião	38 – <u>57.4</u> – 103	24 – <u>39.5</u> – 91	0.31 (0.834 x 0.378) – <u>0.38</u> – 0.64 (1.067 x 0.601)		
MNRJ 047	Arraial do Cabo	43 – <u>71.0</u> – 101	20 – <u>39.0</u> – 78	0.13 (0.367 x 0.367) – <u>0.43</u> – 0.98 (1.249 x 0.784)		
MNRJ 686	Búzios	43 – <u>53.0</u> – 86	29 – <u>36.0</u> – 63	0.15 (0.514 x 0.294) – <u>0.34</u> – 0.83 (1.115 x 0.759)		
UFRJPOR 1204	Arraial do Cabo	23 – <u>58.8</u> – 78	20 – <u>31.1</u> – 55	0.15 (0.620 x 0.250) – <u>0.47</u> – 1.57 (1.280 x 1.230)		
UFRJPOR 1206	Arraial do Cabo	30 – <u>53.4</u> – 65	23 – <u>31.7</u> – 43	0.13 (0.450 x 0.290) – <u>0.37</u> – 0.50 (0.830 x 0.600)		
UFRJPOR 2879	Arraial do Cabo	58 – <u>71.2</u> – 85	23 – <u>31.7</u> – 48	0.21 (0.550 x 0.380) – <u>0.26</u> – 0.43 (1.010 x 0.430)		
UFRJPOR 2917	Arraial do Cabo	40 – <u>58.4</u> – 80	15 – <u>24.1</u> – 55	0.04 (0.260 x 0.170) – <u>0.23</u> – 0.34 (0.900 x 0.380)		
UFRJPOR 2940	Arraial do Cabo	43 – <u>57.3</u> – 78	22 – <u>36.9</u> – 53	0.01 (0.120 x 0.060) – <u>0.03</u> – 0.06 (0.110 x 0.510)		
UFRJPOR 2962	Arraial do Cabo	36 – <u>52.6</u> – 72	14 – <u>22.4</u> – 48	0.01 (0.175 x 0.097) – <u>0.16</u> – 0.80 (1.038 x 0.776)		
UFRJPOR 3582	Urca do Tubarão	52 – <u>64.1</u> – 87	15 – <u>28.9</u> – 47	0.04 (0.210 x 0.180) – <u>0.61</u> – 0.68 (0.890 x 0.760)		
UFRJPOR 4210	Itacaré	120 – <u>133.6</u> – 144	22 – <u>32.4</u> – 48	0.25 (0.553 x 0.281) – <u>0.32</u> – 0.77 (1.125 x 0.689)		
UFRJPOR 4804	Fernando de Noronha	50 – <u>62.4</u> – 75	18 – <u>21.5</u> – 28	0.04 (0.210 x 0.210) – <u>0.23</u> – 0.57 (0.810 x 0.700)		
UFRJPOR 4819	Recife	60 – <u>131.6</u> – 175	20 – <u>38.1</u> – 102	0.01 (0.080 x 0.070) – <u>0.26</u> – 2.15 (2.050 x 1.050)		

Figs 7-12. *Aplysina fulva*, live specimens. (7) Rocky coast between Prainha and Praia Brava ("Costão do Navio"), São Sebastião, SP, ca. 5 m depth – scale bar is 2 cm long; (8) Praia Preta, São Sebastião Channel, São Sebastião, SP, ca. 3 m depth – scale bar is 1 cm long; (9) Búzios, RJ, ca. 3 m depth – scale bar is 2 cm long; (10) Búzios, RJ, ca. 3 m depth – scale bar is 10 cm long; (11) Pedra Vermelha, Ilha de Cabo Frio, Arraial do Cabo, RJ, ca. 3 m depth – scale bar is 5 cm long; (12) Ilha da Âncora, Búzios, RJ, ca. 6 m deep – scale bar is 2 cm long.







Figs 13-15. *Aplysina fulva*. (13) Preserved specimen (MNRJ 1990) – scale bar is 2 cm; (14) skeletal architecture (MNRJ 735) – scale bar is 500  $\mu\text{m}$ ; (15) spongin fibres in greater detail (MNRJ 735) – scale bar is 200  $\mu\text{m}$ .

Ecology. The species is uncommon in the study area, and no dense population has been found in over seventy stations sampled. The largest population appears to be at Praia Preta, where the largest specimens were seen. Specimens tend to be slightly cryptic, frequently with only a small visible portion, the remaining growing underneath medium-sized boulders, or among colonies of the zoanthid *Palythoa caribaeorum*.

Remarks. *Aplysina fulva* is the least well diagnosed species of the genus in the Tropical southwestern Atlantic. The opposite opinion has been expressed by ZEA (1987), and it may be possible that Caribbean populations appear more clearly set apart, than their southern relatives. In the hope of finding some clearcut diagnostic features for the São Sebastião and Ilhabela populations studied here, specimens from other localities along the Brazilian coast were studied in parallel. Eight specimens from the Cabo Frio region (Arraial do Cabo and Búzios), and four from localities along the northeastern Brazilian coastline were studied. All these were considered typical in the sense that they comprise large, erect, irregularly shaped, massive digits with small oscula spread around. They are all very dark in the fixative, and many of them were reported to be brownish-yellow alive. These broad descriptors fit well with knowledge of Caribbean populations of the species based on extensive *in situ* observation (e.g. WIEDENMAYER 1977; VAN SOEST 1978; ZEA 1987). The Cabo Frio region is especially important here because an extensive survey of its sponge biota has been conducted by scuba diving during the years 1986 to 1991 (MURICY 1989; MURICY *et al.* 1991; HAJDU *et al.* 1992), followed by scattered dives ever since, and *Aplysina fulva* is perhaps the most conspicuous shallow-water sponge in the area (Figs 9-12; specimens may comprise over 40 digits and spread over 1m in diameter; Custódio, unpubl. res.). Contrastingly, specimens in the São Sebastião Channel area are usually small, and frequently bright-yellow (Figs 7-8), which made us hesitating about their correct identification.

Table II clearly show that if a diagnostic feature exists for the *Aplysina fulva* of the São Sebastião Channel area and its environs, when compared to specimens collected on other localities along the Brazilian coast, it is to be sought in characters other than the morphometry of their spongin network. The only two specimens clearly set apart by the stoutness of their fibres are UFRJPOR 4210 and 4819, respectively from Itacaré and Recife, which possess fibres over 120  $\mu\text{m}$  (mean thickness). Excluding these outsiders, fibres' mean thickness range from 36.0 to 57.4  $\mu\text{m}$  in the São Sebastião Channel area populations vs. 52.6 to 71.2  $\mu\text{m}$  elsewhere. This difference is not judged enough here to warrant the recognition of a new species. Our decision rests on the fact that only six vs. twelve specimens were studied here (study area vs. the rest of the Brazilian coastline), a certainly meagre database from which to propose a solution based on any sort of statistical approach.

One possibility that must be considered here is that *Aplysina fulva*, on what is likely to be its austral distribution limit, would have slightly thinner fibres. It is well known that keratose sponges (Orders Dendroceratida, Dictyoceratida and Verongida) have their highest diversity in the tropics and subtropics, being very rare in colder waters (e.g. SARÀ & VACELET 1973). The waters in the São Sebastião Channel area can be as cold as 13°C at the approach of Central South Atlantic Waters (SCHAEFFER-NOVELLI 1990; MIGOTTO *et al.* 1993; PIRES-VANIN *et al.* 1997; HAJDU *et al.* 1999).

*Aplysina aff. cauliformis*

Figs 3, 16-18, Tab. III

Material studied. MNRJ 1674, rocky coast between Praia Brava and Praia de Toque-Toque (São Sebastião, 23°50.067'S – 45°29.449'W), 8 m depth, E. Hajdu *leg.*, 24/IV/1998. MNRJ 1991, Pedra Montada (Barequeçaba, São Sebastião, 23°49.746'S – 45°26.478'W), 4 m depth, E. Hajdu *leg.*, 01/III/1999.

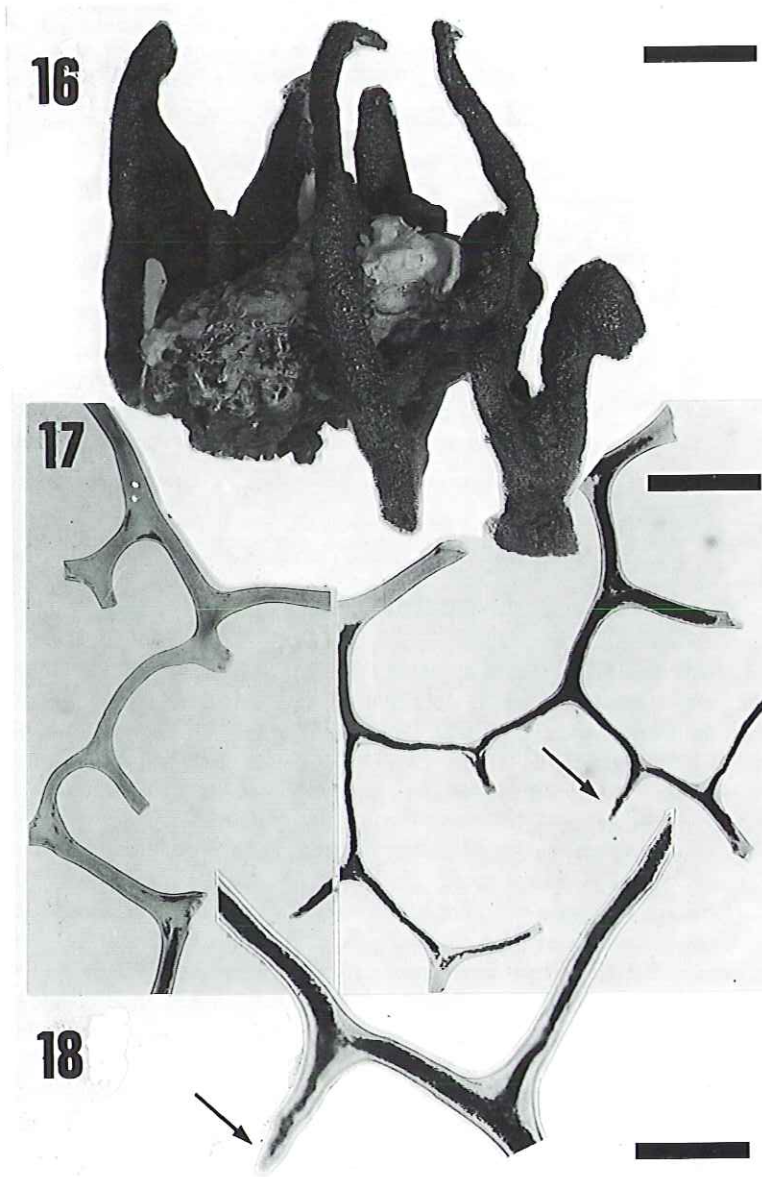
Comparative material. UFRJPOR 4027, Tamandaré, PE. UFRJPOR 4167, Ilha de Santo Aleixo (Serinhaém, PE). UFRJPOR 4190, Viçosa Reef (Nova Viçosa, BA). UFRJPOR 4208, Coroa de Pedra (off Itaparica, BA). UFRJPOR 4285, CE. UFRJPOR 4407, 16°34'0155"S – 38°46'1820"W (st. C-72, REVIZEE, off BA).

Description. The two specimens collected bear digits of varied morphologies. They can be thin, tapering slightly, dichotomous, reptant; stout, irregular; lobate; or vulcaniform. Protuberances (14) can reach 8 cm in height (1674), but are mostly smaller than 5 cm high. Specimen 1991 occupied an area of nearly 600 cm<sup>2</sup>. Surface is more markedly conulose in specimen 1674 than on 1991, which bear some (nearly) smooth sectors, especially around the oscula. There may be naked portions of the fibrous skeleton sticking out of the sponge in both specimens. Oscula (1-2 mm in diameter) are spread nearly everywhere. Some alignment (3-6 oscula) is seen in both specimens. Texture is compressible, easily torn. Live-colour ranged from yellow to purple (Fig. 3), and specimen 1991 had still some brown-ochre parts. In spirit they are both deep brownish-purple (Fig. 16).

Skeleton (Tab. III). No ectosomal specialization. Choanosome with a delicate, irregular tridimensional polygonal network (Fig. 17) of pithed (markedly laminated in 1991) spongin fibres (Fig. 18). After preservation and preparation, fibres are yellow to brown, with a pith which is either of the same colour, or much darker, nearly black. The same specimen may have pith of both colours. Fibres are smooth, straight, curved or undulating (seldom).

Ecology. Specimens were associated to algae, tube-worms, ectoprocts and barnacles. They were both growing on light exposed habitats, although light-intensity was not particularly strong due to either water turbidity and/or shadows created by neighbouring erect algae (*e.g. Sargassum* sp.). They occurred in depths ranging from 4 to 8 m.

Remarks. The two specimens from the São Sebastião Channel area dealt with here sit somewhere between currently available diagnoses for both *Aplysina cauliformis* and *A. fulva*. They share with *fulva* their overall irregular shape with stout irregular protuberances, and dark colour after preservation in ethanol. With *cauliformis* they share their purplish live colour (Fig. 3, at least tinges of it, as in ZEA 1987) and oscula which may be aligned on one side. MNRJ 1674 has a somewhat reptant shape which is more often seen in *cauliformis* specimens found elsewhere along the Brazilian coastline (Búzios, RJ and Salvador, BA), as well as some slender digits. These specimens were identified as *aff. cauliformis* to stress that they look very different from those described above under *fulva*.



Figs 16-18. *Aplysina* aff. *cauliformis*. (16) Preserved specimen (MNRJ 1674) – scale bar is 2 cm; (17) skeletal architecture (MNRJ 1674) – scale bar is 200  $\mu$ m; (18) spongin fibres (MNRJ 1674) – scale bar is 100  $\mu$ m. Arrows point to the same fibre, shown under different magnifications.

Table III. Micrometric data for the skeletal architecture of *Aplysina aff. cauliformis* (specimens from the study area), *Aplysina cauliformis* (specimens from the northeastern Brazilian Coast), and *Verongia longissima sensu* DE LAUBENFELS (1956). Measures are in  $\mu\text{m}$  and  $N = 20$ , unless stated otherwise.

Specimen	Locality	Fibre width:		Pith width:		Mesh area ( $\text{mm}^2$ ): smallest area (length x width) – mean area – largest area (length x width)
		thinnest – mean – thickest	Thinnest – mean – thickest	Thinnest – mean – thickest	Thinnest – mean – thickest	
MNRJ 1674	São Sebastião, SP	36 – 57.0 – 79	24 – 43.1 – 60	0.02 (0.223 x 0.087) – 0.29 – 0.45 (0.989 x 0.456)		
MNRJ 1991	São Sebastião, SP	43 – 58.6 – 70	19 – 28.6 – 46	0.06 (0.300 x 0.200) – 0.30 – 0.50 (1.230 x 0.410)		
UFRJPOR 4027	Tamandaré, PE	58 – 101.2 – 125	12 – 24.5 – 101	0.04 (0.250 x 0.160) – 0.39 – 0.77 (1.000 x 0.770)		
UFRJPOR 4167	Serinhaen, PE	43 – 97.0 – 134	17 – 27.0 – 43	Not available		
UFRJPOR 4190	Nova Viçosa, BA	26 – 66.0 – 110	12 – 15.0 – 74	Not available		
UFRJPOR 4208	Itaparica, BA	33 – 64.3 – 79	21 – 33.1 – 50	0.14 (0.514 x 0.281) – 0.29 – 0.52 (0.747 x 0.698)		
UFRJPOR 4285	Ceará	67 – 91.9 – 107	20 – 31.9 – 52	0.01 (0.110 x 0.090) – 0.17 – 0.71 (0.910 x 0.780)		
UFRJPOR 4407	REVIZEE, BA	47 – 73.4 – 90	17 – 35.2 – 62	0.08 (0.090 x 0.090) – 0.11 – 0.64 (0.860 x 0.750)		
<i>V. longissima</i> De Laub., N° 55009	Ubatuba, SP	30 – 70.3 – 100	18 – 35.1 – 60	0.23 (0.500 x 0.470) – 0.41 – 0.59 (0.90 x 0.66) (N=4)		

## DISCUSSION

LENDEFELD (1889) synonymized POLEJAEFF's (1884) Brazilian record of *Verongia tenuissima* (off Alagoas state) with *Aplysina archeri*, based on reexamination of the former's type specimen. Lendenfeld's description of *A. archeri* does correspond to this species as currently known (e.g. ZEA 1987), so that we trust he could have taken an informed decision. Nevertheless, the species has not been recollected ever since the "Challenger" Expedition (1873-1876), despite extensive dredging conducted on the Brazilian northeastern shelf and slope (1960s to the present), and we are skeptical about its identity. Polejaeff's mention of a "hilly" outer surface could perhaps be equated with VAN SOEST's (1978) statement that the surface "shows much relief", but could also be comparable to what is known from *A. lacunosa*, which definitely occurs along the Brazilian coast. The "Challenger" station, ca. 730 m deep, is at odds with the typical bathymetric distribution of the genus, and we suggest the record of *A. archeri* to be kept in doubt until additional material is collected. Recently, MALDONADO & YOUNG (1998) and LEHNERT & VAN SOEST (1999) reported on a new species of *Aplysina*, *A. bathyphila* Maldonado & Young, 1998, from deeper waters off the Bahamas and off Jamaica, but records came from 60-150 m depth only.

*Aplysina capensis* was originally described from South Africa, but neither its assignment to *Aplysina*, nor the species' occurrence on the Brazilian coast (CE) are well established (HECHTEL 1983). De Laubenfels' material is unavailable, and we cannot verify this record. On biogeographic grounds it can be said that the occurrence of any South African sponge along the Brazilian coast is very unlikely (e.g. HECHTEL 1976; VAN SOEST 1994). The species is diagnosed by its "lettuce-like" growth form.

*Aplysina cauliformis* was recorded for the Brazilian coast by COLLETTE & RÜTZLER (1977, off the mouth of the Amazon river) and by MURICY & MORAES (1998, Tamandaré, PE). We have not reexamined Collette & Rützler's material, but find it likely that it is correctly identified as the species appears to be widespread along the Brazilian coast. MURICY & MORAES (1998) record has been reexamined (Tab. III) and found to be correctly identified too, as the sponge is long, erect, slender, with aligned oscula, and the morphometry of its fibre network falls within the range of variation for the species.

Additionally, DE LAUBENFELS (1956) listed *Verongia longissima* (Carter, 1882) for the Ubatuba area (northern coast of São Paulo state). De Laubenfels based his concept of *longissima* in its thin digits and inconspicuous colour-change when preserved (DE LAUBENFELS 1948). He considered *Aplysina cauliformis* a likely synonym of *Verongia aurea* (Hyatt, 1875) (= *Aplysina fulva*, in part; fide WIEDENMAYER 1977). WIEDENMAYER (1977) had the opportunity to examine syntypes of both *cauliformis* and *longissima*, and considered the former a good species of *Aplysina*, transferring the latter to the synonymy of *Spinosella tenerrima* (Duchassaing & Michelotti, 1864) (= *Callyspongia tenerrima*; fide VAN SOEST 1980). We had the opportunity to examine a microscopic slide from De Laubenfels' Brazilian material and found it to pertain to *Aplysina*. This specimen do not conform to the type material of *Verongia longissima* (= *Callyspongia*), but rather, seem close to HECHTEL's (1965) interpretation of the species (= *Aplysina cauliformis sensu* WIEDENMAYER 1977). In the absence of any descriptive data on the specimen itself it is, nevertheless, impossible to assign his record with confidence to either *A. cauliformis* or *A. fulva*. DE LAUBENFELS' (1936, 1948) concept of *Verongia aurea* was based on a misconception, as *Spongia fulva* Pallas, 1766 is not a synonym of *S. officinalis* Linnaeus, 1759 (WIEDENMAYER 1977), and is rather a valid *Aplysina* species. In summary, DE LAUBENFELS (1936, 1948) considered what is currently understood as *A. cauliformis* (e.g. *V. longissima* HECHTEL 1965; *A. cauliformis sensu* VAN SOEST 1978; ZEA 1987) as a likely junior synonym of *A. fulva*. Opinions expressed in the recent literature are followed (e.g. WIEDENMAYER 1977; VAN SOEST 1978; ZEA 1987), that both species can be recognized as separate.

*Aplysina fistularis* was recorded for the Brazilian coast by DE LAUBENFELS (1956), HECHTEL (1976, as *Verongia f.*), and COLLETTE & RÜTZLER (1977, as *V. f. forma f.*). None of these specimens have been reevaluated here, but the species is known to occur at Abrolhos (BA; Muricy, pers. comm.; underwater photograph), and is thus a confirmed record for the Brazilian coast. Indeed, it is quite possible that its type locality is located somewhere along this coastline, as ESPER (1794) referred to it as originary from the "American Coast of South Atlantic" (*apud* LENDENFELD 1889). MURICY's (1989) record of the species is here ascribed to *Aplysina fulva*, on the basis of reexamination of an extensive series of specimens collected at Arraial do Cabo (RJ; Tab. II, and additional material in the UFRJPOR collection), on which he based his record. *Aplysina fulva*, as discussed above, is widespread along the Brazilian coast. It has been cited by JOHNSON (1971, as *Verongia f.*; CE), COLLETTE & RÜTZLER (1977, as *V. fistularis forma fulva*, off the

mouth of the Amazon river), SOLÉ-CAVA *et al.* (1981, as *A. fistularis forma fulva*, ES), MURICY *et al.* (1991, 1993, RJ) and MOTHEs & BASTIAN (1993, Fernando de Noronha Archipelago, PE). MOTHEs-DE-MORAES's (1987, SC) and LERNER's (1996, SC) records were reevaluated and ascribed to the new species described above, *Aplysina caissara* sp. n. Thus, the occurrence of *Aplysina fulva* at localities farther south than those studied here remains to be established.

*Aplysina janusi* (originally as *Verongia*; syntype restudied, MNHN-LBIM-NBE 1026) is transferred here to *Aiolochoxia* Wiedenmayer, 1977 (Druinellidae, Verongida, Demospongiae), being possibly conspecific with *A. crassa* (Hyatt, 1875). The picture provided by BOURY-ESNAULT (1973, Pl. III, fig. 3) is a bit odd, as a tubular shape has not been reported for *A. crassa*, from Brazil at least, yet. The picture reminds of a *Callyspongia* (Callyspongiidae, Haplosclerida, Demospongiae) instead.

*Aplysina lacunosa* was quoted cryptically by HECHTEL (1983). This would be the correct identification for his *Verongia* sp. a (HECHTEL 1976). *Aplysina lacunosa* is confirmed here as occurring along the Brazilian coast, on the basis of recently collected material deposited in the MNRJ (1504) and UFRJPOR (4429) collections.

Other records of *Aplysina longissima* for the Brazilian coast were carried out by JOHNSON (1971) and HECHTEL (1976), both as *Verongia longissima*. Both these records are here ascribed to *A. cauliformis*. As explained above, *longissima* is unavailable for species of *Aplysina*, as its type specimen was found to be conspecific to *Callyspongia tenerrima*. JOHNSON's (1971) record is suspect as the oscula were reported to be spread around the branches, and no live colour was known, so that the identification rests mostly on the ramose, cylindrical habit, which is definitely to be found among *A. fulva* specimens too. HECHTEL (1976) did not describe his specimens, but from his earlier taxonomic treatment (HECHTEL 1965; Jamaican sponges) we tend to believe in his identification.

*Aplysina pergamentacea* was described from Piedade (near Recife, PE). It has a compressed lamellate shape with oscula situated mostly on the rims (HECHTEL 1983). Its habit does appear unique and the species appears valid. Study of additional specimens will establish how trustworthy these characters are. Confidence in the new species described above, *A. caissara* sp. n., stems in great part from the large series of specimens observed *in situ*.

As mentioned above, *Aplysina tenuissima* (as *Verongia*), recorded for the Brazilian coast by POLEJAEFF (1884), has been transferred to *A. archeri* by LENDENFELD (1889), but we are uncertain about the correct identification of the specimen. Since HYATT's (1875) original record has been transferred too, and as the name *tenuissima* has never been used again, it appears wise to consider Polejaeff's record as a dubious *archeri*, rather than a dubious *tenuissima*.

Given the rationale above, an amended list of species of *Aplysina* occurring along the Brazilian coastline is as follows: *A. caissara* sp. n., *A. cauliformis*, *A. fistularis*, *A. fulva*, *A. lacunosa*, and *A. pergamentacea*. *Aplysina archeri* and *A. capensis* are dubious records.



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