

SPECIES RICHNESS AND DISTRIBUTION OF AZOOXANTHELLATE SCLERACTINIA IN BRAZIL

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ABSTRACT

The azooxanthellate Scleractinia from Brazilian waters are reviewed based on examination of museum specimens and current literature, indicating the occurrence of 59 species, including the first southern Atlantic description of: *Caryophyllia berteriana* Duchassaing, 1850, *Caryophyllia crypta* Cairns, 2000, *Caryophyllia scobinosa* Alcock, 1902, and *Dendrophyllia alternata* Pourtales, 1880. A checklist of all species, including first reported occurrence, relevant literature, survey vessel, position and depth range data, and water masses within which Brazilian azooxanthellate Scleractinia occur, are provided. An identification key is proposed and almost all species discussed in this document are illustrated. Distributional patterns of deep-sea corals from Brazil as well as other geographical areas are briefly discussed, and a strong affinity with those Scleractinia from the Caribbean waters is demonstrated. A diagnosis for the species first time described for the southern Atlantic is provided.

The corals of the order Scleractinia can be divided into two ecological classes: the zooxanthellate and azooxanthellate. The term zooxanthellate is used to distinguish the corals that live in symbiosis with dinoflagellate algae, being restricted to the euphotic zone at tropical and subtropical temperatures. In Brazilian waters, due essentially to the great geographic barrier formed by the waters of Amazon River, the zooxanthellate corals are isolated from those of the Caribbean, with only 15 species recorded for the region. Azooxanthellate Scleractinia do not live in symbiosis, being reported from the intertidal zone to more than 6000 m depth (Cairns and Stanley, 1982). In the western Atlantic, the azooxanthellate corals are diverse and abundant, with over twice as many species of azooxanthellate than zooxanthellate corals recorded (Cairns, 1979). While the majority of azooxanthellate species are small and solitary, and usually do not contribute to the construction of the “deep-reef”, certain exceptions to these characteristics occur (Cairns, 1998).

The Brazilian coast can be considered as a transition area between the Caribbean (approx. 130 species) and the Antarctic and the Sub-Antarctic (approx. 40 species) coral fauna. Despite the increase of the number of studies in the last few years describing Brazilian azooxanthellate corals, only 58 species have been previously reported. This study presents a list of all known species of azooxanthellate Scleractinia that occur in Brazilian waters. The number of species totals 59, which is likely to be an underestimate for the actual biodiversity of this area due primarily to the few sample-specific collecting campaigns.

Our knowledge of the azooxanthellate coral fauna in the study area began with the study by Pourtalès (1874) of the zoological material collected during the HASSLER Expedition where he described two valid species from Brazilian waters: *Rhizosmilia maculata* (as *Bathygyathus maculatus*), from off Abrolhos, and *Sphenotrochus auritus* from off Cabo Frio. Pourtalès also reported the occurrence of three additional species: *Tethocyathus cylindraceus* (as *Thecoclyathus cylindraceus*), *Cladocora debilis* (as *Cladocora patriarcha*) and *Madracis asperula*. *Tethocyathus cylindraceus* and

C. debilis were collected off Cabo Frio and *M. asperula* at 11°49'S, off Bahia. During the next century, an additional 10 studies on azooxanthellate coral fauna were published, adding 15 species to Brazilian waters (Lindström, 1877; Moseley, 1881; Vaughan, 1906; Gardiner, 1913; Squires, 1959; Laborel, 1970; Tommasi, 1970; Laborel, 1971; Wells, 1973; Leite and Tommasi, 1976). Subsequently, Cairns published some revisional studies on the Caribbean and Antarctic and Sub-Antarctic corals and included several species reported from Brazilian waters, that combined, can be considered as the basis for the knowledge on the taxonomy of the Brazilian azooxanthellate corals (Cairns, 1977, 1978, 1979, 1982, 2000). Zibrowius (1988) listed the occurrence of 34 species based on the material collected by R/V MARION DUFRESNE, however, no station number data were available for these species. Recently, four more species were recorded from Brazilian waters (Paula and Creed, 2004; Pires et al., 2004; Kitahara and Cairns, 2005) (Table 1). Additional records of azooxanthellate corals from Brazilian waters can be found in Pires (2007).

Here I present a list of all azooxanthellate Scleractinia species reported in the Brazilian Exclusive Economic Zone (EEZ). I summarize references to relevant literature, sampling vessel information, position and depth range data, as well as water mass descriptions within which all species of the Scleractinia occur. An identification key is given and illustrations for many species are provided (Figs. 2–5).

MATERIAL AND METHODS

The results presented here were based on the compilation of literature and on the examination of specimens deposited at Museu Oceanográfico do Vale do Itajaí (MOVI), Brazil, and National Museum of Natural History (NMNH), United States. Only specimens reported or collected from within the Brazilian EEZ (Fig. 1) were considered.

Measurements and meristics follow Wells (1956), Zibrowius (1980), and Cairns (1979, 1990, 2000). The basic morphological terminology used is explained by Wells (1956) and the septal formula by Cairns (1989).

ABBREVIATIONS.—GCD—greater calicular diameter; LCD—lesser calicular diameter; CD—calicular diameter; S_1 —first septal cycle; C_1 —costae of the first septal cycle; P_1 —paliform lobes of the first cycle; C—costae; S—septa; MOVI—Museu Oceanográfico do Vale do Itajaí.

RESULTS AND DISCUSSION

Of the 59 species of azooxanthellate corals reported from Brazilian waters, four are described for this area for the first time. These are: *Caryophyllia berteriana*, *Caryophyllia crypta*, *Caryophyllia scobinosa*, and *Dendrophyllia alternata*. For many of the additional species listed here, knowledge of their regional and bathymetric distribution is extended (Table 1).

Caryophyllia berteriana Duchassaing, 1850 (Fig. 2H)

Material.—MOVI 10933, 31°03'S, 49°24'W, 320 m; MOVI 16479, 29°14'S, 48°02'W, 250 m; MOVI 23867–23870, 31°20'S, 49°41'W, 296 m; MOVI 24047, 29°17.78'S, 47°51.46'W, 460 m; MOVI 31720, off Rio de Janeiro.

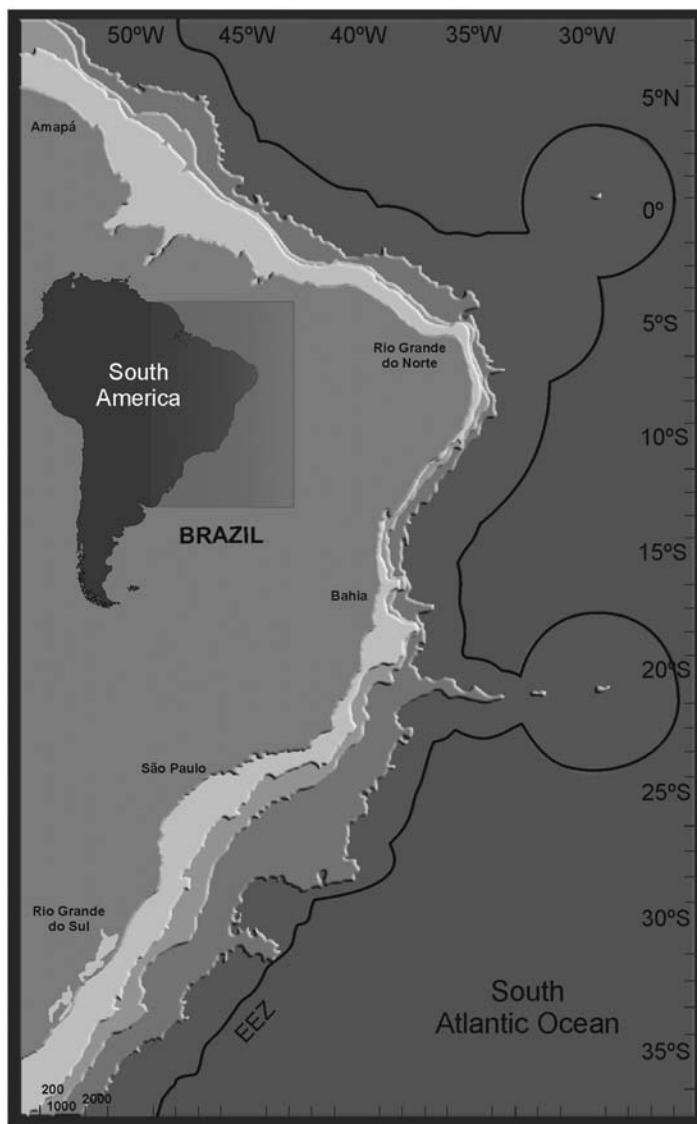


Figure 1. Brazilian coastal region showing the extent of the Exclusive Economic Zone (EEZ).

Diagnosis.—Corallum ceratoid, calice round to elliptical; all specimens examined have a pedicel reinforced by concentric layers of stereome, producing a strong structure, which attaches corallum to the substrate by an encrusting base; costae variable, usually more prominent near the calice; broad, subequal, and flat to slightly convex, separated by narrow furrows; septa arranged in seven systems of four cycles, but septa hexamerally arranged are more common; ($S_{1-2} > S_3 > S_4$); axial margins of primary, secondary, and quaternary septa straight to slightly sinuous, but those of tertiary cycles are very sinuous; pali with sinuous inner margins present before each S_3 ; columella arranged in an elliptical field and composed of 3–9 small, twisted, pointed ribbons, which can be fused together.

Table 1. Checklist of the Brazilian azooxanthellate Scleractinia. (*) Authors: [1] Pourtalès, 1874; [2] Lindström, 1877; [3] Moseley, 1881; [4] Vaughan, 1906; [5] Gardner, 1913; [6] Squires, 1959; [7] Laborel, 1970; [8] Tommasi, 1979; [9] Laborel, 1971; [10] Wells, 1973; [11] Leite and Tommasi, 1976; [12] Cairns, 1977; [13] Cairns, 1978; [14] Cairns, 1979; [15] Zibrowius, 1980; [16] Cairns, 1982; [17] Leão, 1986; [18] Fernandes and Young, 1986; [19] Zibrowius, 1988; [20] Hetzel and Castro, 1994; [21] Laborel, 1996; [22] Pires, 1996; [23] Cairns, 1997; [24] Sumida et al., 2000; [25] Paula and Creed, 2004; [26] Pires et al., 2004; [27] Le Goff Vitry et al., 2004; [28] Kitahara and Cairns, 2005; [29] Paula and Creed, 2005; [30] Kitahara (2006); [31] Castro et al. (2006). (**) Water masses: [CSW] continental shelf water; [AIW] Antarctic Intermediate Water; [NADW] North Atlantic Deep Water. (***) New distributional extension. (****) World distribution: [WA] western Atlantic; [EA] eastern Atlantic; [IO] Indian Ocean; [WCP] western and central Pacific; [EP] eastern Pacific; [SA] Sub-Antarctic and Antarctic region.

Species / Author	First report in Brazilian waters / Survey vessel	Further reports in Brazilian waters*
<i>Madracis asperula</i> Milne-Edwards and Haime, 1849	Pourtalès (1874) / HASSLER	7; 8; 18; 20; 23; 31
<i>Madracis pharensis</i> (Heller, 1868)	Laborel (1970) / CALYPSO	23
<i>Madracis brueggemanni</i> (Ridley, 1881)	Gardiner (1913) (as <i>Madracis scotiae</i>) /	10; 23; 31
		3 (as <i>Madracis scotiae</i>)
		7
<i>Fungiacyathus symmetricus</i> (Pourtalès, 1871)	Laborel (1970) / CALYPSO	14; 19
<i>Fungiacyathus crispus</i> (Pourtalès, 1871)	Cairns (1979) / OREGON	15; 26
<i>Astrangia rathbuni</i> Vaughan, 1906	Vaughan (1906) / ?	7; 9; 17; 20; 22; 23; 31
<i>Astrangia solitaria</i> (Lesueur, 1817)	Vaughan (1906) (as <i>Astrangia brasiliensis</i>) / ?	23
		As <i>A. brasiliensis</i> 7; 9; 17; 31
<i>Bathelia candida</i> Moseley, 1881	Cairns (1982) / CALYPSO; WALTER HERWIG	–
<i>Madrepora oculata</i> Linnaeus, 1758	Cairns (1979) / WALTER HERWIG	19; 29; 30; 31
<i>Madrepora carolina</i> (Pourtalès, 1871)	Cairns (1979) / ?CHAIN	23
<i>Caryophyllia berteriana</i> Duchassaing, 1850	Present paper / MARGUS II, ATLÂNTICO SUL	31
<i>Caryophyllia crypta</i> Cairns, 2000	Present paper / CHAIN	–
<i>Caryophyllia barbadensis</i> Cairns, 1979	Zibrowius (1988) / MARION DUFRESNE	23
<i>Caryophyllia antennularum</i> Pourtalès, 1874	Cairns (1979) / CALYPSO	–
<i>Caryophyllia scabiosaa</i> Alcock, 1902	Present paper / ATLÂNTICO SUL	–
<i>Caryophyllia a. caribeanna</i> Cairns, 1979	Cairns (1979) / CALYPSO	22; 24; 31
<i>Premocystathus corniformis</i> (Pourtalès, 1868)	Cairns (1979) (as <i>C. corniformis</i>) / OREGON	23
<i>Coenocystathus parvulus</i> (Cairns, 1979)	Cairns (1979) (as <i>C. parvula</i>) / W. BESNARD	As <i>C. corniformis</i> 19; 22
<i>Concentrotheca laevigata</i> (Pourtalès, 1871)	Zibrowius (1988) / MARION DUFRESNE	23

Table 1. Continued.

Species / Author	Latitudinal range in Brazilian waters	Depth range (m)	Water masses type**	World distribution
<i>Madracis asperula</i> Milne-Edwards and Haime, 1849	11°49'S–22°00'S	73–110	CSW	WA; EA
<i>Madracis pharensis</i> (Heller, 1868)	21°48'S	?	?	WA;
<i>Madracis breugemanni</i> (Ridley, 1881)	13°04'S–20°52'S	45–91	CSW	EA; WCP?; EP?
<i>Fungiacyathus symmetricus</i> (Pourtales, 1871)	Northeastern 24°16'S–27°38'S	120–250	CSW, SW	WA
<i>Fungiacyathus crispus</i> (Pourtales, 1871)	0°8'S 24°20'S	274	SW	WA; EA
<i>Astrangia rathbuni</i> Vaughan, 1906	15°00'S–33°22'S***	21–90	CSW	WA; SA
<i>Astrangia solitaria</i> (Lesueur, 1817)	Northeastern Brazil	0–51	CSW	WA
<i>Bathelia candida</i> Moseley, 1881	32°00'S	500	SW	WA; SA
<i>Madrepora oculata</i> Linnaeus, 1758	17°25'S–30°03'S***	425–800	SW, AIW	Cosmopolitan
<i>Madrepora carolina</i> (Pourtales, 1871)	St. Peter and Paul Rocks	100–300	CSW, SW	WA
<i>Caryophyllia berteriana</i> Duchassaing, 1850	20°40'S–31°20'S***	274–500	SW	WA
<i>Caryophyllia crypha</i> Cairns, 2000	St. Peter and Paul Rocks***	291	SW	WA
<i>Caryophyllia barbadensis</i> Cairns, 1979	Southern Brazil	129–249	CSW, SW	WA
<i>Caryophyllia amillarum</i> Pourtales, 1874	? 24°54'S	1,000	AIW	WA
<i>Caryophyllia scobinosa</i> Alcock, 1902	Southern Brazil***	?	?	IO; WCP
<i>Caryophyllia a. caribeanus</i> Cairns, 1979	0°18'S 13°22'S–27°34'S	274–1,050	SW, AIW	WA; EA; IO; WCP
<i>Premocystis corniformis</i> (Pourtales, 1868)	0°8'N 24°35'S–31°14'S***	274–600	SW, AIW	WA; EA; IO?
<i>Coenocyathus parvulus</i> (Cairns, 1979)	21°48'S–31°17'S***	95–300	CSW, SW	WA
<i>Concentrotheca laevigata</i> (Pourtales, 1871)	?	?	?	WA; EA

Table 1. Continued.

Species / Author	First report in Brazilian waters / Survey vessel	Further reports in Brazilian waters*
<i>Trochocyathus rawsonii</i> Pourtales, 1874	Cairns (1979) / CHAIN	19; 23
<i>Trochocyathus laboreli</i> Cairns, 2000	Cairns (2000) / PROF. W. BESNARD; EMILIA	29; 30; 31
<i>Tethocyathus cylindraceus</i> (Pourtales, 1868)	Pourtales (1874) / HASSLER	As <i>Trochocyathus</i> sp. 8 ¹
<i>Paracyathus pulchellus</i> (Philippi, 1842)	Cairns (1979) / OREGON	15; 23
<i>Cladocora debilis</i> Milne-Edwards and Haime, 1849	Pourtales (1874) (as <i>C. patriarca</i>) / HASSLER	11; 15; 19; 21; 22; 23; 26; 31
<i>Stephanocyathus diadema</i> (Moseley, 1876)	Laborel (1970) (as <i>C. diadema</i>) / CALYPSO	As <i>Cladocora arbuscula</i> 8; 22
<i>Stephanocyathus paliferus</i> Cairns, 1977	Cairns (1977) / CHALLENGER	12; 14; 19
<i>Deltocyathus italicus</i> (Michelotti, 1838)	Laborel (1970) / CALYPSO	14
<i>Deltocyathus agassizii</i> Pourtales, 1867	Zibrowius (1988) / MARION DUFRESNE	14; 22; 24; 26; 31
<i>Deltocyathus calcar</i> Pourtales, 1874	Cairns (1979) / WALTHER HERWIG, CALYPSO	? <i>Deltocyathus conicus</i> 15
<i>Deltocyathus eccentricus</i> Cairns, 1979	Cairns (1979) / OREGON	19; 23; 26; 31
<i>Deltocyathus moseleyi</i> Cairns, 1979	Zibrowius (1988) / MARION DUFRESNE	Not <i>D. italicus</i> 7; 8
<i>Deltocyathus halianthus</i> (Lindström, 1877)	Lindström (1877) (as <i>L. halianthus</i>) / EUGENIE	15; 19; 22; 24; 26; 31
<i>Desmophyllum dianthus</i> (Esper, 1794)	Laborel (1970) (as <i>D. cristagalli</i>) / CALYPSO	23
<i>Monohedotrochus capitolii</i> Kitahara and Cairns, 2005	Kitahara & Cairns (2005) / ATLÂNTICO SUL	<i>D. cristagalli</i> 14; 15; 19
<i>Phyllangia a. americana</i> M. E. and Haime, 1849	Laborel (1970) / CALYPSO	—
<i>Rhizosmilia maculata</i> (Pourtales, 1874)	Pourtales (1874) (as <i>B. maculatus</i>) / HASSLER	9; 17; 20; 22; 23
<i>Lophelia pertusa</i> (Linnaeus, 1758)	Laborel (1970) (as <i>Lophelia prolifera</i>) / CALYPSO	22; 23; 31
<i>Anomocora fecunda</i> (Pourtales, 1871)	Cairns (1979) / CHAIN	? <i>Bathyocyathus maculatus</i> 8
<i>Pourtalosmilia conferta</i> Cairns, 1978	Cairns (1978) / CHAIN	? <i>Caryophyllia maculata</i> 7
<i>Phacelocyathus floss</i> (Pourtales, 1878)	Cairns (1979) / NEKTON	15; 19; 23; 27; 29; 30; 31 <i>Lophelia prolifera</i> 14 15; 23 23

Table 1. Continued.

Species / Author	Latitudinal range in Brazilian waters	Depth range (m)	Water masses type***	World distribution
<i>Trochocyathus rawsonii</i> Pourtales, 1874	Northern Brazil–0°18'N 29°20'S***–31°05'S*** 24°09'S–24°20'S***	274–300	SW	WA; IO?
<i>Trochocyathus laboreli</i> Cairns, 2000		125–390	CSW, SW	WA
<i>Tethocyathus cylindraceus</i> (Pourtales, 1868)	Off Cabo Frio	64	CSW	WA, WCP
<i>Paracyathus pulchellus</i> (Philippi, 1842)	0°18'N 31°02'S***–33°37'S***	183–310	SW	WA; EA
<i>Cladocora debilis</i> Milne-Edwards and Haime, 1849	19°45'S–34°29'S*** 8°37'S–25°06'S	75–438 1,234–2,150	CSW, SW NADW	WA; EA
<i>Stephanocyathus diadema</i> (Moseley, 1876)	0°18'N	274	SW	WA
<i>Stephanocyathus paliferus</i> Cairns, 1977	24°43'S–26°46'S	46–2,150	CSW, SW, AIW, NADW	WA; EA
<i>Deltocyathus italicus</i> (Michelotti, 1838)	?	?	?	WA
<i>Deltocyathus agassizi</i> Pourtales, 1867	13°04'S–32°40'S	91–450	CSW, SW	WA
<i>Deltocyathus calcar</i> Pourtales, 1874	0°18'S	240–700	SW, AIW	WA; EA
<i>Deltocyathus eccentricus</i> Cairns, 1979	15°35'S–26°46'S			
<i>Deltocyathus moseleyi</i> Cairns, 1979	20°40'S	120–520	CSW, SW, AIW	WA; EA
<i>Deltocyathus halianthus</i> (Lindström, 1877)	22°47'S–32°40'S	46–180	CSW, SW	WA
<i>Desmophyllum dianthus</i> (Esper, 1794)	22°30'S–34°12'S***	800–1,000	AIW	Cosmopolitan
<i>Monohedonrochus capitolii</i> Kitahara and Cairns, 2005	28°43'S–35°00'S	150–460	SW	WA
<i>Phyllangia a. americana</i> M. E. and Haime, 1849	From Amapá to São Paulo state	3–53	CSW	WA
<i>Rhizosmilia maculata</i> (Pourtales, 1874)	1°24'S–20°51'S	20–73	CSW	WA
<i>Lophelia pertusa</i> (Linnaeus, 1758)	17°25'S–34°30'S***	300–1,000	SW, AIW	Cosmopolitan
<i>Anomocora secunda</i> (Pourtales, 1871)	St. Peter and Paul Rocks	182	SW	WA; EA
<i>Pourtalosmilia conferta</i> Cairns, 1978	0°18'S	55–220	CSW, SW	WA
<i>Phacelocyathus flos</i> (Pourtales, 1878)	St. Peter and Paul Rocks Off Recife	?	?	WA

Table 1. Continued.

Species / Author	First report in Brazilian waters / Survey vessel	Further reports in Brazilian waters*
<i>Solenosmilia variabilis</i> Duncan, 1873	Laborel (1970) / CALYPSO	14; 15; 19; 29; 30; 31 Not <i>Madrepora oculata</i> 6
<i>Dasmosmilia lymani</i> (Pourtales, 1871)	Pourtales (1874) / HASSLER	8; 14; 15; 19; 22; 23
<i>Dasmosmilia variegata</i> (Pourtales, 1871)	Cairns (1979) / OREGON	15; 19; 22; 23; 26
<i>Deltocyathoides simpsonii</i> (Pourtales, 1871)	Cairns (1979) (as <i>P. simpsonii</i>) / OREGON	23
<i>Sphenotrochus auritus</i> Pourtales, 1874	Pourtales (1874) / HASSLER	<i>Peponocyathus simpsonii</i> 15 7; 23; 31
<i>Flabellum apertum</i> Moseley, 1876		<i>Stenocyathus</i> sp. 8; 19 19; 31
<i>Placotrochides frustum</i> Cairns, 1979		<i>Placotrochides frusta</i> 15
<i>Javania cailletii</i> (Duchas, and Michelotti, 1864)	Cairns (1979) / ALBATROSS	15; 19; 23; 26
<i>Polymyces fragilis</i> (Pourtales, 1868)	Cairns (1979) / WALTHER HERWIG	19; 23
<i>Schizocyathus fissilis</i> Pourtales, 1874	Pires <i>et al.</i> (2004) / Prof. VLADIMIR BESNARD	—
<i>Stenocyathus verniformis</i> (Pourtales, 1868)	Laborel (1970) / CALYPSO	14; 15; 23; 31
<i>Balanophyllia dinaea</i> Cairns, 1977	Cairns (2000) / SALDANHA PESCA N2	—
<i>Eguchipsammia gaditana</i> (Duncan, 1873)	Cairns (1979) (as <i>D. gaditana</i>) / CHAIN	—
<i>Rhizopsammia goezi</i> (Lindström, 1877)	Cairns (2000) / ?	23
<i>Cladopsammia manuelensis</i> (Chevalier, 1966)	Cairns (1979) (as <i>Rhizopsammia manuelensis</i>) / WALTHER HERWIG	<i>Dendrophyllia gaditana</i> 15 <i>Balanophyllia</i> sp. 22
<i>Dendrophyllia alternata</i> Pourtales, 1880	Present paper / SLEBECH	23 <i>R. manuelensis</i> 15; 21
<i>Enallopssammia rostrata</i> (Pourtales, 1878)	Laborel (1970) / CALYPSO	27
<i>Tubastraea tagusensis</i> Wells, 1982	Paula and Creed (2004) / ?	14; 19
<i>Tubastraea coccinea</i> Lesson, 1829	Paula and Creed (2004) / ?	<i>E. amphelioides</i> 7; 15 29
		29

Table 1. Continued.

Species / Author	Latitudinal range in Brazilian waters	Depth range (m)	Water masses type**	World distribution
<i>Solenosmilia variabilis</i> Duncan, 1873	13°38'S–34°19'S***	50–1,000	CSW, SW, AIW	Cosmopolitan
<i>Dasmosmilia lymani</i> (Pourtales, 1871)	24°25'S–31°23'S***	95–320	CSW, SW	WA; EA; WCP
<i>Dasmosmilia variegata</i> (Pourtales, 1871)	0°18'S	258–320	SW	WA; EA; IO
<i>Deltoxyathoides simpsonii</i> (Pourtales, 1871)	24°20'S–24°25'S	274	SW	WA; EA
<i>Sphenotrochus auritus</i> Pourtales, 1874	0°18'N	15–50	CSW	WA
<i>Flabellum apertum</i> Moseley, 1876	1°57'N–22°10'S	400–800	SW, AIW	WA; SA
<i>Placorhoides frustum</i> Cairns, 1979	3°43'S	763	AIW	WA; EA
<i>Javania cailleti</i> (Duchas, and Michelotti, 1864)	23°55'S–33°42'S	107–200	CSW, SW	Cosmopolitan
<i>Polymyces fragilis</i> (Pourtales, 1868)	0°18'S	130–300	CSW, SW	WA
<i>Schizocyathus fissilis</i> Pourtales, 1874	29°20'S***–30°59'S	258	SW	WA; EA
<i>Schizocyathus verniformis</i> (Pourtales, 1868)	25°15'S	128–552	CSW, SW, AIW	Cosmopolitan
<i>Balanophyllia dineta</i> Cairns, 1977	0°18'S			
<i>Euglyphsammia gaditana</i> (Duncan, 1873)	St. Peter and Paul Rocks			
<i>Rhizopsammia goesi</i> (Lindström, 1877)	21°48'S–22°22'S	116	CSW	WA
<i>Cladopsammia manuelensis</i> (Chevalier, 1966)	4°27'N	110–291	SW	WA; EA; IO; WCP
<i>Dendrophyllia alternata</i> Pourtales, 1880	St. Peter and Paul Rocks	18	CSW	WA
<i>Enalopsammia rostrata</i> (Pourtales, 1878)	17°00'S	78–320	CSW, SW	WA; EA
<i>Tubastraea tagusensis</i> Wells, 1982	27°51'S***–33°42'S	320–500	SW	WA; EA
<i>Tubastraea coccinea</i> Lesson, 1829	23°48'S–31°03'S***	425–766	SW, AIW	Cosmopolitan
	24°49'S–30°03'S***	3–20	CSW	WA; EP
	Off Rio de Janeiro	3–20	CSW	WA; EA; IO; WCP; EP
	Off Rio de Janeiro to Santa Catarina***	3–20	CSW	

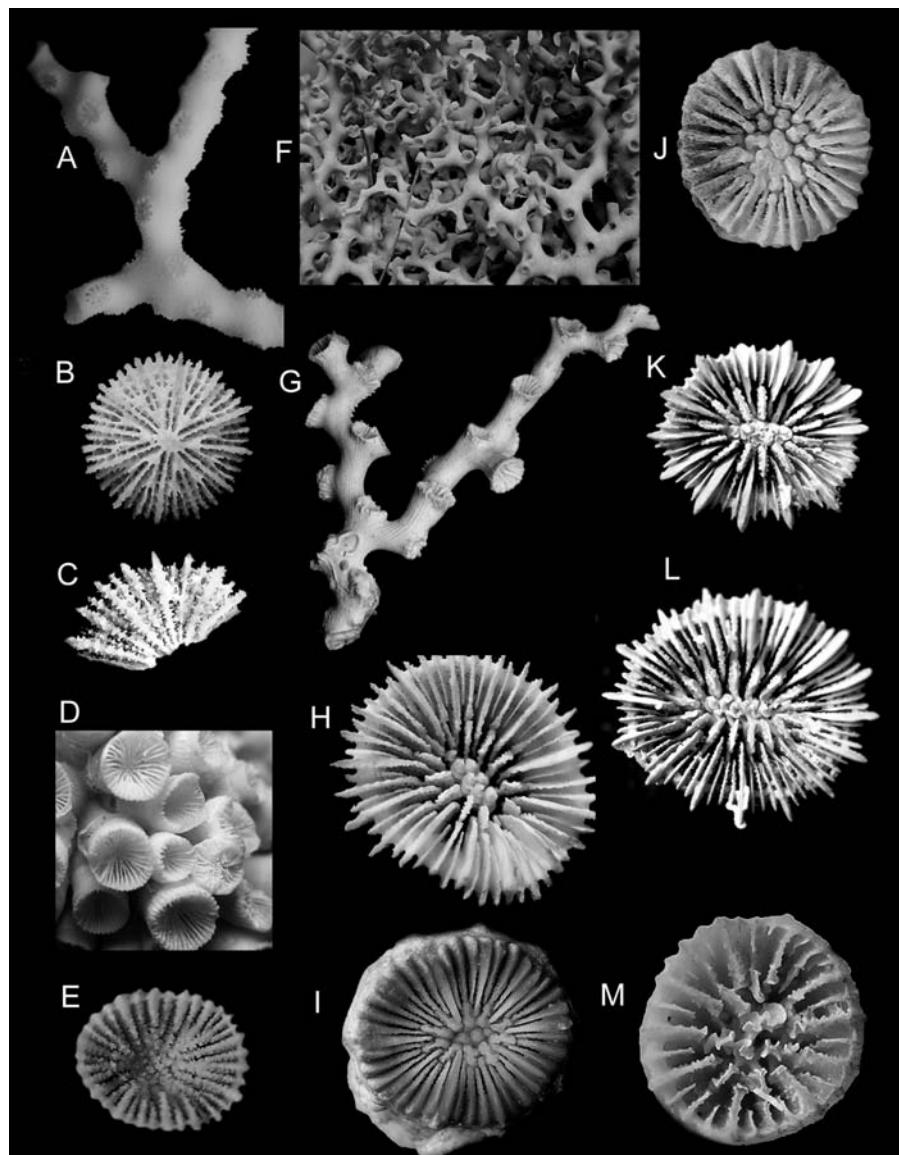


Figure 2. (A) distal branch of *Madracis asperula* (MOVI 38627), $\times 3.1$; (B) calicular view of *Fungiacyathus symmetricus* (MOVI 38625), $\times 2.4$; (C) fragment of *Fungiacyathus crispus* (MOVI 38623), $\times 5.3$; (D) colony of *Astrangia rathbuni* (MOVI 00020), $\times 1.7$; (E) calicular view of *Astrangia solitaria* (MOVI 38609), $\times 4.7$; (F) colony of *Madreporella oculata* (MOVI 05081), $\times 1.3$; (G) distal branch of *Madreporella carolina* (MOVI 38606), $\times 1.6$; (H) calicular view of *Caryophyllia berteriana* (MOVI 23867), $\times 2.2$; (I) calicular view of *Caryophyllia crypta* (MOVI 38622), $\times 3.4$; (J) calicular view of *Caryophyllia scobinosa* (MOVI 23774), $\times 1.5$; (K) calicular view of *Caryophyllia barbadensis* (MOVI 38608), $\times 5$; (L) calicular view of *Caryophyllia ambrosia caribbeana* (MOVI 38628), $\times 1.25$; (M) calicular view of *Premocyathus cornuformis* (MOVI 38617), $\times 8.3$.

Distribution in Brazilian Waters.—off Rio de Janeiro, Santa Catarina ($29^{\circ}14'S$) and Rio Grande do Sul ($31^{\circ}20'S$) states; 250–460 m.

Remarks.—As the first description from southern Atlantic Ocean, the specimens from southern Brazil are larger than other *C. berteriana* analyzed throughout the world, mainly in calicular diameter and height. The specimens MOVI 23867–23870 represent the most distant record from the Equator. In Brazilian waters this species can be found on hard substrate of the continental shelf and slope, and on biodetritic areas. In southern Brazil, this species is influenced by the subtropical water mass ($20\text{--}11.6^{\circ}\text{C}$).

Caryophyllia crypta Cairns, 2000

(Fig. 2I)

Material.—MOVI 38622, 7 mi east from Arquipélago de São Pedro e São Paulo (St. Peter and St. Paul rocks), 291 m.

Diagnosis.—Corallum ceratoid with a monocyclic base. C_{1-2} ridged near calice. Theca and peripheral septa usually yellowish brown. Septa hexamerally arranged in 4 cycles, but additional S_5 may be present ($S_1 > S_2 > S_3 * S_4$), *when adjacent to primaries, S_4 usually wider than S_3 , but those adjacent to S_2 being equal or less wide than S_3 , which in turn is the least exsert septa. Primary and secondary septa have slightly sinuous axial edges, but those of S_3 moderately sinuous. Each tertiary septa bearing a robust P_3 which form a crown encircling the columella. Columella composed of 1–6 slender twisted elements. Fossa moderately deep.

Distribution in Brazilian Waters.—St. Peter and St. Paul rocks, 291 m.

Caryophyllia scobinosa Alcock, 1902

(Fig. 2K)

Material.—MOVI 23773–23774, off Rio Grande do Sul State; MOVI 24024, off Rio Grande do Sul State.

Diagnosis.—Corallum cornute (curved between 45° – 95°), unconsolidated pedicel 1.5 mm in diameter; largest Brazilian specimen examined (MOVI 23774) is 21.1×17.3 mm in calicular diameter and 26.3 mm tall; calice elliptical (GCD:LCD = 1.12–1.21); costae well defined and covered by low rounded granules; corallum white to light gray; septa hexamerally arranged in four cycles (48 septa); however, the largest specimen has 56 septa arranged in 14 systems and has correspondingly 14 pali; S_{1-2} highly exsert (~2.2–3.0 mm) and have slightly sinuous vertical axial edges, that almost reach the columella; S_3 are the least exsert septa (~1.0 mm), have moderately sinuous inner edges and support a crown of 12–14 sinuous and pointed granulated pali; S_4 about 1.5–1.8 mm exsert, and a pair of S_4 fusing with primary and secondary adjacent septa; columella composed of 6–10 twisted elements.

Distribution in Brazilian Waters.—Off Rio Grande do Sul State, southern Brazil, depth unknown.

Remarks.—As the first description in the Atlantic Ocean, this species can be found close to hard or biodetritic substrate in the initial phase of development, and on unconsolidated areas when in adult form. An intraspecific difference between the

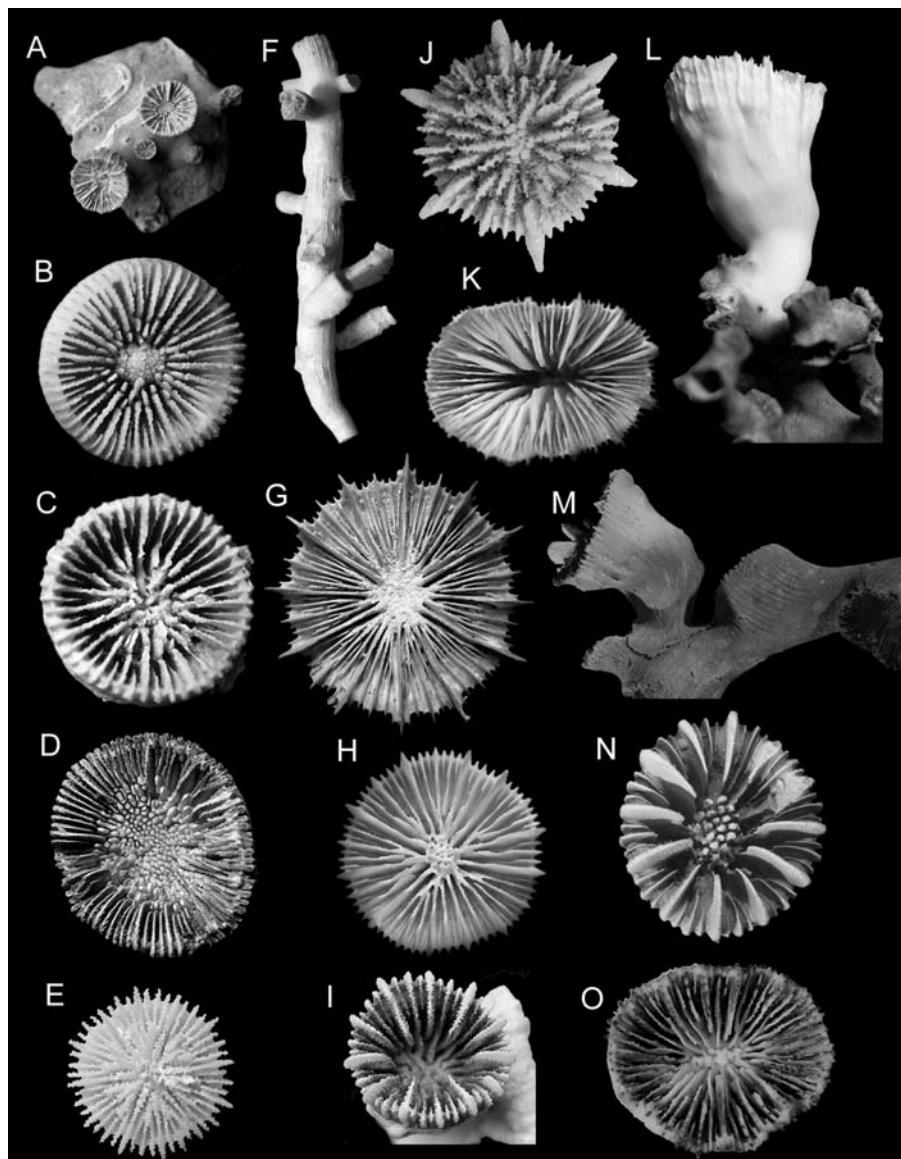


Figure 3. (A) colony view of *Coenocyathus parvulus* (MOVI 23980), $\times 1.9$; (B) calicular view of *Trochocyathus rawsonii* (MOVI 38613), $\times 1.6$; (C) calicular view of *Trochocyathus laborei* (MOVI 24064), $\times 1.9$; (D) calicular view of *Paracyathus pulchellus* (MOVI 23842), $\times 1.9$; (E) calicular view of *Deltocyathus italicus* (MOVI 38614), $\times 2.2$; (F) lateral view of *Cladocora debilis* (MOVI 23940), $\times 1.5$; (G) calicular view of *Stephanocyathus diadema* (MOVI 38633), $\times 0.7$; (H) calicular view of *Stephanocyathus paliferus* (MOVI 38634), $\times 1.1$; (I) calicular view of *Phyllangia americana* (MOVI 38607), $\times 2.4$; (J) calicular view of *Deltocyathus calcar* (MOVI 38626), $\times 4.3$; (K, L) calicular and lateral view of *Desmophyllum dianthus* (MOVI 26927), $\times 0.7$, 0.9, respectively; (M) lateral view of *Monohedotrochus capitolii* attached on *Bathelia candida* (USNM 83389), $\times 0.7$; (N) calicular view of *M. capitolii* (MOVI 24049), $\times 2.9$; (O) calicular view of *Rhizosmilia maculata* (MOVI 38620), $\times 2.1$.

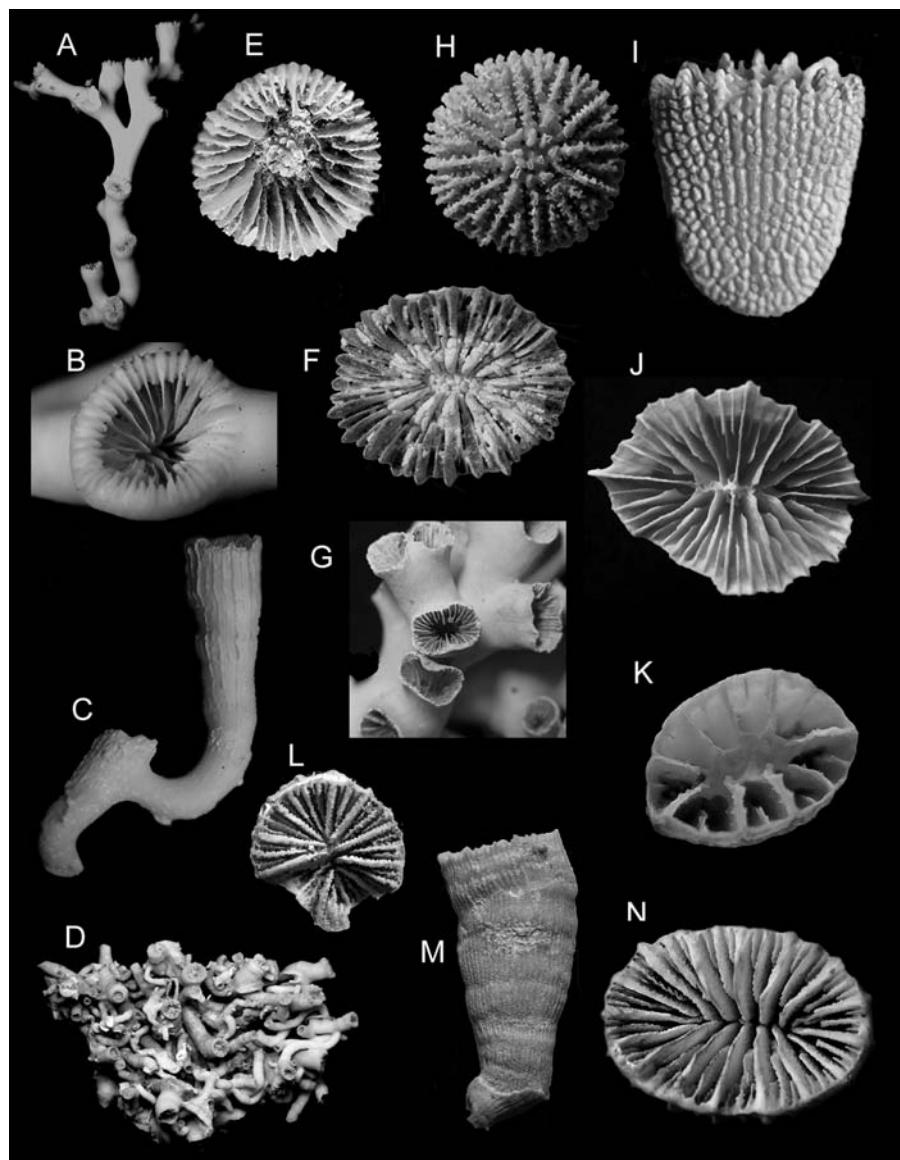


Figure 4. (A) lateral view of *Lophelia pertusa* (MOVI 23865), $\times 0.5$; (B) calicular view of *L. pertusa* (MOVI 26816), $\times 2.0$; (C) lateral view of *Anomocora fecunda* (MOVI 38627), $\times 2.4$; (D) colony view of *Pountalosmilia conferta* (MOVI 24062), $\times 0.3$; (E) calicular view of *P. conferta* (MOVI 24062), $\times 2.7$; (F) calicular view of *Phacelocyathus flos* (MOVI 38621), $\times 2.4$; (G) infratentacular budding in *Solenosmilia variabilis* (MOVI 28876), $\times 1.6$; (H) calicular view of *Peponocyathus stimpsonii* (MOVI 38612), $\times 9.7$; (I) lateral view of *Sphenotrochus auritus* (MOVI 38611), $\times 9.2$; (J) calicular view of *Flabellum apertum* (MOVI 20939), $\times 1$; (K) calicular view of *Placotrochides frustum* (MOVI 38618), $\times 6.9$; (L) calicular view of *Polymyces fragilis* (MOVI 24054), $\times 1.1$; (M) lateral view of *Dasmosmilia lymani*, $\times 2.1$; (N) calicular view of *Javania cailleti* (MOVI 23835), $\times 1.8$.

description of Cairns (1995) and the examined specimens was observed on the color of the corallum. The specimen MOVI 23774 has three different, parallel to calice, color bands, but only two bands are evident on the specimen analyzed by Cairns (1995). However, a more detailed study describing the differences between the two free *Caryophyllia* reported from Brazil, *C. scobinosa*, and *Caryophyllia ambrosia caribbeana* Cairns, 1979, is yet to be carried out.

Dendrophyllia alternata Pourtalès, 1880
(Fig. 5J)

Material.—MOVI 10717, 31°00.984'S, 49°20.688'W, 302–320 m; MOVI 10719–10720, 31°01.784'S, 49°21.953'W, 277–320 m; MOVI 20916–20917, 25°55.54'S, 43°37.79'W, 318 m; MOVI 24483, off Laguna, Santa Catarina State.

Diagnosis.—Colony dendroid with dichotomous branching; branches with calices occurring laterally in the plane, in alternating fashion; the largest fragment (MOVI 24483) has a groove that bears the calices, with approximately 2.0 mm deep; distance between calices range from 4.0 to 8.0 mm; calice project 1.0–5.0 mm above the branch and are perpendicular to basal branches, but obliquely on the terminal branches; calices round to slightly elliptical, measuring 4.0–7.0 mm in diameter, the GCD oriented in the same direction of the branch pattern; coenosteum costae prominent and rounded, separated by deep, narrow furrows; costal granulation fine, consisting of pointed spines; corallites normally contain 39–45 septa, arranged in six systems and four cycles; S_1 and S_2 equal, not exsert, and extend to t columella; Pourtalès Plan present (S_4 before S_3) but poorly defined; columella elongate and aligned in direction of branches, commonly composed of a fused mass of rods.

Distribution in Brazilian Waters.—Off Paraná, Santa Catarina and Rio Grande do Sul States, 277–320 m.

Remarks.—One of the fragments examined in this study has a three-dimensional branching pattern. This pattern is probably made by a change in the position of the colony (a possible fishing effect?). According to Cairns (1979), a mature colony is about 1 m height, however, in a basal fragment (MOVI 24483) collected off Laguna City, the diameter of the branch is greater than those observed by Cairns (1979), indicating that the size of a mature colony is probably higher than 1 m.

KEY TO BRAZILIAN AZOOXANTHELLATE SCLERACTINIA

1a. Solitary	2
1b. Colonial	36
2a. Unattached	3
2b. Attached	24
3a. Corallum discoid to or patellate	4
3b. Corallum not discoid or patellate	8
4a. Base with a circular scar	<i>Deltocyathus moseleyi</i>
4b. Base not scarred	5
5a. Shape of base conical (apical angle between 80–120°)	<i>Deltocyathus italicus</i> (Fig. 3E)
5b. Shape of base flat, convex or slightly conical (> 140°)	6

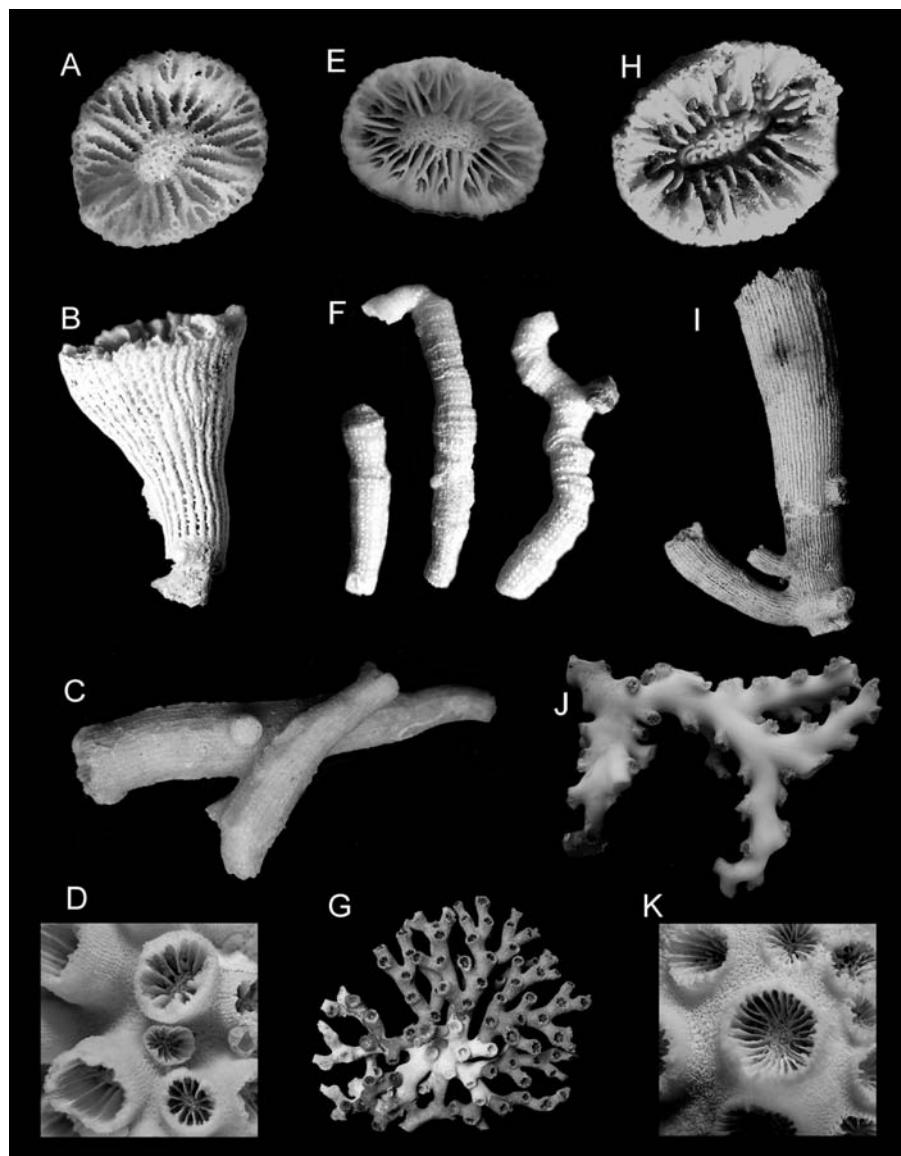


Figure 5. (A,B) calicular and lateral view of *Balanophyllia dineta* (MOVI38610), $\times 4.8$, 3.9, respectively; (C) lateral view of *Eguchipsammia gaditana* (MOVI 38624), $\times 2.5$; (D) calices of *Tubastraea coccinea* (MOVI 38636), $\times 1.4$; (E) calicular view of *Rhizopsammia goesi* (MOVI 38629), $\times 2.6$; (F) lateral view of three specimens of *Stenocyathus vermiciformis* (MOVI 38615), $\times 2.6$; (G) colony view of *Enallopsammia rostrata* (MOVI 20602), $\times 0.4$; (H, I) calicular and lateral view of *Cladopsammia manuelensis*, $\times 3.6$, 1.5, respectively; (J) fragment of *Dendrophyllia alternata* (MOVI 10720), $\times 0.5$; (K) calices of *Tubastraea tagusensis* (MOVI 38635), $\times 1.5$.

- 6a. Calicular rim usually thickened / S_4 rudimentary, attached to S_3 near columella / often more than 48 septa *Deltocyathus eccentricus*
- 6b. Calicular rim not thickened / S_4 not rudimentary / usually 48 septa 7
- 7a. C_1 always broader than other costae and usually projecting outward as large spines / S_2 usually dark pigmented *Deltocyathus calcar* (Fig. 3J)

- 7b. Equicostate, no projecting costal spines / corallum white. *Deltocyathus agassizi*
- 8a. Paliform lobes absent 9
- 8b. Paliform lobes present 13
- 9a. Costae spinose / all septa irregularly dentate 10
- 9b. Costae nonspinose / septa usually entire or just one cycle dentate 11
- 10a. Larger septa usually with 16–18 tall spines / corallum usually broken
..... *Fungiacyathus crispus* (Fig. 2C)
- 10b. Larger septa usually with 12–15 spines / corallum usually entire
..... *Fungiacyathus symmetricus* (Fig. 2B)
- 11a. Septa arranged in four cycles / columella rudimentary or absent
..... *Flabellum apertum* (Fig. 4J)
- 11b. Septa arranged in three cycles / columella well developed (lamellar or elongate) 12
- 12a. Septa hexamerally arranged / all septa exsert *Sphenotrochus auritus* (Fig. 4I)
- 12b. Septa with 12 primaries (S_1 and S_2) and 12 small S_3 , but 8–13 primary septa may occur / all
septa nonexsert *Placotrochides frustum* (Fig. 4K)
- 13a. Paliform lobes present before one or two cycle of septa 14
- 13b. Paliform lobes present before more than two cycle of septa 20
- 14a. Pourtalès Plan present *Balanophyllia dineta* (Fig. 5A,B)
- 14b. Pourtalès Plan not present 15
- 15a. Three cycles of septa present 16
- 15b. Four cycles of septa present 19
- 16a. Secondary septa smaller than the tertiary / always fixed to a parent corallum
..... *Schizocyathus fissilis*
- 16b. Primary and secondary are the largest septa and higher cycles progressively smaller 17
- 17a. Corallum cylindrical, elongate, and vermiform *Stenocyathus vermiformis* (Fig. 5F)
- 17b. Corallum cornute or trochoid to turbinate (usually curved about 90°) 18
- 18a. Base narrow and pointed *Caryophyllia a. caribbeana* (Fig. 2L)
- 18b. Base always open *Premocyathus cornuformis* (Fig. 2M)
- 19a. Corallum white / costae bearing a row of outward projecting granules
..... *Deltocyathoides stimpsonii* (Fig. 4H)
- 19b. Corallum present three or two parallel color lines / costae with low rounded granules ..
..... *Caryophyllia scobinosa* (Fig. 2K)
- 20a. Paliform lobes present before all cycles of septa / calicular edge jagged / columella com-
posed of a solidly fused, granular mass *Stephanocyathus diadema* (Fig. 3G)
- 20b. Paliform lobes absent in the last cycle / calicular edge entire / columella not solidly fused,
composed by distinctive elements 21
- 21a. Septa hexamerally arranged in five cycles 22
- 21b. Septa hexamerally arranged in four or six cycles 23
- 22a. Corallum bowl-shaped / C_{1-2} bear blunt spines C_{3-5} prominent only near calicular edge /
corallum wall thick *Stephanocyathus paliferus* (Fig. 3H)
- 22b. Corallum ceratoid to trochoid / all costae are convex and extend to the base (less C_5) / C_{1-2}
usually dark brown / corallum wall thin *Dasmosmilia variegata*
- 23a. Septal formula: $S_1 > S_2 > S_3 > S_4$ / fossa of moderate depth / paliform lobes before all but last
cycle *Trochocyathus laboreli* (Fig. 3C)
- 23b. Septal formula: $S_{1-3} > S_4 > S_5 > S_6$ / fossa deep / paliform lobes before all but last two cycles .
..... *Dasmosmilia lymani* (Fig. 4M)
- 24a. Paliform lobes present 25

24b. Paliform lobes absent	33
25a. S_4 not dimorphic	26
25b. S_4 adjacent to S_1 usually slightly wider than S_3 , those adjacent to S_2 equal or less wider than S_3 / theca and peripheral septa usually yellowish brown	<i>Caryophyllia crypta</i> (Fig. 2I)
26a. Septa octamerally, decamerally	27
26b. Septa hexamerally arranged	28
27a. Costae unequal (C_3 about twice as large as others) / septal decamerally arranged in 3 cycles (10:10:20) / septal granules small	<i>Caryophyllia antillarum</i>
27b. Costa equal / septa octamerally arranged in 3 cycles (8:8:16) / septal granules prominent (equal to the septal thickness in height)	<i>Caryophyllia barbadensis</i> (Fig. 2J)
28a. Pali present only before penultimate septal cycle (P_2 or P_3)	29
28b. Pali present before all but last cycle	30
29a. Corallum ceratoid / septa hexamerally arranged in 4 cycles ($S_{1-2} > S_3 > S_4$) / all septal edges sinuous	<i>Caryophyllia berteriana</i> (Fig. 2H)
29b. Corallum subcylindrical / septa hexamerally arranged in 3 cycles ($S_1 > S_2 > S_3$) / all septal edges straight except for the lower inner edges of S_2 , which are slightly sinuous	<i>Concentrotheca laevigata</i>
30a. Columella papillose composed of up to 60 closed set, uniform, slender rods	<i>Paracyathus pulchellus</i> (Fig. 3D)
30b. Columella composed of less than 30 rods	31
31a. Paliform lobes of the second cycle larger than the P_{1-3}	32
31b. Paliform lobes of the second and third cycles equal in size, and larger than P_1	<i>Trochocyathus rawsonii</i> (Fig. 3B)
32a. Corallum tympanoid / costae well defined and ornamented with a single row of teeth / upper axial edge is the tallest region of S_1	<i>Deltocyathus halianthus</i>
32b. Corallum subcylindrical - theca bears granulated, flat, indistinct costae	<i>Tethocyathus cylindraceus</i>
33a. Pedicel reinforced with 6 pairs of rootlets	<i>Polymyces fragilis</i> (Fig. 4L)
33b. Pedicel not reinforced with rootlets	34
34a. Columella well defined composed of 8–20 straight rods terminating all at same level / S_{1-3} connected to the columella by curled trabecular lobes	<i>Monohedotrochus capitolii</i> (Fig. 3M,N)
34b. Columella rudimentary, absent, or present just in young specimens	35
35a. Septa arranged in 4 cycles / wall epithecal / base reinforced by layers of stereome	<i>Javania cailleti</i> (Fig. 4N)
35b. Septa arranged in 5 cycles (sometimes with additional S_6)	<i>Desmophyllum dianthus</i> (Fig. 3L,K)
36a. Corallum branched (or primary corallites with short calicular nubs)	37
36b. Corallum not branched	49
37a. Calices occur just on one side of the colony	<i>Enallopsammia rostrata</i> (Fig. 5G)
37b. Calices occurs on two sides or randomly	38
38a. Septa arranged according to Pourtalès Plan	39
38b. Septa not arranged according Pourtalès Plan	40
39a. Small, elongate, and sparsely branched colonies / columella spongy bordered by the paliform teeth of the S_{1-2} and the P_4 / calice present just on the end of branch	<i>Eguchipsammia gaditana</i> (Fig. 5C)

- 39b. Colony dendroid with uniplanar, dichotomous branching / columella elongate aligned in the direction of the branch and composed of several granulated, individualized rods or a fused mass of rods / calices occurring laterally in the plane of branching in alternating fashion. *Dendrophyllia alternata* (Fig. 5J)
- 40a. One or two cycles of septa present / columella with a styliform rod projecting 41
 40b. More than two cycles of septa 42
- 41a. Closely spaced corallites at branch tip (less than 1 CD) / GCD up to 2.2 mm / usually 10 exsert septa. *Madracis asperula* (Fig. 2A)
 41b. Corallites well spaced (1–3 CD) / usually 8 septa / GCD with 0.85–1.4 mm *Madracis brueggemannii*
- 42a. Paliform lobes present 43
 42b. Paliform lobes absent 46
- 43a. First septal cycle equal in width to the second (S_{1-2}) 44
 43b. First septal cycle larger than second ($S_1 > S_2$) / corallites always elongate 45
- 44a. Colony dendroid / corallites arranged in opposite and alternating fashion on branch *Bathelia candida* (Fig. 3M [in part])
 44b. Colony bushy / corallites often anastomose laterally, producing a corallum with many small cavities *Pourtalosmilia conferta* (Fig. 4D,E)
- 45a. Columella papillose composed of 5–8 discrete elements / C1–3 slightly convex or rarely ridged, and finely granular / S_3 slightly exsert *Cladocora debilis* (Fig. 3F)
 45b. Columella not well formed, composed of a loose mingling of ribbon-like elements / low costae separated by shallow grooves are distinguishable from the calice to the base / S_3 nonexsert *Anomocora fecunda* (Fig. 4C)
- 46a. Colony formed by intratentacular budding 47
 46b. Colony formed by extratentacular budding 48
- 47a. Dichotomous branching / septa usually arranged in six systems and three cycles / columella usually present *Solenosmilia variabilis* (Fig. 4G)
 47b. Branches often anastomose / septa not arranged in regular systems or cycles / columella rare *Lophelia pertusa* (Fig. 4A,B)
- 48a. S_1 dimorphic (4 large and 2 smaller) / septal granules small and inconspicuous *Madrepora carolina* (Fig. 2G)
 48b. S_1 not dimorphic / septal faces bear granules usually low in profile, but sometimes very prominent) at distal branches, corallites flared *Madrepora oculata* (Fig. 2F)
- 49a. Septa arranged according Pourtalès Plan 50
 49b. Septa arranged normally (not in a Pourtalès Plan) 51
- 50a. $S_1 > S_2$ / costae not well defined *Rhizopsammia goesi* (Fig. 5E)
 50b. $S_1 = S_2$ / costae well defined *Cladopsammia manuelensis* (Fig. 5H,I)
- 51a. Multilobate condition present / one or more septal cycles bearing more than two paliform teeth. 52
 51b. Multilobate condition absent 53
- 52a. Corallites closely spaced / septa slender near calicular edge, bearing several obliquely oriented, slender paliform teeth along the axial edge / thick and continuous basal coenositeum. *Astrangia Rathbuni* (Fig. 2D)
 52b. Corallites sparsely spaced / distal septal edges up to 1.0 mm and coarsely dentate, medial axial edges smooth, and lower axial edges bearing vertical paliform lobes easily distinguished from columellar elements. *Astrangia solitaria* (Fig. 2E)
- 53a. Synapticulotheca very porous (no epitheca) 54
 53b. Epitheca present and not porous 55

- 54a. Calices high exsert *Tubastraea coccinea* (Fig. 5D)
 54b. Calices low exsert *Tubastraea tagusensis* (Fig. 5K)
- 55a. Paliform lobes present just before one septal cycle (P_1 or P_3 or P_4) 56
 55b. Paliform lobes present before all but last cycle *Phacelocyathus flos* (Fig. 4F)
- 56a. Septal hexamerally arranged in just two cycles / paliform lobes present before first cycle (P_1) *Madracis pharensis*
 56b. Septal hexamerally arranged in more than three cycles / paliform lobes present before penultimate cycle (P_3 or P_4 , rarely P_5) 57
- 57a. All septa inner edges sinuous *Coenocyathus parvulus* (Fig. 3A)
 57b. All septa inner edges straight to slightly concave 58
- 58a. S_1 having a finely serrate upper (distal) edge / upper theca and calice with a distinctive light brown coloration *Phyllangia americana* (Fig. 3I)
 58b. S_1 not serrate at upper edge / septal faces of S_{1-3} and upper theca usually pigmented with black-brown granules *Rhizosmilia maculata* (Fig. 3O)

DISCUSSION

Azooxanthellate Scleractinia are recorded in all five degree sections of latitude along the Brazilian coast, however, their greatest richness is between 20° and 35°S (20°–25°S, 26 species; 25°–30°S, 22 species; 30°–35°, 23 species). The increase in species richness is likely due to this area having had more exploration as well as there being a high effort of commercial deep-sea demersal fishing. However, the richness along the southeastern and southern Brazilian continental shelf and slope can be the result of the richness of the Antarctic current that passes through this region (Fig. 6).

Of the 59 species of azooxanthellate corals reported from the Brazilian coast (representing nine families: Caryophylliidae [53.4%], Dendrophylliidae [13.8%], Flabellidae [6.9%], Pocilloporidae [5.2%], Oculinidae [5.2%], Rhizangiidae [3.5%], Turbinoliidae [3.5%], Guyniidae [3.5%], and Fungiacyathidae [3.5%]), one can divide their vertical distribution according to their occurrence of different water masses: ([CSW] continental shelf water: 1–150 m, 27–20 °C, salinity 36.5; [SW] subtropical water: 151–500 m, 20–11 °C, salinity 36–35; [AIW] Antarctic Intermediate Water: 501–1120 m, 3.5–4 °C, salinity 34–34.3; and [NADW] North Atlantic Deep Water: below 1121 m). Examination of depth distributions reveal that about half of the corals are found living in two or more distinct oceanographic environments, and the species richness is highest within the subtropical water mass, with an average of 18.5 different species for each 50 m depth.

When occurrence by family is compared with the vertical distribution (Table 1), the species of Caryophylliidae have the larger bathymetric ranges, with 11 species having a depth range of > 300 m, and at times > a 900 m depth range (i.e., *Deltocyathus italicus* and *Solenosmilia variabilis*). The Rhizangiidae and Pocilloporidae are two families that are restricted to the shallow water regions, and are only reported up to 110 m. The other families (Dendrophylliidae, Flabellidae, Fungiacyathidae, Guyniidae, Oculinidae, and Turbinoliidae) do not contain species with a wide depth range, being restricted to only one or two water masses. Species diversity is larger between 130 and 500 m, where the oceanographic temperature and salinity parameters are 21° and 11.3 °C and 36.0 and 35.0, respectively (Fig. 1). However, it must be noted that collection effort has been concentrated in this depth range.

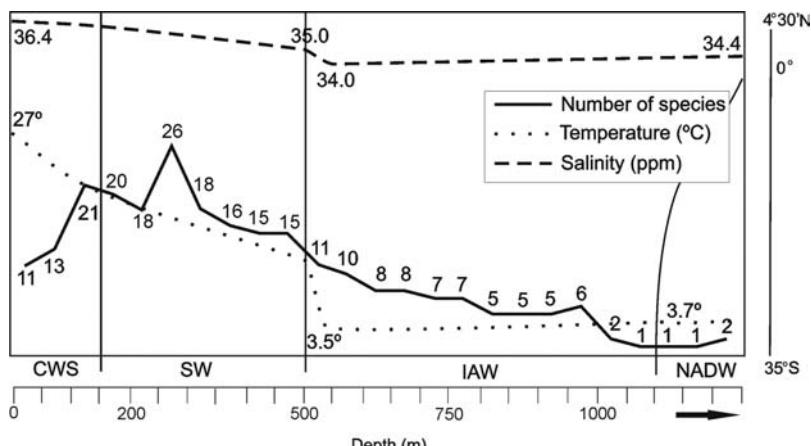


Figure 6. Mean temperature and salinity data for Brazilian coastal waters, to 1250 m, and species richness for each of the 50 m depth intervals. The lines between the water masses are estimated and the scale of latitudes is related only to water masses. CSW = continental shelf water; SW = subtropical water; AIW = Antarctic Intermediate Water; NADW = North Atlantic Deep Water

For the zoogeographic analysis, five large regions were considered due to the differences between the oceanographic conditions: (North Atlantic–NA [western North Atlantic from the Mississippi Delta north], Caribbean–CA [from Mississippi Delta south, including Gulf of Mexico, Lesser Antilles, and the Amazon delta], North Brazil–NB [from Amazon delta to Espírito Santo State], Southern Brazil–SB [from south of Espírito Santo to the extreme southern regions of Uruguay], and finally Antarctic and sub-Antarctic region–ASA [from Argentina to Continental Antarctic]).

Of the 59 species included in this paper, 34 (~59%) are reported to occur in the western North Atlantic (Cairns, 1979; 2000; Cairns et al., 1999), 52 (~88%) from the Caribbean region, 40 (~67%) from the North Brazilian region, 38 (~64%) from the South Brazilian region, and only 10 (~16%) from within the Antarctic and sub-Antarctic zone. The distribution pattern indicates that 24 species are very widespread throughout the western Atlantic; however, among the widespread species, only seven are recorded in Antarctic and Sub-Antarctic waters (*Desmophyllum dianthus*, *Enallopssammia rostrata*, *Javania cailleti*, *L. pertusa*, *Madrepora oculata*, *S. variabilis*, and *Stenocyathus vermiciformis*). The distributional relationship among the regions indicates that the Brazilian scleractinian coral species have a high affinity with the Caribbean species, and a weak affinity with those species found within the Antarctic and sub-Antarctic regions.

ACKNOWLEDGMENTS

I am very grateful to S. Cairns (USNM) who has been very generous with his time, advice, and support as well as allowing me the use of the National Museum of Natural History coral collection and providing specimen loans for this study. I extend my gratitude to the Smithsonian Short Term Visitor Staff and to R. George (GIBS Institute) for their financial support. I thank P. Greenhall (USNM), S. Cairns (USNM), H. Boscolo (IBAMA), and C. Mello (SEA) for all logistical support on the CITES papers and other permissions. I thank J. Soto (MOVI) who provided me with the motivation to study Scleractinia. I am especially indebted to M. Mincarone (MOVI), for his advice and suggestions help me to improve an earlier version of this paper, and D. Tracey (NIWA) for the comments on the manuscript. M.V.K. supported by CAPES, Brazil.

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