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A REVISION OF THE SHALLOW-WATER AZOOXANTHELLATE SCLERACTINIA OF THE WESTERN ATLANTIC

by

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ABSTRACT

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This paper constitutes the second of a two part revision of the western Atlantic azooxanthellate Scleractinia – this part addressing the taxonomy and distribution of the 73 species known to occur at depths shallower than 183 m within the tropical and warm temperate realm. Of this number, 27 species occur exclusively shallower than 183 m; these are fully described, figured, and mapped. The remaining 46 species are also known to occur at depths greater than 183 m, most of those species treated more fully in part 1 (CAIRNS 1979). Lists are also provided of the azooxanthellate species that occur exclusively deeper than 183 m (56 species) as well as the western Atlantic zooxanthellate fauna (65 species), resulting in the first comprehensive list of all 192 western Atlantic scleractinian species. In the western Atlantic there are approximately twice as many azooxanthellate as zooxanthellate species. One species, *Tubastraea coccinea* is considered to be introduced; its distribution and chronology of its possible dispersal are mapped and discussed.

Approximately 6900 specimens (1100 lots) were examined, collected from over 550 stations. Additional records of all but three of the 73 species are reported herein. Ten species and one subspecies are described as new; ten new combinations are suggested.

Among the 73 shallow-water species several patterns of distribution were discerned: widespread insular and continental, primarily insular, primarily continental, endemic to Brazil, and endemic to the Carolinian Province. The most common pattern, shared by 18 species, was a distribution that includes the entire tropical western Atlantic as well as the northern warm temperate region in the northern Gulf of Mexico and/or southeast coast of the US, these 'eurythermic tropical' species usually extending no farther than 34°30' to 35°00'N. Among the 27 exclusively shallow-water azooxanthellates, the percentage of species endemic to the western Atlantic (85%) and the amphi-Atlantic component (11%) were considerably higher and lower, respectively, than those components for the deeper water azooxanthellates, but virtually identical to that of the western Atlantic zooxanthellate corals.

Key words: **Scleractinia, azooxanthellate, Caribbean, western Atlantic, taxonomy, biogeography.**

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INTRODUCTION

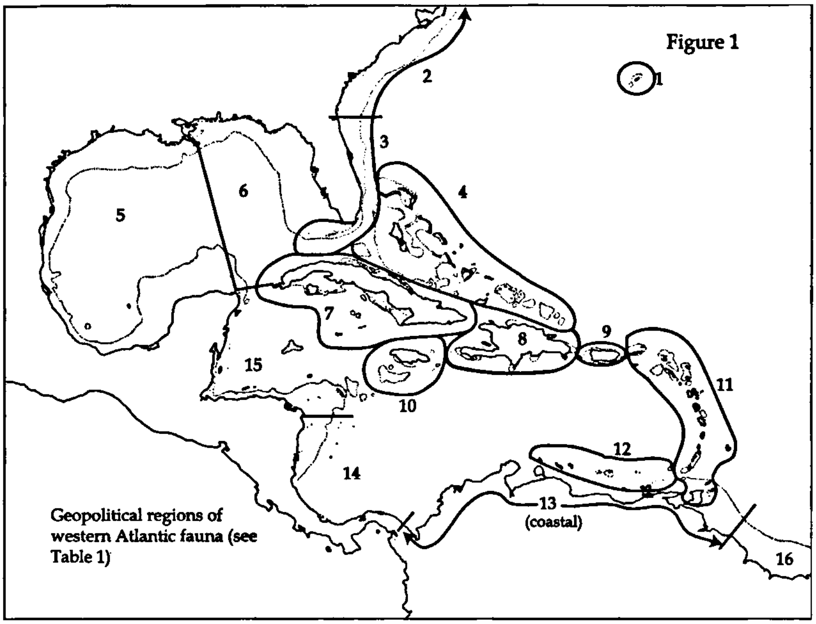
In 1979, I (CAIRNS 1979) published a revision of the deep-water azooxanthellate Scleractinia of the tropical western Atlantic, consisting of an account of 88 species. It had always been my intention to publish the complementary text, which would treat the shallow-water azooxanthellate species from the same region; however, specimens were less available for such a comprehensive treatment until extensive collections were made by the BLM/MMS and various other independent expeditions and collectors (see Station List). Now, two decades later, I submit the second and final part of the revision of the western Atlantic azooxanthellate corals.

The coverage for this revision includes all azooxanthellate species that have all or part of their bathymetric range shallower than 183 m and that occur in the tropical and/or warm temperate regions of the western Atlantic. Altogether 73 species are treated, 43 of which are more thoroughly discussed in previously published papers (CAIRNS 1977a-b, 1978a, 1979; see Table 1 and Fig. 1), most of which have bathymetric ranges that are shallow but also exceed 183 m; the remaining 30 are fully described herein. Despite the overlap of 43 species, all 73 shallow-water species are included herein so that this paper can be considered comprehensive for the shallow-water fauna. Another 56 azooxanthellate species (Appendix 1) occur in waters exclusively deeper than 183 m, which brings the total number of western Atlantic azooxanthellates to 129 species.

Historical Resume: A history of the literature on western Atlantic azooxanthellate corals, including both deep and shallow-water species, was given by CAIRNS (1979) and will not be repeated here, except to update several significant papers published after 1979.

In his revision of the Scleractinia of Cuba, ZLATARSKI (1982) included the redescriptions and illustrations of six shallow-water azooxanthellate species from that country. His descriptions, synonymies, and ecological notes were extensive; however, one of the six species, *Caryophyllia smithi*, is herein reidentified as *Caryophyllia crypta* and *Coenocyathus caribbeana*. Five of these six species were also reported and illustrated by CAIRNS (1982b) from Belize.

The most significant addition to this fauna was the report on shallow-water ahermatypic corals from Trinidad by HUBBARD & WELLS (1986). These



authors reported 19 coral species, including one new species, from northwestern Trinidad and the islands between Trinidad and Península de Paria, Venezuela, called Dragon's Mouths. One of these 19 species is now considered hermatypic and another four have been synonymized with other species, which reduces the number of azooxanthellates reported from this region to 14. As HUBBARD & WELLS (1986) explained, this area is environmentally atypical, being strongly influenced by riverine discharge and thus having seasonal variation in salinity, as well as high turbidity and low light penetration. Although these conditions tend to inhibit the growth of reef corals, azooxanthellates are common and, indeed, seem to flourish. For instance, in this region, two species (*Astrangia solitaria* and *Colangia immersa*) reach a calicular size maximum; two others (*Thalamophyllia riisei* and *Eguchipsammia cornucopia*) have unusually prolific branching; one species (*Cladocora debilis*) has an unusual, sympodial branching pattern; and *Rhizopsammia maculata* occurs without black pigment. Furthermore, several species (*e.g., Madracis myriaster* and *Javania cailetti*) are found at unusually shallow depths in this region. Most of these specimens are deposited at the

USNM and the peculiarities mentioned above are discussed in the species accounts.

Building on two earlier papers that listed the azooxanthellate coral fauna from the Gulf of Mexico (CAIRNS 1977b, 1978a), additional records and a summary of all azooxanthellate species were reported by VIADA & CAIRNS (1987) and CAIRNS *et al.* (1994) from the six subdivisions of the Gulf.

A very detailed account of one species, *Astrangia poculata*, was published by PETERS *et al.* (1988), including a redescription, complete synonymy, neotype designation, illustrations, and discussions of ecology and nomenclatural history.

CAIRNS *et al.* (1991) listed all scleractinian species that occur off North America at depths shallower than 200 m, including 51 species from the western Atlantic. Common names were given for some species.

Finally, in a beautifully illustrated field guide, HUMANN (1993) included colour, *in situ* photographs of 15 shallow-water azooxanthellate species, including three described as new species herein. Many of the illustrated specimens are deposited at the USNM. HUMANN provided common names for all the corals he illustrated.

There have been many more references to shallow-water western Atlantic azooxanthellate corals in the literature, but usually as parts of larger revisions or checklists on reef corals from various regions. These citations are listed in the synonymies of each species as well as in the References section.

MATERIAL AND METHODS

Material: This study is based on the examination of approximately 6900 coralla divided into 1100 lots that were collected from over 550 stations, including 54 vessels or programs (see Station List), and several hundred additional sites not listed as stations from throughout the western Atlantic. Additional records are reported herein for all but three of the 73 shallow-water azooxanthellate species, those being: *Caryophyllia zopyros*, *C. barbadensis*, and *Gardineria paradoxa*. The three most commonly collected species were *Astrangia poculata*, *Balanophyllia floridana*, and *Phyllangia americana americana*.

The largest source of new records for the study originated with the various programs of the BLM/MMS. Other significant contributions included specimens collected by the U.S. Fish & Wildlife Service vessels; RSMAS, University of Miami; the Johnson-Sea-Link (HBOI); and from the Discovery Bay Lab, Jamaica, the latter donated to the USNM by JOHN W. WELLS. There were many more sources of material, as listed in the Station List and in the New Records section of each species.

Methods: As mentioned in the Introduction, this paper is meant as much as possible to serve as a complement, not a repetition, of my earlier paper (CAIRNS 1979) on the deep-water azooxanthellates; however, all species that have a bathymetric range shallower than 183 m are included herein. Thus, for the 43 species that occur in both papers, a reduced treatment is given herein, including only an updated (post 1979) synonymy, and a diagnosis (not a description); type deposition, type locality, and distributional maps are omitted.

Otherwise, synonymies are made as complete as possible, including occurrence in checklists (annotated as 'listed'). In order to clarify what previously published material was examined by the author, the following convention was used (see MATTHEWS 1973). Three symbols are used in the synonymies, which always precede the year of publication:

*, means that this entry represents the original description of a validly described species under the terms of the ICZN (1985);

v*, means that I have examined the type series of this species; and

v., means that I have examined this/these nontype specimens and agree that they belong in this synonymy. The letter 'v' is Latin for *vidimus* (we have seen). This convention is not used for publications written by myself, as it is obvious that I have seen specimens that I have previously reported.

In the 'New Records' sections, the station number is followed by the number of specimens examined, followed by the museum of deposition and its catalog number, if any. Most newly designated types are deposited at the USNM.

183 m (instead of 200 m) was chosen as the maximal lower limit for a species to be included in this paper. This still maintains a complete coverage of all western Atlantic azooxanthellates, as none has a range exclusively between 183 and 200 m, and omits species such as *Fungiacyathus symmetricus*, which has a range of 183-1664 m, and thus is not considered as part

of the shallow-water fauna. In order to avoid erroneous depth ranges for species as a result of bathymetrically wide-ranging trawls, a 'confirmed' depth range is employed in this paper, which is defined as the deepest shallow to the shallowest deep component of all trawls considered. For instance, if a species was trawled at a station indicating a range of 20-300 m and again at a station indicating 250-500 m, the confirmed depth range would be 250-300 m, a conservative estimate of the true depth of capture range.

In some cases the corallum was dyed black with cloth dye and recoated with sublimed ammonium chloride in order to improve contrast for conventional photography.

Several azooxanthellate species listed by CAIRNS (1979: Tables 1, 4) as occurring in shallow water are not included in this report for various reasons. For instance, *Tethocyathus cylindraceus* was listed by CAIRNS (1979) as occurring at 155-649 m. POURTALÈS (1874) even reported it from Cabo Frio at 64 m, but his identification was based on a dead specimen and was equivocal; that specimen has not subsequently been located at MCZ and was not subsequently reported by POURTALÈS (1880a) at that depth range. The 155 m record originates from BL-296 (POURTALÈS 1880a), which CAIRNS (1979) stated was not *T. cylindraceus*. Therefore the shallowest records of this species is 100-200 fms (=183-366 m) for the syntypes (POURTALÈS 1868) and 183 m from Barbados (POURTALÈS 1874), and thus it is not included in this report. Similar upward revisions of the minimum depth range have been made to *Desmophyllum striatum, Madrepora oculata,* and *Thalamophyllia gombergi,* details of the changes included herein under the discussion of congenerics. *Desmophyllum dianthus* is not included because it occurs shallower than 183 m only in the cold temperate region. *Madracis formosa* is herein considered to be zooxanthellate (FENNER 1993b) as is *Agaricia cailleti* (FENNER, *pers. comm.* 1997). Finally, *Oculina varicosa* appears to be a facultative zooxanthellate (REED 1980) and the status of *O. valenciennesi* is uncertain. Neither are included herein.

Since 1979, four species of exclusively deep-water azooxanthellates can be added to the western Atlantic fauna. Although not an integral part of this paper, they are included in the calculations of faunistic affinities in the zoogeographic analysis. One of these species is *Caryophyllia sarsiae* Zibrowius, 1974, five specimens herein reported from off Bermuda at 1097-1200 m (Figs. 69, 71; USNM 76307, 80473). CAIRNS (1995a) considered that species to be a junior synonym of *C. diomedeae* Marenzeller, 1904, with a circumtropical/temperate distribution at 245-2200 m. One specimen (Figs. 85-86; USNM 62523) of a second species, *Premocyathus dentiformis* (Alcock, 1902), is herein reported from P-876 (off St. Vincent, Lesser Antilles, 231-258 m). It is otherwise known from the tropical western Pacific at 115-757 m (CAIRNS & ZIBROWIUS 1997). The third species, *Polymyces wellsi* Cairns, 1991, is reported from three stations (P-586, USNM 98948; O-11225, USNM 98949, Figs. 174-175; and Eastward-36259, University of California, Santa Cruz), including off the Bahamas; off Havana, Cuba; and off Nicaragua at depths of 549-1682 m. This species is otherwise known to be cosmopolitan in tropical and temperate waters at 355-1165 m (CAIRNS & ZIBROWIUS 1997). Finally, *Cryptotrochus carolinensis* was described by CAIRNS (1988), a species known only from off North Carolina at 320-338 m.

LIST OF ABBREVIATIONS

VESSELS AND EXPEDITIONS:

Alb	U. S. Fish Commission Steamer Albatross
ASLAR	Atlantic Slope and Rise Studies (a BLM/MMS program)
B-A DS	Barbados-Antigua Expedition of 1918 (Dredging Station)
BL	U. S. Coast Survey Steamer Blake
BLM	Bureau of Land Management, U. S. Department of Interior
CI	R/V Columbus Iselin
CSA	Continental Shelf Associates, Jupiter, Florida
DBL	Discovery Bay Lab, Jamaica
EJ	Ed Joyce station
FH	U.S. Fish Commission Steamer Fish Hawk
G	R/V Gerda
Gos	R/V Gosnold
GS	R/V Gilliss
IOSP	Instituto Oceanographico da Universidad de São Paulo
JS	Johnson Smithsonian Deep-Sea Expedition, Yacht Caroline (1933)
JSL	Johnson-Sea-Link
LGL	LGL Ecological Research Associates, Bryan, TX
LMRS	South Atlantic Outer Continental Shelf Living Marine Resources Study (a BLM/MMS program)
MMS	Mineral Management System, U. S. Department of Interior (previously called the Bureau of Land Management)
NEEB	New England Environmental Benchmark Program (a BLM/MMS program)
O	M/V, R/V Oregon and R/V Oregon II
OCS	Outer Continental Shelf (a BLM/MMS program)
P	R/V Pillsbury
SB	M/V, R/V Silver Bay
SOFLA	Southwest Florida Shelf Ecosystem Study (a BLM/MMS program)
TAMU	Texas A & M University (R/V Alaminos)
USGS	United States Geological Survey
WB	N/Oc Wladimir Besnard

MUSEUMS:

BM	The Natural History Museum (formerly the British Museum (Natural History), London
FSBC I	Florida State Board of Conservation Identification number (now the Florida Department of Environmental Protection)
HBOI	Harbor Branch Oceanographic Institution, Fort Pierce, FL
IRCZM	Indian River Coastal River Museum, Fort Pierce, FL (associated with the HBOI)
MCZ	Museum of Comparative Zoology, Harvard, MA
MNHN	Muséum National d'Histoire Naturelle, Paris
MNRJ	Museu Nacional/Universidade Federal do Rio de Janeiro

NMC	National Museum of Canada, Ottawa
RMNH	Nationaal Natuurhistorische Museum Naturalis (formerly Rijksmuseum van Natuurlijke Histoire), Leiden
ROM	Royal Ontario Museum, Toronto
RSMAS	Rosenstiel School of Marine and Atmospheric Science, University of Miami, FL (specimen cataloged in Invertebrate Museum prefaced with UMML)
SME	Station Marine d'Endoume, Marseille
SMNH	Swedish Museum of Natural History, Stockholm
TU	Tulane University, New Orleans, LA
UCSC	University of California, Santa Cruz
USNM	United States National Museum (now named the National Museum of Natural History), Smithsonian Institution, Washington, D.C.
YPM	Yale Peabody Museum, New Haven CT

MORPHOLOGICAL AND MISCELLANEOUS TERMS:

BP	Before present
CD	Calicular diameter
GCD	Greater calicular diameter
HT:GCD	Ratio of height to greater calicular diameter of a solitary corallum
ICZN	International Commission of Zoological Nomenclature
LCD	Lesser calicular diameter
PD	Pedicel diameter
PD:GCD	Ratio of pedicel diameter to greater calicular diameter
Sx, Cx, Px	Septa, costae, or pali (respectively) of cycle designated by numerical subscript
Sx > Sy	In the context of a septal formula, indicates that septa of cycle x are wider than septa of cycle y.
v.	In the context of a synonymy, indicates that I have examined these specimens (literally *vidimus*).
*	In the context of a synonymy, indicates that this entry represents the original description of a validly described species (see MATTHEWS 1973).

STATION LIST

Station	*Latitude	*Longitude	Depth (m)	Date
		Akaroa		
92	10°20'20"S	36°10'25"W	21	3 IX 1965
		U.S.F.S. Albatross (Alb)		
2120	11 07 00 N	62 14 30 W	134	30 I 1884
2142	9 30 15	76 20 30	77	25 III 1884
2146	9 32 00	79 54 30	62	2 IV 1884
2152	4 km NW of Havana Light		702	30 IV 1884
2157	23 10 00	82 21 00	57	30 IV 1884
2160	23 10 31	82 20 37	305	"
2161	23 10 36	82 20 28	267	"
2167	23 10 40	82 20 30	368	1 V 1884
2280	35 21 00	75 21 30	29	19 X 1884
2285	35 21 25	75 24 25	24	"
2313	32 53 00	77 53 00	181	5 I 1885
2316	24 25 30	81 47 45	91	15 I 1885
2317	24 25 45	81 46 45	82	"
2318	24 25 45	81 46 00	82	"
2319	23 10 22	82 20 06	245	17 I 1885
2320	23 10 39	82 18 48	238	"
2321	23 10 54	82 18 00	421	"
2322	23 10 54	82 17 45	210	"
2327	23 11 45	82 17 54	333	"
2330	23 10 15	82 19 15	221	"
2331	23 10 31	82 19 55	209	"
2336	23 10 48	82 18 52	287	19 I 1885
2338	23 11 00	82 20 00	346	19 I 1885
2354	20 59 30	86 23 45	238	22 I 1885
2374	29 11 30	85 29 00	48	7 II 1885
2386	29 15 00	88 06 00	110	4 IV 1885
2387	29 24 00	88 04 00	59	"
2388	29 24 30	88 01 00	64	"
2394	28 38 30	87 02 00	768	13 IV 1885
2405	28 45 00	85 02 00	55	15 IV 1885
2406	28 46 00	84 49 00	48	"
2407	28 47 30	84 37 00	44	"
2412	26 18 30	83 08 45	49	19 IV 1885
2414	25 04 30	82 59 15	48	"
2596	35 08 30	75 10 00	90	17 X 1885
2617	33 37 30	77 36 30	26	20 X 1885
2619	33 38 00	77 36 00	27	"
2639	25 04 50	80 15 10	102	9 V 1886

Station	*Latitude	*Longitude	Depth (m)	Date
2640	25 05 00	80 15 00	102	"
2641	25 11 30	80 10 00	110	"
2651	24 02 00	77 12 45	177	13 V 1886
2762	23 08 00	41 34 00	108	30 XII 1886
M/V Aleutian Bounty				
83-165	26 30'N	84 50'W	640	12 XI 1983
R/V Alvin				
761-F27	27 04.0'N	79 18.8'W	611	29 V 1977
762-F13	27 03.1	79 19.3	620	30 V 1977
764-F17	26 54.8	79 09.6	452	1 VI 1977
846	26 25.7	77 52.1	785	3 XI 1978
1268	40 13.3	67 36.9	1809	?
1270	40 21.7	67 40.0	933	19 IX 1982
1335	27 05	79 40	620	21 II 1984
Alpha Helix				
16	12 30'18"N	70 02'42"W	30	26 VI 1977
Anton Dohrn				
6392	30 49'N	79 49'W	400-425	?
ASLAR				
Gyre 4	40 50'42"N	68 00'12"W	67	13 V 1983
Gyre 15	32 10 14	76 42 50	1900-2020	18 IX 1985
Oceanus 1	41 13 00	67 15 18	55	9 XI 1981
Atlantis				
20-28	St. Paul Rocks, Atlantic		205-225	19 III 1966
Barbados-Antigua Expedition of 1918 (B-A DS)				
3	Pelican Id., Barbados		137-146	15 V 1918
4	"		201	"
9	"		183	16 V 1918
10	"		196	"
32	off Payne's Bay Church, Barbados		91	21 V 1918
34	S.E. of Hastings, Barbados		146-164	23 V 1918
45	Pelican Id., Barbados		164-182	25 V 1918
59	W. of Telegraph Sta., Barbados		157	30 V 1918
65	Payne's Bay Church, Barbados		91	31 V 1918
U.S.C.G.S. Blake (BL)				
2	23 14'N	82 55'W	1472	1878
155	16 41 54	62 13 24	161	16 I 1879
203	14 28 50	64 05 40	176	10 II 1879
247	12 05 25	61 47 15	311	25 II 1879
296	13 05 24	59 38 45	155	10 III 1879

Station	*Latitude	*Longitude	Depth (m)	Date
		BLM (1974)		
17	29 37'N	87 27'W	66	1974
18	29 33	87 24	82	"
19	29 27	87 25	82	"
22	29 50	86 26	82	"
33	29 38	86 11	69	"
		BLM, James Island Area Block		
198-2	32 46'28.70"N	78 51'41.65"W	32-33	
380-3	32 33 59.80	78 33 49.62	97-102	
380-4	32 33 57.83	78 34 15.61	72-79	
380-7	32 34 23.23	78 34 47.63	60-63	
380-11	32 34 39.56	78 34 08.53	96-98	
380-19	32 35 33.34	78 34 23.93	64-69	
463-4	32 30 37.36	78 49 01.67	46-49	
463-5	32 30 13.41	78 49 27.65	47	
463-6	32 30 31.53	78 49 21.41	47-48	
463-7	32 28 58.77	78 48 35.79	57-58	
463-11	32 29 51.84	78 51 22.57	50-54	
463-14	32 29 06.89	78 50 13.34	50-51	
463-16	32 29 17.19	78 49 29.73	49	
463-18	32 29 26.64	78 49 12.73	49	
463-19	32 29 43.17	78 48 55.21	51	
463-20	32 30 11.32	78 48 01.01	48	
463-21	32 30 05.35	79 48 28.17	50	
I-2A	32 46	78 51	95-98	
I-11	32 34	78 34	96-98	
		BLM, LMRS		
O-S01	31 31'48"N	79 44'42"W	54	9 III 1981
O-S03	30 26 12	80 12 18	61	11 III 1980
O-S05	33 48 42	76 34 12	102	14 V 1981
O-S06	32 29 24	78 49 42	49	3 XI 1981
1-579	31 32 12	79 44 06	61	8 III 1980
1-580	30 26 54	80 12 06	60	10 III 1980
I-S05	34 24 00	76 35 06	24	13 VIII 1981
MS-03	30 54 00	80 36 18	35	22 VIII 1980
MS-04	33 31 48	77 24 36	28	12 VIII 1981
MS-06	32 48 36	78 39 36	34	6 V 1981
		BLM, NEEB		
24	40 35'17"N	67 11'15"W	121	9 V 1977
27	40 27 17	67 31 36	140	7 V 1977

Station	*Latitude	*Longitude	Depth (m)	Date
BLM, OCS				
A1	39 14’42”N	72 42’18”W	91	3 XI 1975
A2	39 21 36	72 31 00	128	”
F1	38 44 00	73 14 42	85	1 VI 1977
F2	38 44 18	73 09 12	110	”
F4	38 44 12	73 02 36	206	10 II 1977
K5	38 01 36	73 53 48	151	12 III 1976
L4	37 08 06	74 36 54	97	4 VIII 1977
L5	37 06 06	74 33 26	180-200	22 III 1976
4C	31 45 26	80 29 03	20	24 II 1977
5B	31 12 00	81 07 59	11	21 II 1977
5C	31 08 00	80 49 57	19	25 II 1977
6H	30 22 56	79 56 52	320	2 IX 1977
BLM, SOFLA				
1	26 45.77’N	82 43.11’W	25	28 X 1980
3	26 45.86	83 21.44	50	29 X 1980
7	26 16.82	82 44.02	32	6 XI 1980
9	26 16.83	83 23.81	60	5 XI 1980
10	26 16.73	83 42.82	71	3 XI 1980
11	26 16.72	83 46.82	83	4 XI 1980
13	25 45.93	82 09.35	22	8 XI 1980
15	25 45.89	82 31.62	34	9 XI 1980
17	25 45.58	83 20.23	59	15 XI 1980
23	25 16.89	83 37.79	77	17 XI 1980
27	24 47.77	83 08.02	54	20 XI 1980
29	24 47.59	83 41.19	67	21 XI 1980
30	24 47.42	83 51.15	76	21 XI 1980
32	26 16.67	84 04.08	137	25 VII 1981
35	25 44.84	84 21.03	159	26 VII 1981
36	25 16.83	83 57.35	127	2 VIII 1981
38	25 16.50	84 14.77	159	2 VIII 1981
39	24 47.16	83 55.36	152	3 VIII 1981
44	26 17.87	82 12.62	13	5 XII 1982
45	26 03.18	82 08.45	17	6 XII 1982
51	25 17.67	81 48.00	16	8 XII 1982
52	25 17.80	81 39.80	14	3 VI 1983
55	24 36.17	82 41.97	27	25 III 1985
R/V Chain (Cruise 35)				
35-15	St. Paul Rocks, Atlantic Ocean		291	13 IV 1963
35-16	”	”	110-146	13 IV 1963
35-20	?	?	?	?
35-35	7-8°N	54-58°W	?	28 IV 1963
35-36	8 10.5	57 40	104	28 IV 1963
35-38	8 08	57 52.5	110	”
35-39	8 08	57 52	101	”
35-43	8 53	59 04	?	29 IV 1963

Station	*Latitude	*Longitude	Depth (m)	Date
		Circé		
25	29 20.3'N	87 45.9'W	100	
27-1	29 20.3	87 45.8	112	
27-2	29 20.3	87 45.8	112	
28-1	29 20.3	87 45.9	104	
28-2	29 20.3	87 45.9	104	
28-3	29 20.3	87 45.9	104	
29	29 19.8	87 46.4	107	
30-1	29 19.8	87 46.5	107	
31-2	29 19.8	87 46.5	107	
81-3	28 39.8	89 49.6	?	
83-1-F	28 32.8	89 55.6	?	
		R/V Columbus Iselin (CI)		
158	23 30'24"N	76 55'36"W	1317	5 II 1974
		M/V Combat		
90	28 52'N	80 05'W	119	3 IX 1956
283	32 56	78 06	91	19 IV 1957
384	34 54	75 25	137	17 VI 1957
457	25 19	80 07	119	26 VII 1957
		CSA		
1331-1	29 18'N	88 21'W	?	14 X 1991
1347-1	29 52	87 14	67	1991
1347-2	29 56	87 04	73	"
		CSA, Pinnacle site		
2	29 26.6'N	87 36.5'W	69-81	12 V 1997
4	29 19.7	87 46.1	95-107	17 V 1997
7	29 15.4	88 20.3	70-88	16 V 1997
9	29 14.3	88 19.6	89-96	16 V 1997
		R/V Delaware II		
004	27 40.1'N	80 13.5'W	18	18 V 1984
008	27 49.9	80 02.3	46	"
010	27 20	79 58	92	20 IV 1983
012	27 20	80 01	46	20 IV 1983
023	27 40	79 59	64	21 IV 1983
029	27 50	80 00	64	"
062	28 41	80 03	64	20 V 1983
067	28 41	80 03	86-91	33 IV 1983
074	29 19.8	80 29.9	33	21 V 1984
075	29 19.4	80 17.7	46	"
121	30 40	80 06	92	26 IV 1983
126	30 31	80 10	64	"
131	30 20	80 14	64-66	27 IV 1983
132	30 20	80 12	92	"

Station	*Latitude	*Longitude	Depth (m)	Date
137	30 10	80 14	91	27 IV 1983
138	30 11	80 15	64	27 IV 1983
140	30 00	80 20	48	27 IV 1983
R/V Eastward				
10868	29 —'N	80 —'W	70-82	?
10881	28 18 54	79 59 00	75-78	1969
10892	28 02 00	79 59 30	68-72	?
19483	18 28 30	77 23 36	100-220	1972
19497	Discovery Bay, Jamaica		200	1972
26533	27 28.2	78 57.8	?	?
30174	19 24.5	81 20.2	1050-1125	10VII 1976
30176	19 24.4	81 16.7	600-1250	"
30178	19 25.4	81 22.5	585-600	11 VII 1976
34957	30 50.7	79 30.3	790	1979
35941	38 07.8	73 48.4	116-312	?
35948	38 06.9	73 50.1	670-790	4 V 1979
35985	40 11.8	68 07.9	755-930	1979
35992	40 16.0	68 06.6	630-1175	19 V 1979
36023	40 22.8	67 39.4	430-613	25 V 1979
36259	27 30.6	78 02.2	1115	1981
EJ (=R/V Hernan Cortez II)				
77-136	27 56'N	84 48'W	192	?
81-8	26 54	84 32	53	21 IV 1981
81-9	26 28	84 42	228-236	22 IV 1981
81-20	26 51	84 35	178-186	24 IV 1981
81-21	27 01	84 41	199-207	"
81-22	27 07	84 49	239-247	"
81-24	27 49	84 21	148-162	25 IV 1981
81-29	27 31	84 31	126-136	"
Endeavor				
1	22 33'07"N	74 46'10"W	70-600	6 XI 1986
Explorer				
1b	16 39'N	82 50'W	274	11 III 1960
U.S.F.C.S. Fish Hawk (FH)				
134	Puerto Rico		?	I 1899
770	Narragansett Bay, R.I.		15	6 VIII 1880
775	"		15-22	"
842	"		15	31 VIII 1880
957	Buzzard's Bay, MA		11	26 VIII 1881
958	"		9	26 VIII 1881
1237	Block Id. Sound, R.I.		37	30 VIII 1887
1686	Long Id. Sound, CT		29	9 IX 1892

Station	*Latitude	*Longitude	Depth (m)	Date
7106	Anclote Keys, FL		23	28 III 1901
7123	26 33	83 10	51	2 IV 1901
7282	24 21 15	81 52 15	199	19 II 1902
7516	off Fowey Rocks Light, FL		91	30 III 1903
8339	37 15 05	76 04 40	46	22 X 1915
8371	37 03 18	75 58 12	14	3 XII 1915
8499	36 57 06	75 59 56	23	22 IV 1916
8592	36 56 37	75 58 38	19	18 VII 1916
8595	36 57 02	76 00 26	22	25 VII 1916
8596	36 58 53	76 00 22	14	25 VII 1916
8602	37 17 01	76 14 14	10	26 VII 1916
8826	Chesapeake Bay, MD		46	8 VII 1920
8827	"		18	9 VII 1920
		R/V Gerda (G)		
304	25 26'N	79 23'W	796	23 V 1964
602	25 05	80 14	95	15 IV 1965
694	26 28	78 40	622-695	21 VII 1965
701	26 29	78 40	274-311	22 VII 1965
702	26 29	78 40	73-219	22 VII 1965
703	26 29	78 40	27-165	"
704	26 29	78 40	274-366	"
725	26 01	79 10	143-210	3 VIII 1965
849	25 54	79 59	256	2 VIII 1967
882	21 12	86 20	64-73	9 IX 1967
899	20 57	86 34	40-165	10 IX 1967
956	20 50	86 30	46-183	29 I 1968
983	24 05	80 20	216	5 III 1968
984	24 05	80 20	155-230	"
985	24 06	80 12	37-201	"
986	24 05	80 19	137-241	"
1002	27 19	80 01	38-59	21 V 1968
1003	27 18	80 02	46-48	"
1086	24 21.5	82 26.7	59-60	26 IV 1969
1246	23 57.7	80 28.6	?	11 III 1970
		R/V Gilliss (GS)		
74-04-94	36 39'48"N	74 36'30"W	77-87	21 XI 1974
75-08-95	36 41 12	74 41 30	105-135	20 IX 1975
		R/V Gilliss (GS Geology)		
5	24 22'N	80 50'W	247-265	
44	24 26	80 45	145-266	
71-5	24 48.5	80 26.5	90-150	
71-6	24 41	80 33	155-188	

Station	*Latitude	*Longitude	Depth (m)	Date
		R/V Gosnold (Gos)		
39	off Pt. Morant, Jamaica		200-300	18 III 1967
112/27	17 55'N	76 05'W	400-480	13 II 1968
112/78	17 21	78 19	700	23 II 1968
1456	33 49.6	77 30.0	27	19 V 1964
1481	32 20.0	79 46.1	25	21 V 1964
1483	32 20.0	80 13.5	13	21 V 1964
1494	30 59.5	80 59.8	19	"
1503	30 19.8	81 15.0	12	22 V 1964
1504	30 15.3	81 19.6	15	"
1507	29 59.0	81 02.3	22	"
1508	30 00.0	81 15.0	19	"
1509	29 50.1	81 13.9	17	"
1510	29 49.9	80 59.5	22	23 V 1964
1514	29 46.0	81 12.5	39	"
1521	29 00.0	80 39.0	19	"
1533	28 20.9	80 00.5	78	24 V 1964
1535	28 09.8	80 11.0	32	"
1539	28 00.5	80 20.0	22	25 V 1964
1540	28 00.0	80 11.4	32	"
1541	28 00.1	80 00.1	66	"
1564	25 08.5	80 11.9	105	28 V 1964
1575	24 25.1	82 00.1	74	31 V 1964
1588	24 39.4	80 37.3	207	1 VI 1964
1620	27 10.0	80 00.0	72	4 VI 1964
1624	27 30.0	80 01.5	56	"
1643	29 01.0	79 40.3	822	5 VI 1964
1647	29 41.5	79 43.6	727	6 VI 1964
1686	30 00.0	80 45.5	36	11 VI 1964
1688	29 20.0	80 45.1	24	"
1689	29 09.4	80 44.1	24	"
1716	29 39.9	80 14.7	76	13 VI 1964
1738	30 31.2	79 52.0	480	14 VI 1964
1769	31 59.1	78 45.0	386	17 VI 1964
1774	32 20.0	79 00.0	85	18 VI 1964
1857	34 18.7	76 00.1	85	26 VI 1964
1860	34 37.0	75 44.4	66	"
1863	34 51.0	75 31.0	86	"
1866	35 03.0	75 18.0	85	27 VI 1964
2027	38 39.9	74 45.2	26	2 VIII 1964
2349	29 28.7	76 59.4	1098	21 VIII 1965
2366	28 29.0	79 00.0	895	24 VIII 1965
2439	29 28.7	76 59.4	1098	21 VIII 1965
2452	27 23.8	79 29.3	695	14 IX 1965
		Grampus		
5118	26 30'00"N	83 55'00"W	108	23 III 1889

Station	*Latitude	*Longitude	Depth (m)	Date
		R/V Hernan Cortez		
D	27 37'N	83 58'W	55	11 VIII 1966
L	26 24	83 22	55	13 XI 1966
		Hidalgo		
316	16 04'48"N	82 57'06"W	37	29 VII 1962
319	16 21 12	82 44 24	48	30 VII 1962
334	16 04 12	81 36 00	37	31 VII 1962
		CSS Hudson		
3A	12 29'N	61 13'W	439-549	17 III 1968
4B	12 23	61 20	297-423	"
		Wagenaar Hummelinck		
1334	Caracas Baai, Curaçao		10	9 II 1955
1442	off Barbados		100	19 II 1964
1443	off Barbados		200	"
		IOSP		
1	24 20'S	44 40'W	130	19 V 1962
	JS (R/V Caroline) Johnson-Smithsonian Deep-Sea Expedition			
16	18 33'45"N	66 15'00"W	732-1097	30 I 1933
52	18 30 30	66 04 05	366-548	2 II 1933
99	18 40	64 56	329-366	3 III 1933
		JSL-I (Johnson-Sea Link)		
1037	26 43.3'N	79 01.2W	194	17 V 1981
1200	27 49.0	79 57.5	88	3 VI 1982
1277	23 58.2	74 26.4	243	9 X 1982
1332	26 14.8	77 37.7	66	12 IV 1983
1334	26 25.0	77 47.3	243	14 IV 1983
1354	Grand Bahama Id., Bahamas		376-378	13 VI 1983
1355	26 41.8	79 01.3	231-301	"
1357	26 42.92	79 00.72	244-309	14 VI 1983
1360	26 40.49	79 00.42	272-313	16 VI 1983
1495	24 01	74 34	309	20 X 1983
1500	24 02.75	74 32.53	391-527	22 X 1983
1504	24 04.6	74 33.1	323-353	24 X 1983
1910	26 27	78 43	411	28 X 1986
2064	27 46.8	91 33.1	366	16 VI 1987
2317	18 24.71	75 03.0	266	12 X 1988
2582	27 55.29	91 29.04	188	4 IX 1989
2585	27 44.37	91 07.54	129-144	5 IX 1989
2586	27 44.09	91 07.20	183	6 IX 1989
2590	27 48.31	91 33.70	252-263	8 IX 1989
2591	27 48.35	91 33.34	?	IX 1989

Station	*Latitude	*Longitude	Depth (m)	Date
3659	25 23.07	77 51.50	180-190	14 II 1994
3660	25 23.08	77 51.13	77	15 II 1994
JSL-II (Johnson-Sea-Link)				
809	25 36.2'N	76 44.5'W	409-482	10 IV 1984
816	25 23.7	77 54.5	231-412	14 IV 1984
1519	26 28.86	78 49.57	564	8 XI 1987
1720	13 15.82	59 40.43	226	10 IV 1989
1724	13 02.75	59 38.60	174	12 IV 1989
1736	13 14.90	59 39.20	74	19 IV 1989
1845	16 10.00	61 49.13	234	10 V 1989
3005	26 38.3	78 57.80	249	24 X 1997
3104	29 50.93	87 16.55	67	28 VIII 1991
LGL				
E2-2	28 16.78'N	86 14.77'W	622	18 V 1985
WC-6	27 42.3	91 32.9	543-783	10 VI 1985
Nekton (gamma)				
232	Discovery Bay, Jamaica		166	?
244	"		274	4 IX 1972
Oregon (O)				
933	27 36'N	83 18'W	37	18 III 1954
1493	20 40	93 20	1833	14 IV 1956
1494	29 15	88 30	110	3 V 1956
2075	1 57	48 15	48	17 XI 1957
2727	26 13	82 10	17	3 II 1960
3210	29 50	87 08	121	8 II 1961
3147	30 13.5	88 13	13	23 XI 1960
3480	29 23	88 35	57	30 I 1962
3494	29 33	88 24	48	5 II 1962
3568	14 14	81 59	183-366	21 V 1962
3603	12 16	82 54	27-37	2 VI 1962
3621	16 00	81 09	219-254	6 VI 1962
3704	28 54	88 46	402	12 VIII 1962
4216	0 15'S	46 45	27	8 III 1963
4225	0 18	44 23	182	9 III 1963
4227	1 24'S	43 11	73	10 III 1963
4228	2 02'S	43 17	51	"
4231	1 50'S	42 43	65	"
4393	12 32	71 04	84	25 IX 1963
4394	12 37	71 10	119	"
4398	12 46	70 41	201	26 IX 1963
4459	10 50	66 58	97	13 X 1963
4461	10 50	66 55	97	"
4832	14 16	80 27	220-238	12 V 1964

Station	*Latitude	*Longitude	Depth (m)	Date
4904	10 00	76 05	146-183	28 V 1964
5016	13 05	59 40	146-183	20 IX 1964
5033	11 06	62 40	54	23 IX 1964
5398	17 53	77 50	40-48	18 V 1965
5442	20 20	69 59	11-20	31 V 1965
5648	12 27	69 51	229	2 X 1965
5683	12 31	71 41	82	9 X 1965
5696	12 05	72 13	33	12 X 1965
5699	12 13	72 25	68	12 X 1965
5737	9 37	79 03	66	19 X 1965
11225	12 35	82 16	549	27 X 1970
11705	30 26	79 44	640	19 I 1972
22084	18 24.2	75 02.8	421-519	12 VII 1977
23271	0 30'S	46 23	37	6 XII 1977
24237	17 49.5	66 08.8	311-457	28 VII 1978
24238	17 49.7	66 07.8	503-567	28 VII 1978
		Pelican		
116-5	26 31.5'N	96 26.0'W	95	4 II 1939
117-1	26 30.0	96 26.0	91	5 II 1939
167-5	27 41.0	80 07.5	29	17 I 1940
169-7	28 24.5	80 03.0	64	18 I 1940
177-10	30 56.0	81 00.5	18	26 I 1940
180-5	31 53 3	80 34 3	27	2 II 1940
182-6	32 06 0	79 14 0	110	4 II 1940
204-3	28 59.0	80 04.0	91-183	29 III 1940
209-5	29 00.5	80 41.5	16	5 IV 1940
		R/V Pillsbury (P)		
112	32 08'N	79 16'W	70-95	28 VII 1964
199	27 59	79 20	311-329	11 VIII 1964
236	5 20	4 45'E	101-128	12 V 1965
330	9 37.5	78 54	64-128	8 VII 1966
365	9 31.3	76 15.4	56-58	13 VII 1966
366	9 31	75 59	33-37	“
372	9 45	76 12	82-101	”
389	9 53.8	75 50.9	51-70	15 VII 1966
392	9 45.1	76 09.1	75-79	16 VII 1966
399	9 01.3	76 40.2	119-179	17 VII 1966
405	8 49.2	77 21.2	92-93	17 VII 1966
417	9 24.8	78 12.7	51	19 VII 1966
419	9 28.3	78 20.7	51-55	”
435	9 08.5	80 29.5	37-48	20 VII 1966
439	8 51.3	81 08.3	18-22	“
444	8 57.5	81 31	73	21 VII 1966
584	21 02	86 24	347-353	23 V 1967
592	21 00	86 23	174-348	15 III 1968

Station	*Latitude	*Longitude	Depth (m)	Date
595	21 08.5	86 27	33-586	"
596	21 04	86 22	46-420	"
619	15 56	87 34	18-64	20 III 1968
623	16 00	86 08	42-55	21 III 1968
624	15 59.5	86 05.5	35-37	"
625	15 59.5	86 02.5	27-37	"
629	15 58.2	86 09.0	40	"
650	6 07	52 19	84-91	8 VII 1968
658	7 10	53 36	126-135	9 VII 1968
671	7 07	55 08	64	11 VII 1968
684	7 19	56 51	55-59	14 VII 1968
686	7 00	57 08	26-27	15 VII 1968
691	8 25	58 08	82-88	"
705	10 45	62 00	77-86	18 VII 1968
707	11 21	62 21	78	19 VII 1968
708	11 24.7	62 40.5	70-73	"
709	11 08.8	62 46.1	46	"
710	10 47.4	62 55.0	46-48	"
711	10 48	63 13	46-51	"
712	11 08	63 18	24-27	"
717	11 21	64 10	64	20 VII 1968
718	11 22.5	64 08.6	60	"
727	10 20	65 02	64	21 VII 1968
728	10 22.5	65 23	80	21 VII 1968
734	11 01.8	65 34.2	60-68	22 VII 1968
736	10 57	65 52	70-155	"
737	10 44	66 07	60-73	22 VII 1968
745	11 57.9	66 50	64-66	24 VII 1968
749	10 37.0	67 57.9	59	25 VII 1968
758	11 42.2	69 40	15-18	27 VII 1968
759	12 09	69 49	35-37	"
761	11 52	70 22	35	"
768	12 33.4	71 10.8	64-68	28 VII 1968
769	12 31	71 41	143-146	"
773	12 17	72 15	60-64	29 VII 1968
775	12 05	72 38.5	79-82	"
778	11 46.5	72 48.0	9	30 VII 1968
835	9 36	60 10	48	30 VI 1969
838	10 32	60 23	93-115	"
840	10 40.5	60 37.5	29-37	1 VII 1969
841	10 49.5	60 29	55-68	"
857	12 23.5	61 21.6	9-348	3 VII 1969
874	13 11.2	61 05.3	156	6 VII 1969
876	13 13.9	61 04.7	231-258	"
887	14 09.0	60 56.7	18	7 VII 1969
913	14 53.8	61 04.9	46-48	10 VII 1969
924	15 13.0	60 56.9	68-69	14 VII 1969

Station	*Latitude	*Longitude	Depth (m)	Date
931	15 31.2	61 12.3	146-494	15 VII 1969
935	15 36.5	61 18.8	33-38	"
944	16 33.0	61 37.0	360-421	17 VII 1969
969	17 27.8	61 41.1	69-339	20 VII 1969
991	18 47	64 46.8	205-380	23 VII 1969
1143	20 54.5	73 28.2	110-220	13 I 1970
1191	17 41	75 41	33	2 VII 1970
1196	17 27.5	75 57	26	3 VII 1970
1202	17 51.1	76 23.8	18	4 VII 1970
1220	17 35.9	77 21.8	24-27	6 VII 1970
1242	18 27.6	77 56.9	1	9 VII 1970
1273	17 51.6	71 39.2	9-18	18 VII 1970
1294	18 15.2	70 58.3	48-49	20 VII 1970
1302	?	?	35	21 VII 1970
1303	18 21	69 14.3	170-176	"
1330	11 51.2	83 26.6	24	28 I 1971
1335	12 28.9	83 04.8	27	"
1336	12 42	82 47	38-46	29 I 1971
1360	15 23.2	82 19.3	18	1 II 1971
1362	15 36	83 04	24	"
1368	16 03.2	85 12	117-124	2 II 1971
1369	16 07	85 38	55-57	2 II 1971
1384	19 45	67 00	7919-7956	6 VII 1971
1395	18 21.3	69 12.6	165-167	10 VII 1971
1411	20 18	69 13	27-183	18 VII 1971
		N/OC Almirante Saldanha		
1743	01 12'00"S	43 54'05"W	55	4 XI 1967
		R/V Silver Bay (SB)		
37	29 15'N	85 31'W	66	14 VII 1957
48	29 00	85 31	42-55	15 VII 1957
331	29 15	88 16	128-137	26 III 1958
437	23 37	87 58	91-121	18 V 1958
961	20 02	91 58	48	28 I 1959
1125	20 04	91 50	48	?
1515	33 37	76 49.3	15-16	11 XII 1959
1571	29 03	80 15.5	42-46	21 I 1960
1634	35 02	75 26	55-59	23 II 1960
1697	34 01	76 51	33	29 II 1960
1698	34 03.5	76 44	37	"
1710	34 36	76 35	13-14	2 III 1960
1788	32 01	79 24	64-82	14 III 1960
1789	32 01.5	79 14.5	101-128	"
1902	28 53.5	80 09	64	17 IV 1960
1952	28 05.5	80 11.5	29-30	20 IV 1960
1956	28 02.5	80 08	37	"

Station	*Latitude	*Longitude	Depth (m)	Date
1959	27 49.5	79 58.5	91	"
1970	28 25	80 01	91	23 IV 1960
1999	28 27	80 13	37	25 IV 1960
2008	28 13.5	80 02.5	59-73	"
2009	28 15	80 02	73	"
2010	28 17.5	80 01.5	62-75	"
2020	28 22.5	80 02	75-82	26 IV 1960
2061	29 36.5	80 23	40	30 IV 1960
2368	29 16.5	80 04	384	2 V 1960
2405	24 31.5	81 13	137	27 X 1960
2412	24 31.5	81 26.5	64	26 X 1960
2425	24 24	81 59	137	29 X 1960
2432	24 27	83 04	73	30 X 1960
2446	24 08	80 09.5	40-183	3 XI 1960
2447	24 00.5	80 25	165-229	"
2462	23 37	79 34	366-412	6 XI 1960
2523	28 53	80 05	90	15 XI 1960
2547	33 11	77 26	49-104	7 XII 1960
2813	34 35	75 53	42-46	1 III 1961
3033	28 28	80 10	40-43	25 IV 1961
3147	28 47	80 09	55	9 V 1961
3191	29 14.5	80 15.5	60	8 VII 1961
3266	28 22.5	80 07	48	13 VII 1961
3278	28 04	80 02.5	62-64	14 VII 1961
3284	27 55	80 03	55	15 VII 1961
3407	27 52	80 07	37	22 IX 1961
3467	27 27	79 00	229-274	25 X 1961
3494	23 36	75 25	183-366	3 XI 1961
4122	35 08	75 08	73-91	6 VI 1962
4195	34 05	77 18	26	2 VIII 1962
4215	29 58	80 08	366-384	22 VIII 1962
4228	29 14	80 03	366	24 VIII 1962
4419	29 09	80 12	66-73	5 X 1962
4420	29 09	80 10	73-97	“
4428	29 14	80 50	18-20	6 X 1962
5107	27 59	80 01	73	28 IX 1963
TAMU				
76-68-II-1	27 54'53"N	93 26'50'W	100	11 X 1976
Triton				
553-56	off Palm Beach, FL		183	5 VI 1951
USGS				
VIII-A-1B	27 57.1'N	91 57.6'W	99	11 IV 1976
VIII-A-2	27 52.4	91 50.9	175	"
VIII-A-3	27 49.5	91 53.8	114	"
IX-1	27 54.5	93 18.0	61	21 IV 1976

Station	*Latitude	*Longitude	Depth (m)	Date
USGS-AE-9701				
42	29 26.50'N	87 41.42'W	73	8 VIII 1997
67	29 26.43	87 34.63	70	10 VIII 1997
77	29 24.36	87 59.53	75-77	12 VIII 1997
Vema				
15-1	31 54'N	79 05'W	413	29 X 1958
16-65	46 45	56 22	42	9 IX 1960
N/OC Wladimir Besnard (WB)				
2	24 09'S	43 59'W	160	22 VII 1969
6	23 22 S	44 23	46	"
302	23 14 S	?	49	16 II 1968
318	25 15 S	44 00	180	7 II 1969
379	23 59 S	44 07	130	22 VII 1969
413	33 40 S	51 46	78	31 X 1968
5148	24 14 S	44 32	134	?
5192	24 13.2 S	44 24.8	180	20 VII 1987
5366	24 22.30 S	44 18	240	12 VIII 1988

* All latitudes are N unless otherwise indicated; all longitudes are W unless otherwise indicated.

ZOOGEOGRAPHY

Patterns of Distribution: Among the 73 shallow-water species considered in this revision, several patterns of distribution occur within the western Atlantic (Table 1, column 21; Table 2); however, eight species were not included in the analysis because of a paucity of records (pattern 0).

For the purpose of this analysis, the marine zoogeographic regions and provinces defined by BRIGGS (1974) are adopted, realizing that the boundaries to any province may be highly variable depending on season, current pattern, depth of occurrence, and kind of organism being analyzed. BRIGGS (1974) placed the three northern boundaries of the tropical western Atlantic region at Cape Kennedy (=Cape Canaveral) on the east Florida coast, Cape Romano on the western Florida coast, and Cape Rojo on the Mexican coast. The southern boundary was placed at Cabo Frio, Brazil. Only two shallow-water azooxanthellate species occur throughout this entire realm (Tables 1-2: pattern 1A), which includes both insular and continental coasts, the distribution of *Astrangia solitaria* being almost exactly concordant with this region (Fig. 15). The most common pattern followed by shallow-water azooxanthellate corals (pattern 1B) consists of being widespread throughout the western Atlantic tropics but also extending to varying degrees into the northern warm temperate region in the Gulf of Mexico and southeastern United States. Eighteen of these 'eurythermic tropical' species are listed in Table 1, 10 of which extend to both the northern Gulf of Mexico and southeast coast of the US, and eight of which extend only into the northern Gulf of Mexico. According to BRIGGS, this pattern is not uncommon among tropical organisms between Cape Kennedy and Cape Hatteras, the eurythermic tropical species generally occurring offshore, the temperate species being inshore, this pattern being reinforced by the offshore, northward-following Antilles Current and Gulf Stream. Among the ten species that extend up the coast, most (7 of 10) have their northern range between 34°30'N and 35°08'N (Onslow Bay to Cape Hatteras, NC), which would appear to be not only a boundary for inshore warm temperate but also for the offshore tropical eurythermic fauna (CERAME-VIVAS & GRAY 1966). Another distributional pattern, represented by only four taxa (pattern 1C), consists of species that are widespread throughout the Caribbean, but are not known from the Brazilian Province or from the northern warm temperate region. *Colangia im-*

TABLE 1.—Geopolitical Distribution (see FIG. 1) of the 73 Shallow-Water (0-183 m) Western Atlantic Azooxanthellate Scleractinia

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	•Depth (m)
**Madracis asperula*					x	x	x		x		x	x	x	x	x	x	x		X	?	1B	24-311
**M. brueggemanni*					x	x					x		x	x			X				3B	51-130
M. myriaster	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x					1B	20-1220
**M. pharensis* f. *pharensis*				x	x	x	x	x		x	x		x	x	x		x		X	x	1B	11-333
**Astrangia solitaria*	x		x	x	x		x	x	x	x	X	x	x	x	x		x				1A	0-51
**A. rathbuni*																x	X				4	?-90
**A. poculata*		X	x		x	x			?		?								?		5	0-263
Madrepora carolina	x	x	X	x	x	x	x	x		x	x			x	x			x			1B	53-801
**Oculina tenella*			X			x															5	25-159
Caryophyllia berteriana			x	x	x	x	x		x	x	X	x		x	x	x					1B	99-1033
C. horologium					x	X															5	55-175
**C. crypta*				X			x			x	x	x	x	x	x						1C	12-183
C. antillarum				x			x	x			X										2A	150-730
C. zopyros							x			x	X										2A	73-618
C. barbadensis					x						X						?				0	129-249
Premocyathus cornuformis		x	X	x		x	x			x	x	x			x		x		x	?	2B	137-931
**Coenocyathus humanni*			X																		0	21
**C. caribbeana*				x	?		x			x	x	X			x						1C	5-100
C. parvulus				x	x	x	X			x	x		x		x		x				2B	97-399
**C. goreaui*	X								x												0	2-6
Trochocyathus rawsonii		x	x	x	x	X	x	x	x	x	X		x	x	x	x	x			?	1B	55-700
**T. laboreli*																	X				4	130-240

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	•Depth (m)
Paracyathus pulchellus	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		X		1B	17-250
**Polycyathus senegalensis*		x	x			x					x		x			x			X		3B	12-143
**P. mayae*				X			x	x		x	x				x						2A	137-309
**Cladocora debilis*		x	x			x							x	x	x		x	x	X		3B	32-480
Deltocyathus calcar	x	x	x	x	x	x	x	x	x	x	X	x	x	x	x	x	x				1B	81-675
**D. halianthus*																	X				4	46-130
Thalamophyllia riisei				x	x	x	x			x	X			x	x	x					1B	4-914
Lophelia pertusa	x	x	x	x	x	x			x	x	x		x				x		X	x	1B	146-1200
Dasmosmilia lymani		x	X			x						x				x			x	x	3B	37-366
D. variegata			X			x						x					x		x	x	2B	110-421
Oxysmilia rotundifolia	x	x		x	x	x	x	x	x		x	x	x	x		x					1B	46-640
**Colangia immersa*	x			X			x	x	x	x	x	x		x	x						1C	0.5-347
**C. jamaicaensis*										X					x						0	10-20
**C. multipalifera*										X											0	20
**Phyllangia americana americana*	x	x	x	x	x	x	x		x	x	X	x	x	x	x		x				1B	0-53
**P. pequegnatae*		X			x	x															5	48-112
**Rhizosmilia maculata*			x	x			x		x	x	x	x	x	x	x		X				1A	0.5-508
R. gerdae				X			x		x		x										2A	123-549
Phacelocyathus flos				x		x	X	x	x	x	x			x	x	x	x				2B	20-355
Anomocora fecunda				X		x	x	x		x	x	x	x	x	x		x	x	x		1B	37-640
A. prolifera		x	X	x	x	x					x	x	x			x			x		3C	30-329
A. marchadi				x								x	x						X	x	3B	35-229
Coenosmilia arbuscula				x	x	x	x		x		X	x	x	x	x	x					1B	74-622

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	•Depth (m)
Pourtalosmilia conferta		X	x		x	x											x	x			3D	55-191
Deltocyathoides stimpsonii		x	X		x	x	x				x						x		x		2B	110-553
**Sphenotrochus auritus*																x	X				4	15-64
**S. lindstroemi*											x		x			X					1D	22-78
**S. andrewianus moorei*		x	x			X															5	9-42
Flabellum floridanum			x	x	x	X															5	80-366
Javania cailleti		x	x	x	x	x	x	x		x	X		x	x	x	x	x		x	x	1B	30-1809
Polymyces fragilis		x	X	x	x	x	x				x		x	x	x		x				1B	75-822
Guynia annulata	x			x	x	x	x	x		x	x	x		x	x	x			X	x	1B	30-653
Schizocyathus fissilis			x	x	x	x	x		x		X	x		+	x				x		2B	88-640
Stenocyathus vermiformis		x	X	x	x	x	x				x						x	x	x	x	2B	165-835
Gardineria paradoxa			X							x	x				x					x	2A	91-700
**G. simplex*				x			X	x		x	x				x						2A	46-241
G. minor				x	x		x	x		X	x	x	x	x	x						1C	2-146
Balanophyllia floridana		x	X			x	x				x			x					x		3C	13-220
B. cyathoides				x			X				x				x						2A	45-494
B. palifera				x	x		X			x	x				x						2B	53-708
B. dineta											x	x	X			x	x				1D	27-274
B. caribbeana											X	x	x								1D	33-86
B. pittieri							x						x	X	x						3A	40-96
**Leptopsammia trinitatis*											X				x						0	15-40
Eguchipsammia cornucopia			X	x		x	x	+			x	x	x		x				x		3C	91-300
**E. strigosa*		x									x		X								3B	25-77

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	•Depth (m)
E. gaditana		x		x	x	x	x			x	x		x		x	x		x	**X**	x	3B	97-505
**Rhizopsammia bermudensis*	**X**																				0	8-12
R. goesi				x		x					**X**		x		x		?				1B	4.5-119
Cladopsammia manuelensis			x	x	x	x	x								x		x		**X**		3D	70-366
**Tubastraea coccinea*				x			x		x	x	x	x	x	x					x	**X**	0	0.3-37
	12	24	31	41	33	41	41	18	18	31	51	26	32	28	38	20	27	6	22	11		

1 Bermuda
2 Northeast coast of US (north of Florida: 30°48'N)
3 Eastern Florida and Florida Keys
4 Bahamas
5 Western Gulf of Mexico (boundary between eastern and western Gulf considered as a line from Mississippi Delta to northeastern tip of Yucatan Peninsula
6 Eastern Gulf of Mexico (southeastern border of Gulf considered as longitude 83°30'W between Cuba and Florida Keys; southwestern border the shortest line between Cuba and Yucatan Peninsula
7 Cuba and Cayman Islands
8 Hispaniola
9 Puerto Rico
10 Jamaica
11 Windward Group of Lesser Antilles (Virgin Islands to Trinidad)
12 Leeward Group of Lesser Antilles (from Los Testigos to Aruba)
13 Northern coast of South America (Venezuela and Colombia)
14 Southwestern Caribbean (Atlantic coastal regions of Panama, Costa Rica, Nicaragua (to 15°N)
15 Northwestern Caribbean (Atlantic coastal regions of Honduras, Guatemala, Belize, and Mexico to northern tip of Yucatan Peninsula)
16 Guianas/Suriname (Guyana, Suriname, French Guiana)
17 Brazil
18 St. Peter and Paul Rocks
19 Eastern Atlantic
20 Indo-Pacific
21 Distribution Pattern (see text)

+ denotes a fossil occurrence; bold capital X denotes region of type locality of species.
* denotes the 30 species that were not previously treated in detail by Cairns (1977a-b, 1978a, 1979) and are thus fully discussed in this paper.
• depth range for western Atlantic records only.

TABLE 2. – Distributional Patterns of the 73 Western Atlantic Shallow-Water Azooxanthellate Scleractinia. Eight species have no discernable pattern and are not included.

1. Widespread (insular and continental)
   A. Tropical Western Atlantic (Caribbean, Antillean and Brazilian Provinces): 2 species
   B. Tropical Western Atlantic and Carolinian warm temperate Province (eurythermic tropical): 18 species.
   C. Caribbean: 4 species.
   D. Southeastern Caribbean: 3 species.
2. Primarily Insular ("Antillean Province")
   A. Exclusively Antillean: 7 species.
   B. Antillean and Brazilian Province and warm temperate Carolinian Province (eurythermic tropical): 8 species.
3. Primarily Continental ("Caribbean Province")
   A. Southwestern Caribbean: 1 species
   B. Southern Caribbean and warm temperate Carolinian Province (eurythermic tropical): 7 species
   C. Southern Caribbean, Carolinian Province, and southern Lesser Antilles: 3 species
   D. Bi-temperate: 2 species
4. Endemic to Brazilian Province: 4 species
5. Endemic to warm temperate Carolinian Province: 6 species

mersa and *Gardineria minor* are excellent examples of this pattern (Fig. 6). Another three species (pattern 1D) have a distribution characteristic of both insular and continental coasts in the southeastern Caribbean and northeastern coast of South America.

Seven species (pattern 2A) have their distributions confined primarily to insular coasts, *i.e.,* the Greater and Lesser Antilles and often Arrowsmith Bank, Yucatan Channel, but are not found in the Leeward Group of islands off the coast of Venezuela (Aruba to Los Testigos) or Trinidad and Tobago. This distribution has been called the West Indian Province by BRIGGS (1974) and the Antillean region by BAYER (1961) and CAIRNS (1979). An example of this distribution is that of *Caryophyllia antillarum,* or *Polycyathus mayae* (Fig. 4), when Arrowsmith Bank is included. Another eight species (pattern 2B) have a similar insular distribution but also extend south into the Brazilian Province as well as north into the warm temperate region, like the eurythermic widespread species of pattern 1B. Three of the eight species occur both in the northern Gulf of Mexico and southeastern US (*e.g., Deltocyathoides stimpsonii*), whereas five extend only to the Gulf of Mexico (*e.g., Caryophyllia parvula).*

A third class of distributions appear to be restricted to continental margins. One species, *Balanophyllia pittieri,* is confined to the continental mar-

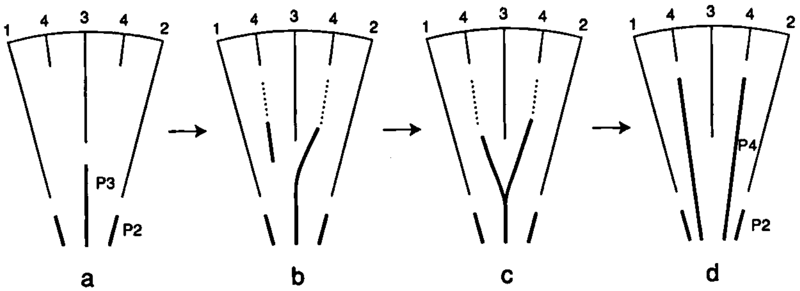


FIGURE 2. Diagrams illustrating the ontogenetic arrangement of paliform lobes (bold lines: P2, P3, P4) within one half-system of a *Colangia multipalifera*. Numbers 1-4 denote septal cycles; dotted lines represent a loose trabecular connection between a paliform lobe and its adjacent septum.

gin of the southwestern Caribbean (pattern 3A; Fig. 9), its distribution coming closest to matching the 'Caribbean Province' as defined by BRIGGS (1974). That province extends from Cape Rojo, Mexico to the Orinoco Delta, Venezuela, as well as including the southeastern coast of Florida, which produces a curiously disjunct nature to the province. Another seven species (pattern 3B) have this basic Caribbean continental pattern but also extend southward into the Brazilian Province and northward into the warm temperate Carolinian Province. Among these seven eurythermic tropical species, three extend to the northern Gulf of Mexico and along the southeastern US coast (*e.g., Cladocora debilis,* Fig. 18), two extend only into the northern Gulf of Mexico (*e.g., Anomocora marchadi*), and two extend only along the southeastern US coast (e.g., *Eguchipsammia stigosa,* Fig. 10). Because the western Caribbean is poorly known and distributional records few, this pattern of distribution (3B) often appears to be disjunct. Of the five eurythermic tropical species that extend up the southeastern US coast, four terminate between 34°30'N and 36°00'N (between Cape Lookout and Cape Hatteras, NC). Another three species (pattern 3C)have essentially the same distribution as pattern 3B, but in addition having several records in the southern Lesser Antilles. A fourth continental pattern (3D: bitemperate) consists of two species that appear to have disjunct distributions in both the northern and southern warm temperate regions.

BRIGGS (1974) defined the tropical Brazilian Province as extending from the Orinoco to Cabo Frio, Brazil. Three shallow-water azooxanthellate

TABLE 3. – Faunal Affinities of the Tropical/Warm Temperate Western Atlantic Azooxanthellate Scleractinia

	Exclusively 0-183 m (N=27 species)	Transitional (N=46 species)	Exclusively over 183 m (N=56 species)	TOTAL (N=129 spec.)
Endemic to Western Atlantic	23 (85%)	25 (54%)	32 (57%)	80 (62%)
Amphi-Atlantic	*3 (11%)	13 (28%)	9 (16%)	25 (19%)
Western Atlantic and W. Pacific	0	0	**5 (9%)	5 (4%)
Cosmopolitan, but not E. Pacific	0	5 (11%)	***4 (7%)	9 (7%)
Cosmopolitan in tropical and temperate seas	****1 (4%)	3 (7%)	6 (11%)	10 (8%)

* Includes two subspecies representing western Atlantic occurrence: *Phyllangia americana americana* and *Sphenotrochus andrewianus moorei.*

** Includes two subspecies representing western Atlantic occurrence: *Fungiacyathus pusillus pusillus* and *Anthemiphyllia patera patera.*

*** Includes one subspecies representing tropical/warm temperate occurrence: *Caryophyllia ambrosia caribbeana.*

**** *Tubastraea coccinea* considered to be an introduced species.

species are endemic to this province (pattern 4), representing 7.5% (3/40 species) of the shallow-water species known from this province.

BRIGGS (1974) defined the disjunct warm temperate Carolinian Province as extending from Cape Rojo, Mexico to Cape Romano, Florida in the Gulf of Mexico, and Cape Kennedy, Florida to Cape Hatteras, North Carolina. Six shallow-water azooxanthellate species are endemic to this province, representing 13% (6/47) of the shallow-water species that are known from this province. Three of these species occur both in warm temperate Gulf of Mexico and southeastern US and three are only known from the Gulf of Mexico. The distribution of one of the former species, *Astrangia poculata,* also extends well into the cold temperate region (Fig. 3)

Faunistic Affinities: In 1979, I (CAIRNS 1979: 205-208, Table 5) analyzed the relationship of the bathymetric ranges of western Atlantic coral species to the size of their geographic distributions, showing a strong correlation of greater depth to greater bathymetric distribution. This analysis is recalculated herein based on a greater number of species and certain refinements in methodology (Table 3). In 1979 the azooxanthellate were divided into two groups: those species occurring exclusively shallower than 200 m, and those occurring deeper than 200 m but which might also occur shallower than 200 at their shallowest. However, in this analysis, the 129 species of azooxanthellate Scleractinia known from the tropical-temperate western Atlantic are divided into three categories: species found exclusively shallower than 200 m (27 species), those 'transitional' species that cross the 200 m boundary (46 species), and those found exclusively deeper than 200 m (56 species). It is the 73 species of the first and second categories that constitute the basis for this paper, but the exclusively deep-water species are reconsidered for comparison. Another 16 species and one subspecies of azooxanthellate Scleractinia are known from the cold temperate north and southwestern Atlantic (CAIRNS 1979: Tables 2-3), but these are not considered in this analysis.

The number of exclusively shallow-water species (see Tables 1, 3), *i.e.*, 27, is coincidentally the same number used in 1979 for the earlier analysis, despite the fact that only 17 species are in common between these two lists. Some of the species in the original list of 27 are now considered to be zooxanthellate (*i.e.*, *Madracis formosa*, *Agaricia cailleti*) and others have been transferred to the transitional group, the deficit replaced by the description of new species. As Table 3 indicates, the shallow-water azooxanthellate fauna is highly endemic (85%), with a small Amphi-Atlantic component (11%), and one cosmopolitan species, *Tubastraea coccinea*. It is noteworthy that two of the three amphi-Atlantic species (*Phyllangia americana americana* and *Sphenotrochus andrewianus moorei*) are considered to be subspecies, each subspecies being restricted to one side of the Atlantic. This percentage affinity is extremely similar to that of the western Atlantic zooxanthellate corals (CAIRNS 1979: table 5), which, of course, are also restricted to shallow water. And if *Tubastraea coccinea* is removed from the analysis on the basis that it is probably an introduced species, the percentage affinities of the shallow water azooxanthellates and zooxanthellates are identical.

When the 102 deeper-water azooxanthellate species are considered, the western Atlantic endemic component decreases to 54-57% and the amphi-Atlantic component increases to 16-28% (Table 3). There is also a 16-18% component of cosmopolitan species. The three cosmopolitan species in the transitional group are *Madracis pharensis*, *Lophelia pertusa*, and *Javania cailleti*; and the five cosmopolitan (except for eastern Pacific) species are: *Dasmosmilia lymani*, *D. marchadi*, *Guynia annulata*, *Stenocyathus vermiformis*, and *Eguchipsammia gaditana*.

Among the 56 species of exclusively deep-water species (Appendix 1 and Table 3), there is an additional category consisting of a disjunct distribution in the western Atlantic and the western Pacific shared with five species, two of which are considered subspecies: *Fungiacyathus pusillus pusillus* (subspecies *pacificus,* Cairns 1995 in the Pacific); *Anthemiphyllia patera patera* (subspecies *costata* Cairns, 1999, in the Pacific); *Stephanocyathus (O.) coronatus* Pourtalès, 1867; *Premocyathus dentiformis* (Alcock, 1902); and *Crispatotrochus sp. cf. C. cornu* (Moseley, 1881). Otherwise, the transitional and exclusively deep-water groups have fairly similar affinities.

In addition to the 129 azooxanthellate species known from the western Atlantic, there an additional 65 zooxanthellate species (Appendix 2), which include four facultative species capable of being either zooxanthellate of zooxanthellate (*i.e., Astrangia poculata, Madracis pharensis, Oculina varicosa,* and *O. diffusa*), the first two of which are included in the list of 129 azooxanthellates. Thus, the total number of scleractinian corals known from the tropical-warm temperate western Atlantic is 192. This almost perfect 2:1 ratio of azooxanthellate to zooxanthellate species is atypical in that worldwide there is essentially the same number of species (*i.e.,* 669 *vs* 655, respectively; CAIRNS, HOEKSEMA, VAN DER LAND, 1999) of both ecological categories. Viewed from a different perspective, the western Atlantic azooxanthellate species constitute 20% of the known worldwide azooxanthellate fauna; the western Atlantic zooxanthellates, 10% of the known worldwide zooxanthellate fauna; and the entire western Atlantic scleractinian fauna represents 15% of the known scleractinian fauna.

SPECIES ACCOUNT

Order *SCLERACTINIA*

Suborder **ASTROCOENIINA**

Family **POCILLOPORIDAE Gray, 1840**

Genus **Madracis Milne Edwards & Haime, 1849**

Diagnosis: Colonies formed by extratentacular budding resulting in massive or ramose coralla. Coenosteum costate or spinose. Septa arranged in groups of 6, 8, or 10, but in rarely more than 2 cycles. Paliform lobes often present on first cycle of septa. Columella styliform.

Type Species: *Madracis asperula* Milne Edwards & Haime, 1849, by monotypy.

Madracis asperula Milne Edwards & Haime, 1849

(Figs. 12, 24-26)

Madracis asperula Milne Edwards & Haime, v*1849a: 70; 1850a: xxii; 1850b: 101, pl. 4, figs. 2a-b. –Milne Edwards, 1857: 139. –Pourtalès, v.1871: 27-28, pl. 7, fig. 4; v.1874: 41; Studer, 1878: 636. –Pourtalès, 1878: 204; v.1880a: 96, 108. –Moseley, v.1881: 182 (in part: specimens from Cape Verde). –Duncan, 1882: 219. –Not Fowler, 1888: 4-6, pl. 32, fig. 1 (=*M. brueggemanni*). –Goreau, 1959: 70 (listed). –Zans, 1959: 28 (listed). –Not Lewis, 1960: 1133, 1138-1140, figs. 9-11 (=*M. mirabilis*). –Not Allen & Wells, v.1962: 389 (=?*M. myriaster*). –Not Roos, 1964: 7, pls. 4b, 5b, 6b (=*M. mirabilis*). –Pfaff, 1969: 21 (listed). –Geyer, 1969: 26 (listed). –Laborel, 1970: 150, 153, 155 (listed). –Tommasi, 1970: 55. –Not Roos, 1971: 53, pls. 9b, 10 (=*M. decactis*). –Porter, 1972: 111 (listed). –Wells, 1973: 19 (key to W. Atlantic species). –Bright et al., 1974: 34 (listed). –Zibrowius & Saldanha, 1976: 103, figs. 6-12. –Cairns, 1978a: 10 (listed). –Zibrowius, v.1980: 16-18, pl. 1, figs. A-J, pl. 2, figs. A-J (description and synonymy). –Castañares & Soto, 1982: Table 1 (listed). –Prahl & Erhardt, 1985: 11. –Rezak et al., 1985: 225 (listed: stn 113, Coffee Lump; stn 115, 127, 128, Geyer Bank; stn 118, Diaphus Bank; stn 125, Rezak Bank). –Prahl & Erhardt, 1989: 541. –Swedberg, 1994: 75-81, fig. 23a-d. –Ogawa, Tanase & Takahashi, 1997: 139.
Axohelia schrammi. –Lindström, v.1877: 14. [Not *Axohelia schrammii* Pourtalès, 1874]
Axhelia asperula. –Vaughan, v.1901: 294, pl. 1, fig. 4, pl. 17, fig. 2.

Madracis mirabilis. –Ludwick & Walton, 1957: 2081, fig. 13C3. [Not *Stylophora mirabilis* Duchassaing & Michelotti, 1860].

Description: Colonies small, sparsely branched in three dimensions, and delicate; branch anastomosis rare. Largest colony examined (BLM, SOFLA-17, USNM 72489) only 4 cm in height, with a pedicel diameter of 3.5 mm. Specimens still attached to substrate are extremely rare in collection, virtually all material reported below consisting of distal branch fragments. Coralla appear to attach to a soft (*e.g.*, sponge) or hard, but small substrate (*e.g.*, a small bryozoan colony), which is easily overgrown or from which the coral detaches during early ontogeny or during collection. Distal branches usually quite slender (1.4-1.7 mm in diameter), not much more than width of a corallite; attenuate; and often flattened or polygonal in cross section. Distal branches in process of bifurcation slightly thicker. Corallites circular on proximal branches, but elongate on branch tips, as though longitudinally stretched, up to 2.2 mm in GCD and 1.3-1.5 mm in LCD. Corallites at branch tip relatively closely spaced, usually less than 1 CD apart. Coenosteum covered with a fine spination, the spines about 0.18 mm in height and 50-80 µm in diameter. Spines often arranged linearly on low ridges that cover the entire coenosteum. Corallum white.

Each corallite contains 10 relatively exsert (0.5 mm), but narrow septa, the axial edge extending only about half distance to columella. Axial edges of S1 vertical, straight, and entire, usually bordered by a small paliform lobe. S2 absent or rudimentary, the latter state represented by an alignment of small spines. Occasionally coralla having corallites with only 8 septa are found at the same station as those having 10 septa, all other characters being the same (see Discussion). Central part of fossa contains a solid, massive columella, elliptical in cross section and with a horizontal top, from which a compressed, styliform rod projects.

Discussion: Three branching azooxanthellate species of *Madracis* are known from the western Atlantic. *M. asperula* is distinguished from *M. myriaster* by having: a smaller corallum; smaller basal branch diameter and smaller, more attenuate distal branches; 3-dimensional branching with little or no branch anastomosis; spinose, instead of tuberculate-striate, coenosteum; and small paliform lobes (P1). And, although their bathymetric ranges overlap, *M. asperula* is usually found in shallower water than

M. myriaster. M. asperula differs from the other branching species, *M. brueggemanni*, in having larger and more closely spaced corallites; a more delicate corallum; a larger columellar base; and more slender, attenuate/flattened branch tips. Furthermore, corallites of *M. brueggemanni* have predominantly 8 septa, whereas those of *M. asperula* usually have 10.

Although ZIBROWIUS (1980) was hesitant to identify the western Atlantic populations of this species as *M. asperula* (type locality, Madeira), I can find no skeletal morphological differences between the amphi-Atlantic populations. Likewise, I can find no differences between the Atlantic populations and the specimen reported by DURHAM & BARNARD (1952) and CAIRNS (1991a) from the Galápagos Islands. A similar species, reported as *Madracis* sp. A by CAIRNS (1994), CAIRNS & KELLER (1993), and CAIRNS & ZIBROWIUS (1997), and as *M. asperula* by GARDINER & WAUGH (1939), has been reported from throughout the Indo-West Pacific.

Coralla from six stations (BLM, SOFLA-9, BLM, SOFLA-10, P-736, P-749, P-759, and Cedar Key, FL) are otherwise similar to *M. asperula* but have only 8 septa per corallite. They are not considered to be *M. brueggemanni*, which customarily has 8 septa per corallite, because these specimens have slender, attenuate branch tips, large corallites, and large columella, characters consistent with *M. asperula*. They are included herein as variants or polymorphs of *M. asperula*. At three of these stations (i.e., BLM, SOFLA-9 and 10, and P-736) typical coralla of *M. asperula* and *M. brueggemanni* were also collected, which raises the possibility that the 'octameral *M. asperula*' may be a hybrid of the two species, a general phenomenon strongly suggested by VERON (1995) to occur among the reef building Scleractinia. Electrophoretic work on fresh material could probably easily solve this taxonomic problem and shed light on the value of using septal number as a species-level character in this genus.

Nomenclatural note: According to the ICZN (1985: Article 13c), the combined description of a new genus and new species confers availability to the both genus and species names, the species named being fixed as the type of the genus by monotypy. This is precisely what happened in the case with *Madracis asperula*, the genus and species being described in a brief three lines by MILNE EDWARDS & HAIME (1849a: 70), the more complete description and figure published the following year (MILNE EDWARDS & HAIME 1850a).

New Records: P-365, 1 branch, USNM 99087; P-366, 1 branch, USNM 99048; P-372, 1 colony and 1 branch, USNM 99062; P-392, 4 branches, USNM 99086; P-399, 4 branches, USNM 99089; P-419, 1 colony and 2 branches, USNM 99088; P-444, 2 branches, USNM 99076; P-592, 6 branches, USNM 99080; P-658, 2 branches, USNM 99079; P-684, 10+ branches, USNM 99075; P-707, 50+ branches, USNM 99085 and UMML 8.333; P-708, 10 branches, UMML 8.222; P-709, 10 branches, USNM 99082; P-710, 1 branch, USNM 99078; P-712, 1 branch, USNM 99077; P-734, 9 branches, USNM 99083; P-736, 20 branches, USNM 99047, 99060 and UMML 8.334; P-737, 20 branches, USNM 99065; P-745, 10 branches, USNM 99084; P-749, 2 branches, USNM 99046; P-759, 1 branch, USNM 99050; P-775, 10 branches, USNM 99068; P-835, 1 branch, USNM 99071; P-840, 100+ branches, USNM 99064; P-841, 5 branches, USNM 99070; P-857, 9 branches, USNM 99067; P-913, 100+ branches, USNM 99063; P-1362, 4 branches, USNM 99049; G-899, 1 branch, USNM 99066; G-956, 4 branches, USNM 99074; G-985, 2 branches, USNM 99073; G-1246, 2 branches, USNM 99081; O-4904, 1 branch, USNM 99057; Alb-2142, 10 branches, USNM 7211; Alb-2161, 2 branches, USNM 16150; Alb-2319, 1 colony, USNM 16141; BLM, SOFLA-9, many branches, USNM 72471-77, 72507; BLM, SOFLA-10, many branches, USNM 72480, 72778-79, 75512, 78219; BLM, SOFLA-11, many branches, USNM 72481-85, 72516; BLM, SOFLA-17, many branches, USNM 72486-89; BLM, SOFLA-23, many branches, USNM 72490-91, 72493, 72495-6, 72521, 72535; BLM, SOFLA-27, many branches, USNM 72497-8; BLM, SOFLA-29, many branches, USNM 72499; BLM, SOFLA-30, 1 branch, USNM 72523; BLM, SOFLA-36, 3 branches, USNM 99331; BL-247, 3 branches, USNM 6409; B-A DS59, 100+ branches, USNM 99056; Chain 35-43, 6 branches, USNM 99055; JS-16, 2 branches, USNM 99058; JS-104, 50+ branches, USNM 99072; USGS IX-1, 4 branches, USNM 75593; Hidalgo-334, 10 branches, USNM 85742; Cedar Key, FL, 55 m, 2 branches, USNM 99051.

Types: Eight syntype branches of *M. asperula* are deposited at the BM (1975.10.16.1) (see ZIBROWIUS 1980). Type Locality: Madeira.

Distribution: Western Atlantic: widely distributed throughout Caribbean, northern and eastern Gulf of Mexico, and eastern coast of South America to Abrolhos Islands, but absent from Bahamas and eastern coast of Florida (Fig. 12); 24-311 m, although most records from shallower than 100 m. Eastern Atlantic: Madeira, Canary Islands, Cape Verde Islands; 2-95 m (ZIBROWIUS 1980). Elsewhere: ?Galápagos Islands; 46-64 m (CAIRNS 1991a).

Madracis brueggemanni (Ridley, 1881)

(Figs. 13, 27-32)

Axohelia brueggemanni Ridley, v*1881: 102-102, pl. 6, fig. 7a-b.
Madracis asperula. -Moseley, 1881: 182 (in part: specimens from Fernando de Noronha). -Fowler, 1888: 418-420, pl. 32, fig. 1 (histology). [Not *M. asperula* Milne Edwards & Haime, 1849]
Madracis scotiae Gardiner, v*1913: 687-688, text figs. 1-2. -Laborel, 1970: 150, 151, 153, 154, 155.
Madracis bruggemanni (sic). -Porter, 1972: 111 (listed).
Madracis brueggemanni. -Wells, 1973: 20, 21-22. -Cairns, 1979: 207 (listed). -Castañares & Soto, 1982: Table 1 (listed). -Rezak et al., v.1985: 225 (listed).

Description: Like *M. asperula,* colonies are small, sparsely branched in three dimensions, and delicate, one of the largest colonies examined (BLM, SOFLA-23, USNM 72576) only 4 cm in height, and up to 6 mm in basal branch diameter. Attached coralla rarely collected; branch anastomosis rare. Branch tips blunt and evenly rounded (1.8-2.6 mm in diameter), several times the width of a corallite; circular in cross section. Distal branches in process of bifurcation slightly clavate, up to 4 mm in diameter. Corallites on proximal branches circular, whereas those on branch tips slightly elliptical, corallites ranging from 0.85-1.4 mm in GCD, often both extremes in size occurring adjacent to one another. Corallites well spaced, even at branch tips, each separated by a distance of 1-3 CD. Coenosteal spination similar in arrangement to that of *M. asperula,* but spines are larger – up to 0.18 mm in height. Corallum white.

Most (95%) corallites contain 8 relatively exsert (0.3 mm), narrow septa. Occasionally corallites contain 6, 7, 9, 10, or even 11 septa, those with less than 8 septa being more common than those with more. Axial edges of S1 vertical, straight, and entire, usually bordered by a small paliform lobe, which form a crown encircling the columella. S2 absent or rudimentary, the latter state represented by a series of elongate spines similar in size and shape to S1 face spines (Fig. 29). Columella base restricted to centre quarter of fossa, supporting a compressed (about 0.17 mm in diameter) styliform rod.

Discussion: In a footnote to his key to the species of western Atlantic *Madracis*, WELLS (1973) implied that *M. brueggemanni* might be a synonym of *M. asperula* because some coralla of the former where known to have corallites with 9 or 10 septa. Indeed, some coralla reported herein occasionally have corallites with 6-11 septa (see Discussion), but other characters (such as its smaller corallite diameter, blunt branch tips, more robust corallum, and smaller columellar base) distinguish *M. brueggemanni* from *M. asperula*. It should also be noted that some coralla of *M. asperula* have 8 septa, and that those specimens may be hybrids of *M. brueggemanni* and *M. asperula* (see Discussion of *M. asperula*).

The other octameral species of *Madracis*, *M. formosa* Wells, 1973, is distinguished by having a much larger corallum, much thicker branches, and is purportedly zooxanthellate, although it is interesting to note that in one case both species are known from the same station (BLM, SOFLA-29) at 63 m.

New Records: P-392, 1 branch, USNM 99105; P-417, 3 branches, USNM 99109; P-419, 1 branch, USNM 99104; P-736, 8 branches, USNM 99103; O-4227, 8 branches, USNM 99107 and UMML 8.332; O-4231, 1 branch, USNM 99106; BLM, SOFLA-9, 7 branches, USNM 72527; BLM, SOFLA-10, 1 branch, USNM 97326; BLM, SOFLA-11, 15 branches, USNM 71528; BLM, SOFLA-23, many branches, USNM 72492, 72529, 72532, 72533, 72569, 72576, 87208; BLM, SOFLA-29, many branches, USNM 72500, 72501, 72534, 72577, 72578; BLM, SOFLA-30, 4 branches, USNM 72574; BLM, SOFLA-36, 7 branches, USNM 72535; JSL-II-1736, 15 branches, USNM 86010; Circé IX-1, 3 branches, USNM 99102.

Types: The lectotype (BM 79.12.27.78) of *M. brueggemanni* was fixed by WELLS (1973:21) as the 'holotype' from a two specimen syntype series, the other syntype (=paralectotype) being identified by him as *M. formosa* Wells, 1973. Type Locality: Victoria (sic) Bank (=Vitoria Seamount), Brazil (20°42'S, 37°27'W), 60 m.

The two syntypes of *M. scotiae* are also deposited at the BM (1939.7.20.14). Type Locality: Scotia station 81: 18°24'S, 37°58'W (Abrolhos Bank), 66 m.

Distribution: Currently known from a disjunct distribution (Fig. 13), including northern and southeastern Gulf of Mexico; southern Caribbean;

Maranhão State, Brazil; Abrolhos Islands; and Vitoria Seamount (type locality); 51-130 m.

Madracis myriaster (Milne Edwards & Haime, 1849)

(Figs. 33-35)

Axhelia myriaster Milne Edwards & Haime, *1849a: 69. –Kenny *et al.*, 1975: 75, fig. 12.
Stylophora mirabilis Duchassaing & Michelotti, v*1860: 62, pl. 9, fig. 6.
Axohelia schrammii Pourtalès, v*1874: 41, pl. 8, fig. 2.
Madracis myriaster. –Werding & Erhardt, 1977: 105-107, fig. 1. –Cairns, 1979: 26-29, pl. 1, figs. 1-2, 4-5, Map 1 (description and synonymy). –Castañares & Soto, 1985: Table 1 (listed). –Fricke & Meischner, 1985: 183, 184, figs. 11c, 12a. –Prahl & Erhardt, 1985: 70, figs. 25a-b. –Rezak, et al., 1985: 225 (listed: stn 115, Geyer Bank). –Hubbard & Wells, v.1986: 125, fig. 3. –Bouchon & Laborel, 1986: 205 (listed). –Messing, 1987: 12, fig. –Prahl & Erhardt, 1989: 540. –Cairns et al., 1991: 45 (listed). –Cairns *et al.*, 1994: 4 (listed).

Diagnosis: Colonies large and robust, usually irregularly branched in one plane, resulting in frequent branch anastomosis. Large colonies up to 40 cm in height and 4 cm in basal branch diameter. Coralla firmly attached, the basal branch encircled with a broad but thin basal encrustation that also bears corallites, common substrates for attachment being gorgonian and antipatharian axes and sometimes cable. Distal branches slender (2-3 mm in diameter) and circular in cross section. Corallites on distal branches slightly elliptical, ranging from 1.7-2.1 mm in GCD and 1.3-1.6 mm in LCD. Corallites close set but not crowded. Coenosteum of distal branches covered with convex, rounded or bluntly pointed tubercles 0.25-0.35 mm in diameter, which are covered with a very fine granulation (25 µm). Toward the proximal part of each branch these tubercles maintain the same width (about 0.3 mm), but elongate in the axis of the branch, fusing with other adjacent tubercles until they form longitudinal bands, which give larger diameter branches a striate or ridged aspect. In large diameter basal branches, several adjacent parallel bands often unite to form a continuous slightly convex fascicle or cord of bands that weave sinuously between successive corallites. This 'tuberculate-striate' coenosteal architecture produces a relatively smooth coenosteal texture, contrasted with the hispid coenosteal texture of *M. asperula* and *M. brueggemanni.* Corallum white. Ten highly exsert septa occur in each corallite; paliform lobes absent. Secondary septa absent. Columella consists of a massive platform from which a compressed styliform rod emerges.

Discussion: The additional records reported herein reinforce the previously known range of the species (CAIRNS 1979: map 1), but also extend the northern range of the species to 33°48'N, 76°34'W (off Onslow Bay, NC) and confirm a greater bathymetric range of 1220 m. This depth range was previously mentioned by WERDING & ERHARDT (1977) as a personal communication from J. WELLS, but was not documented. This depth record is herein reported as taken from the cable ship *Electra* (USNM 81355) off Cape Gravois, Haiti at a depth of 1220 m and a temperature of 5°C.

The overall colour of the living coral is an intense pinkish-orange, and the polyps are yellowish or white. The common name is the 'striate finger coral' (CAIRNS *et al.* 1991). FRICKE & MEISCHNER (1985) observed the living coral from a submersible at 196 m off Bermuda, reporting that its flabellate corallum is oriented perpendicular to the prevailing current. *M. myriaster* is compared to *M. asperula* in the account of that species.

New Records: P-595, 1 branch, USNM 99044; P-684, 1 branch, USNM 99035; P-734, 1 branch, USNM 99036; P-874, 6 branches, USNM 99031; P-887, 1 branch, USNM 99043; O-3568, 3 branches, USNM 90322; O-3494, 1 branch, USNM 99045; O-24237, 1, IRCZM 12:129; Alb-2160, 5 branches, USNM 16149; JSL-I-1037, 1, IRCZM 12:128; JSL-I-1277, 1 live colony, IRCZM; JSL-I-1355, 3 colonies, USNM 73192, 79737; JSL-I-1357, 3 branches, USNM 80363; JSL-I-1360, 50+ branches, USNM 79722; JSL-I-1504, 1 branch, USNM 75208; JSL-I-2317, 1 colony, USNM 84333; JSL-I-2585, 2 colonies, USNM 87788; JSL-I-2591, 5 branches, USNM 89350; JSL-I-3659, 20+ branches, USNM 94396; BLM, SOFLA-35, 2 branches, USNM 72524-25; BLM, SOFLA-36, 10+ branches, USNM 72579-80, 72526; BLM, SOFLA-38, 10+ branches, USNM 72503-04, 72567, 72581-83; BLM, LMRS OS-05, 50+ branches, USNM 71665; B-A DS3, 1 colony, USNM 80188; B-A DS4, 2 branches, USNM 99033; B-A DS9, 100+ branches, USNM 99025; B-A DS10, 1 branch, USNM 99040; B-A DS45, 5 branches, USNM 99032; Pelican 116-5, 10 branches, USNM 99038; Eastward-19483, 1 branch, USNM 80898; Eastward-19497, 2 branches, USNM 83712; Eastward-30174, 1 branch, USNM 84877; JS-99, 1 branch, USNM 99034; Circé 28-3, 7 branches, USNM 73660; CSA Pinnacle site 2, 1, CSA; CSA Pinnacle site 7, 1, CSA; Alvin-846, 1 branch, USNM 62060; Endeavor 1, 3 branches, USNM 77432; Hummelinck-1334, 1 branch, USNM 99030; USGS-AE-9701-42, 3 colonies, USNM 99366; Jamaica, 200 m, 1 large colony, USNM 77167; Cable Ship "Electra", 17°57'N, 73°51'W, 1220 m, 2 basal fragments previously attached to a cable, USNM 81355; 25°16'N, 84°15'W, 159-166 m, 11 branches, USNM 83450 .

Types: See CAIRNS (1979).

Distribution: Common throughout the Caribbean, Bahamas, and Gulf of Mexico (but not southwestern region), ranging from Onslow Bay, NC (33°48'N, 76°34'W) to off Suriname; Bermuda (CAIRNS 1979: map 1); 20-1220 m, but most commonly collected between 150-300 m.

Madracis pharensis forma pharensis (Heller, 1868)

(Figs. 14, 36-41)

Astrocoenia pharensis Heller, *1868: 27, pl. 1, figs. 1-2.
Madracis pharensis. -Goreau & Wells, 1967: 446 (listed). -Laborel, 1967: 5; 1970: 154. -Porter, 1972: 111 (listed). -Colin, 1978: 213 (colour fig.), 214. -Zibrowius, v.1980: 18-20, pl. 3, figs. A-M (synonymy of eastern Atlantic records). -Castañares & Soto, 1982: Table 1 (listed). -Zlatarski, 1982: 39 (discussed). -Prahl & Erhardt, 1989: 540-541.
Madracis pharensis forma *pharensis* Wells, v.1973: 19 (key). -Wells & Lang, 1973: 56 (listed). -Land, Lang & Barnes, 1977: 170 (isotopic composition). -Cairns, 1982b: 276, fig. 121a. -Humann, 1993: 108-109, 3 colour figs. -Fenner, 1993a: 13. -Cairns et al., 1994: 6 (listed).
Madracis decactis forma *pharensis*. -Fenner, v.1993b: 1111-1112. [Not *M. decactis* (Lyman, 1859)]

Description: Colonies consist of stoloniferous chains ('ribbons') of encrusting corallites (Fig. 38), which may periodically give rise to vertical, nodular proliferations of corallites (Figs. 36-37, 39). Stoloniferous chains rarely more than one corallite wide, bordered laterally by smooth epitheca that is often slightly upturned at the periphery, the corallites composing the chain usually poorly developed and separated from one another by a distance of approximately 2 CD. Nodular growths cylindrical to clavate in shape, 2.5-3.5 mm in diameter, and up to 12 mm in height, consisting of successive layers of corallites, one on top of the other – not a true branch. Base of nodules often expose several layers of dead corallites or a smooth, horizontally striate epithecate pedicel (Fig. 36). Corallites on nodules closely packed (cerioid), circular to polygonal in cross section, separated only by a narrow border of sharp, slender coenosteal spines. Corallites 1.5-2.3 mm in diameter. Corallum white.

Septa hexamerally arranged in 2 cycles. S1 slender but highly exsert (up to 0.2 mm), peripherally separated from the theca by a deep notch and axially separated from its paliform lobe by another deep notch. Paliform lobes (P1) well developed, ¼ – ½ width of the S1, forming a circular palar crown low in fossa encircling columella. Faces of S1 and P1 finely spinose to coarsely granular. S2 always present, although not exsert, but often up to half the width of S1. Columella a massive, pointed style, circular in cross section, and very finely granular.

Discussion: *M. pharensis* forma *pharensis* is most commonly found on the ceilings of caves and the undersides of live or dead platy corals, such as *Agaricia*, and coral rubble. According to Humann (1993), the polyps may be cream, yellow, pale green, dull red, pink, or lavender. Colin (1978) and Fenner (1993b) cite rose and pink for polyp colour.

Wells (1973) and Wells & Lang (1973) established a second form of *Madracis pharensis* named forma '*luciphila*' (literally, 'light loving'), characterised by having a more robust growth form (sheet-like, encrusting) and by living in lighted areas and thus having zooxanthellae. Although basically an encrusting morph, like the typical form, it usually produces a much larger corallum (several mm^2 in surface area, consisting of hundreds of contiguous corallites), and having corallites that are more widely spaced (0.3-0.6 mm apart). Each corallite is bordered by a polygonal wall of small spines, all the walls forming a continuous geometric network of coenosteal spines. Calicular features are otherwise identical to the typical form, except that the columella of the zooxanthellate form is usually smaller and laterally compressed, not circular in cross section. Fenner (1993b) reported this form to occur in sunlit areas but usually in the shade, often on vertically oriented substrates, and that the polyp colours were brown or bright green. He also cited specimens that were both zooxanthellate and azooxanthellate, with a graded transition between, which supports the thesis that these are indeed two forms of the same species.

Furthermore, Zlatarski (1982) implied and Fenner (1993b) later stated that *M. pharensis* and *M. decactis* (Lyman 1859) were also conspecific, Fenner considering there to be three intergrading forms of *M. decactis*: typical, *luciphila*, and *pharensis*, each occurring at a certain light intensity, the typical form being a robust, zooxanthellate form often occurring in full sunlight as thick encrustations or bushy/branched coralla. Nonetheless, WELLS (1973) distinguished *M. pharensis* from *M. decactis* by its prominent second cycle of septa, well-developed paliform lobes, and less robust corallum. But, based on certain bimorphic colonies that were variable for these character states, FENNER (1993b) lumped the three phenotypes. Whereas I agree that forma *pharensis* and *luciphila* represent ecological variation of the same species, I am not yet convinced that *M. pharensis* is conspecific with *M. decactis.* Although some colonies of *M. decactis* have rudimentary S2, most are completely devoid of secondary septa. Furthermore, paliform lobes are much better developed in both forms of *M. pharensis,* and *M. pharensis* occurs only as single sheets of corallites, whereas the coralla of *M. decactis* may be thick, with multiple-encrusting layers of coenosteum, bushy, or even ramose.

A phenotype morphologically indistinguishable from *M. pharensis* forma *pharensis* has been reported from throughout the Indo-Pacific at 5-421 m (see CAIRNS & ZIBROWIUS 1997, as *M.* sp. cf. *M. pharensis*). As in the case of the putative Atlantic forms of this species, the confirmation of Pacific *M. pharensis* may hinge on the analysis of characteristics of the soft parts, perhaps including molecular analysis.

New Records: P-595, 1 colony, USNM 99097; P-629, 3 colonies, USNM 99092; P-991, 2 colonies, USNM 99094; P-1191/1273, 1 colony, USNM 99093; P-1303, 3 colonies, USNM 99091; P-1368, 2, UMML; SB-961, 1 colony, UMML; SB-3494, 1 colony, USNM 99100; Alb-2161, 1 colony, USNM 99096; Alb-2320, 1 colony, USNM 99095; Alb-2327, 1 colony, USNM 16140; Alb- 2386, 1 colony, USNM 10376; JSL-I-1495, 2, IRCZM; JSL-I-3660, 3 colonies, USNM 94744; DBL-736, Discovery Bay, Jamaica, 70 m, 1 colony, USNM 84239; DBL-995, Discovery Bay, Jamaica, depth unknown, 1 colony, USNM 99099; DBL, Discovery Bay, Great Chute Cave, 37 m, 1 colony, USNM 81358; DBL, Discovery Bay, Jamaica, 1 colony, USNM 85445; off George Town, Grand Cayman Island, 243 m, 1 colony, USNM 99054; Hyatt Expedition to Brazil (Str. Norseman), 21°48'S, 40°03'W, 3 colonies, USNM 5324, 10920, 10921; Carrie Bow Cay, Belize, 18-31 m, 2 colonies, USNM 47621 and 99101; Glover's Reef, Belize, 11 m, 1 colony, USNM 81359; Bay of Pigs, Cuba, 31-46 m, 1 colony, USNM 99098; Imelda, Gigante Point, Baru I., Colombia, 20 m, 1 colony, USNM 94758.

Types: The syntypes of *M. pharensis* appear to be lost (see ZIBROWIUS 1980). Type Locality: Hvarski Kanal (=Chanel de Lesina), Adriatic Sea, 36 m.

Distribution: Western Atlantic: common throughout Caribbean and Bahamas; northeastern and southwestern Gulf of Mexico and Gulf of Campeche; off Brazil to 21°48'S (Fig. 14); 11-333 m. Eastern Atlantic: Mediterranean, Madeira, Canary Islands, Cape Verde Islands, Azores; 6-40 m (ZIBROWIUS 1980). ?Indo-Pacific: Maldive Islands; Philippines; Indonesia; Fiji; Palau (reported herein, USNM 98951); Gulf of California; 5-421 m (CAIRNS & ZIBROWIUS 1997).

Suborder FAVIINA

Superfamily FAVIOIDEA Gregory, 1900

Family RHIZANGIIDAE d'Orbigny, 1851

Genus Astrangia Milne Edwards & Haime, 1848

Diagnosis: Colonies formed by extratentacular budding, resulting in encrusting coralla that are united by a sheet of coenosteum (cerioid) or by stolons (reptoid). Distal and axial septal edges dentate. Paliform lobes sometimes present on all but last cycle; columella papillose.

Type Species: *Astrangia michelinii* MILNE EDWARDS & HAIME, 1848c [=*A. poculata* (ELLIS & SOLANDER 1786)], by subsequent designation (MILNE EDWARDS & HAIME 1850a: xliv).

Astrangia solitaria (Lesueur, 1817)

(Figs. 15, 42-49)

Caryophyllia solitaria Lesueur, *1817: 179, pl. 8, figs. 10 a-b; 1821: 273-275, pl. 15, figs. 1 a-c -Dana, 1846: 383-384.
Astrangia neglecta Duchassaing & Michelotti, v*1860: 79, pl. 10, figs. 3-4.
Astrangia granulata Duchassaing & Michelotti, v*1860: 79, pl. 9, figs. 13-14.
Astrangia solitaria. -Verrill, 1864: 47. -Pourtalès, 1871: 31, 79-80. -Pourtalès in Agassiz,

1880b: pl. 12, figs, 8-12. –Duncan, 1890: 569. –Vaughan, 1901: 299. –Duerden, 1902: 553-555, pl. 5, figs. 43-45, pl. 6, fig. 47, text-figs. 8 a-b (histology). –Branner, 1904: 266 (list). –Vaughan, 1911: 135. –van der Horst, 1927: 159. –Smith, 1948: 91. –Goreau, 1959: 70 (listed). –Zans, 1959: 29, 35 (listed). –Almy & Carrión-Torres, 1963: 155-156, fig. 15a. –Keith & Weber, v.1965: 499 (isotopic composition). –Laborel, 1966: 282 (list). –Goreau & Wells, 1967: 448 (listed). –Pfaff, 1969: 23 (listed). –Keith & Weber, v.1970: 270 (isotopic composition). –Roos, 1971: 74, pl. 36. –Smith, 1971: 87. –Wells, 1972: 2-4, figs. 1-5 (synonymy). –Antonius, 1972: 93 (listed). –Porter, v.1972: 111. –Erhardt, 1974: 406. –Weisbord, 1974: 399-403, pl. 46, fig. 3 (synonymy). –Werding & Erhardt, 1976: 48. –Land, Lang & Barnes, 1977: 170 (isotopic composition). –Cairns, 1978a: 10 (listed). –Chassaing et al., 1978: 74, figs. 47-48. –Colin, 1978: 257 (colour fig.), 262. –Zlatarski, 1982: 130-132, pl. 44, figs. 1-6, pl. 45, figs. 1-8 (synonymy and complete description). –Cairns, 1982b: 290, pl. 128, figs. b-d. –Castañares & Soto, 1982: table 1 (listed). –Wood, 1983: 105 (colour fig.). –Cortés et al., 1984: 58 (listed). –Cortés & Guzman, 1985: 75, fig. 28a. –Hubbard & Wells, v.1986: 128, figs. 6-7. –Bouchon & Laborel, 1986: 204 (listed). –Cairns et al., 1986: 184, pl. 6, fig. 7 (colour). –Estalella, 1986: 20. –Prahl & Erhardt, 1989: 543. –Tunnel, 1989: 307 (listed). –Humann, v.1993: 172-173, 3 colour figs. –Cairns et al. 1994: 9. –Cortés, 1996: 330.

Astrangia solitaria portoricensis Vaughan, v*1901: 298-299, pl. 1, figs. 6a-b.

Astrangia brasiliensis Vaughan, v*1906: 848-849, pl. 77, figs. 3-6. –Moore, 1958: 154. –Smith, 1971: 87.

Astrangia braziliensis. –Laborel, 1971: 200. –Leão, 1986: 33, figs. (p. 34). –Hertzel & Castro, 1994: 60, 2 colour figs.

Astrangia sp. cf. *A. rathbuni*. –Hubbard & Wells, 1986: 128, figs. 8-9. [Not *A. rathbuni* Vaughan, 1906]

Description: Small reptoid colonies are composed of relatively few (usually less than 20) cylindrical corallites budded extratentacularly from narrow, thin stolons. A continuous coenosteum between or among corallites is rarely present, and the stoloniferous connection is usually encrusted or abraded, resulting in the apparent or actual isolation of individual corallites. Most corallites 4-6 mm in GCD and 4-8 mm in height; however, atypically large corallites from Trinidad (e.g., USNM 68466, figured by HUBBARD & WELLS 1986 as *A. cf. rathbuni*) measure up to 9.3 mm in GCD, whereas some populations from Brazil (type series of *A. brasiliensis* Vaughan, 1906) rarely exceed 3.5 mm in GCD. Also, on rare occasions, corallites may be quite tall, some from Jamaica (USNM 80920) up to 22 mm in height (Fig. 42). Corallites bear broad, flat, granular costae, separated from one another by thin, shallow intercostal striae; costae often extend to stolons, but are often covered by epifauna, and, in some cases, concentric bands of thin epitheca encrust the corallites (Fig. 42). Costal granules low and rounded, occurring 3-4 across width of a costa. Corallites usually uniformly light brown or light brown in distal half, grading to white on lower half. Occasionally corallites are entirely white. However, even in uniformly brown corallites there is usually a lack of pigmentation and thus a white streaking of the septal faces associated with the axial margin of each septal tooth, altogether producing a mottled pattern on well-preserved specimens.

Septa hexamerally arranged in 4 cycles (S1>S2>S3>S4), a full complement of 48 septa rarely achieved, 36 septa (a pair of S4 in each system) being the most common number. S1 exsert (up to 1.1 mm), extending about half distance to centre of corallite. Distal and disto-axial margin of S1 bear 3 or 4 coarse, sharp to rounded teeth, which are only observable in well-preserved specimens. Lower axial edge of S1 vertical and smooth (nondentate), bearing 1-5 slender (cylindrical), vertically-oriented paliform lobes low in fossa. S2 are slightly smaller versions of S1, bearing 2-4 slender paliform lobes, the uppermost P2 rising slightly higher in the fossa than the P1. If flanked by S4, S3 also bear 2-3 slender paliform lobes, the uppermost P3 rising higher in the fossa than the P2 and fusing to its adjacent P2. Axial edges of S4 and unflanked S3 finely dentate. All paliform lobes coarsely granular and vertically oriented, usually easily distinguished from the columellar elements. Fossa deep and steep-sided, containing a papillose columella.

Discussion: *Astrangia solitaria* is one of the most frequently collected and reported azooxanthellate coral in the western Atlantic. An excellent description of the species was given by ZLATARSKI (1982), and a good account of its histology and live observations were given by DUERDEN (1902). Most of the other references reported in the synonymy are simple distributional records. Many, but not all, of the new records of this species are presented below.

Astrangia solitaria is commonly attached to dead coral rubble and the undersides of platy corals. The polyps of this species may be clear, green, or brown. HUMANN (1993) calls it the 'dwarf cup coral'.

New Records: P-435, 10 colonies, USNM 80239; P-712, 1 colony, USNM 80243; P-750, 1 colony, USNM 80244; P-761, 2 colonies, USNM 80245; P-857, 1 colony, USNM 80324; P-1242, 2 colonies, USNM 80330; P-1294, 1 colony, USNM 80332; P-1302, 3 colonies, UMML 8.291; O-4215, 1 colony, USNM 80216; O-4228, 3 colonies, USNM 80217; Chain 35-36, 1 colony, USNM 99110; DBL-1303, Salt Gut Reef, Jamaica, 11 m, 1 colony, USNM 80920; DBL-2516, Rio

Bueno, Jamaica, 20 m, 1 colony, USNM 80877; Saltrou, Haiti, many colonies, USNM 80421-22; Carrie Bow Cay, Belize, many colonies, USNM 47791-99, and 99112; Margarita Island, Venezuela, 1 m, 1 colony, USNM 73922; St. John, Virgin Islands, 1 colony, USNM 96222; Old Providence Island, Nicaragua, 2 colonies, USNM 95519 and 96221; Biscayne Bay, Miami, FL, 1 colony, USNM 80196; Negril Point, Jamaica, 1 colony, USNM 80875; Llandovery Reef, Jamaica, 2 colonies, USNM 80879-80; Marbella Beach, Cartegena, Colombia, 1 colony, USNM 94761; Jobos Bay, Puerto Rico, 5 m, 1 colony, USNM 80876; Nonsuch Bay, Bermuda, 6 m, 1 colony, USNM 80210; Limón Bay, Panama, 0.3 m, 2 colonies, USNM 80878; Chinchorro, Yucatan, Mexico, 3 colonies, USNM 74224; Chankanaab caves, Cozumel, Mexico, 1 colony, USNM 80366; Tierrabomba Island, Colombia, 5 m, 1 colony, USNM 94760; Cocoanut Point, Andros, Bahamas, 10 colonies, USNM 80423; Middle Bight, Andros Island, Bahamas, 1 colony, USNM 80344; Islas Mujeres, Yucatan, Mexico, 9 m, 1 colony, USNM 74227; Pernambuco, Brazil, 1 colony, USNM 10894.

Types: *Caryophyllia solitaria*: deposition unknown. Type Locality: 'Guadeloupe.'

Astrangia neglecta: holotype deposited at the Turin Museum (Coel. 81). Type Locality: St. Thomas, Virgin Islands.

Astrangia granulata: holotype deposited at the Turin Museum (Coel. 83). Type Locality: St. Thomas, Virgin Islands.

Astrangia solitaria portoricensis: holotype and paratype deposited at USNM (36485, 22091, respectively). Type Locality: Fish Hawk stn 134, 'Porto Rico'.

Astrangia brasiliensis: holotype (USNM 10940) and paratypes (USNM 5325, 5326, 10897, 10916 (Fig. 45), 10917, 10918). Type Locality: Periperi, Bahia, Brazil.

Distribution: Widespread from Miami, Florida to southern Bahia, Brazil, including Fernanda de Noronha, all of Caribbean, Bermuda, and southwestern Gulf of Mexico (Fig. 15); 0-51 m.

Astrangia rathbuni Vaughan, 1906

(Figs. 16, 50-54)

Astrangia rathbuni Vaughan, v*1906: 849-850, pl. 78, figs. 1-3. –Squires, v.1963: 10-11, figs. 1-3. –Laborel, 1970: 156; 1971: 200-201, pl. 6, fig. 1, map 7. –Not Avent, King & Gore, 1977: 200 (listed). –Aramayo & Farinati, 1981: 16, pl. 11, fig. 3. –Cairns, 1982a: 10-12, pl. 2, figs. 4-6 (synonymy). –?Leão, 1986: 35, 2 figs. (p. 37). –Hertzel & Castro, 1994: 60. –Pires, 1997: 182.

Not *Astrangia* sp. cf. *A. rathbuni*. –Hubbard & Wells, v.1986: 128, figs. 8-9 (=*A. solitaria* Lesueur, 1817).

Description: Small, relatively spherical colonies up to 5 cm in diameter often encrust dead barnacle valves or bivalve shells. Cylindrical corallites bud from a common, continuous basal coenosteum as well as from theca of parent corallites. Corallites closely spaced, the theca of adjacent corallites often fused, resulting in a bushy corallum. Corallites up to 9 mm in height and 6.5 mm in GCD. Costae and costal granulation as in *A. solitaria*. Most corallites examined reddish-brown in colour.

Septa hexamerally arranged in 4 cycles (S1>S2>S3>S4), but only larger corallites have a full fourth cycle. S1 only slightly exsert and quite narrow at calicular edge (about 0.3 mm), the axial edge bearing 5-7 thin, elongate paliform teeth. S1 only independent septa, their lower axial edges merging imperceptibly with columellar elements. S2 similar to S1 but slightly less wide, bearing 8 or 9 thin paliform teeth that also indistinguishably merge with columella. S3 a slightly narrower version of S2, also bearing 8 or 9 paliform teeth, the lower axial edges of each pair of S3 fusing to the lower axial edge of the flanked S2 near the columella. S4 less wide than S3, bear 6-8 thin paliform lobes, the lower axial edges of each pair of S4 merging to its flanked S3 about half distance to columella. Orientation of paliform teeth oblique, slanted into fossa, not vertical, and the diameter of teeth is 0.10-0.15 mm, the same as the columellar elements. Thus there is no demarcation between the lowermost paliform teeth and the columellar papillae. Fossa relatively deep but open, the axial edges of all septa forming a bowl-shaped, rather than a steep-sided, fossa. Columella consists of 10- 15 elements.

Discussion: In distinguishing *A. rathbuni* from *A. solitaria* most previous authors have stressed that the former has a thick, continuous basal coenosteum, whereas the latter is stoloniferous, often with secondary loss of corallite connection. Whereas this is true, there are many other characters that separate the species. The shape of the septa is quite different between the two species: those of *A. rathbuni* are very slender near the calicular edge, and bear numerous obliquely oriented, slender paliform teeth along the entire axial edge, which are indistinguishable from the columellar elements. The distal septal edges of *A. solitaria* are much wider (up to 1.0 mm) and coarsely dentate, the medial axial edge smooth, and the lower axial edges bearing several vertically oriented paliform lobes that are easily distinguished from the columellar elements. Also, the colony form of *A. rathbuni* is bushy, with more closely spaced corallites, and its colour reddish-brown instead of light brown. Finally, the fossa of *A. rathbuni* is bowl-shaped, whereas that of *A. solitaria* is steep-sided and narrow. Also, although the range of the two species overlaps off the coast of Brazil, *A. rathbuni* occurs much farther south than *A. solitaria* and is not yet known from the Caribbean.

Although LABOREL (1971: 201) reported *A. rathbuni* 'en grande abondance' from 10 stations off Brazil, the species is otherwise rarely collected and nothing is known of its biology. Furthermore, specimens are often collected dead or even fossilized and thus little is known about its depth range; however, LABOREL (1971) reported the species from several to 90 m.

New Records: Beach at Bigisanti, Suriname, (Holocene fossil?), 3 colonies, USNM 80868; 'Brazil', 1 live colony, ex Museu Nacional no. 17, USNM 80484.

Types: The holotypic colony of *Astrangia rathbuni* is deposited at the USNM (10974). Seven more paratypic colonies are also deposited there: USNM 10910, 10971-75, and 5322. The USNM catalog numbers for paratypes listed by LABOREL (1971) are incorrect. Type Locality: Paqueta, Rio de Janeiro, Brazil (depth unknown).

Distribution: Suriname (reported herein); coast of South America from southern Bahia, Brazil (HERTZEL & CASTRO 1994) to Mar del Plata, Argentina (SQUIRES 1963) (Fig. 16); several to 90 m.

Astrangia poculata (Ellis & Solander, 1786)

(Figs. 3, 55-56)

Madrepora poculata Ellis & Solander, v*1786: 165.
Astrangia Michelinii Milne Edwards & Haime, v*1848b: 320, pl. 7, figs. 5, 5a.
Astrangia Danae Milne Edwards & Haime, *1849b: 180. –Miller, 1995: 91-94, figs. 2-3.
Astrangia astreiformis Milne Edwards & Haime, *1849b: 181. –Vaughan, v.1901: 300. –, Thiel, v.1941: 15, pl. 1, figs. 5-6.
Astrangia danae Agassiz, *1850: 68-77, pl. 1, fig. 7.
Astrangia edwardsii Verrill, *1866: 324.
Astrangia poculata. –Peters et al., 1988: 234-250, figs. 1-6 (synonymy, description, neotype selection).

Description: Corallum shape quite variable, depending on environment, ranging from low, encrusting, cerioid coralla to plocoid encrusting coralla, to plocoid branching colonies. Low, cerioid coralla usually found in high energy environments, the corallites often being polygonal with common walls, and having very little to no intercorallite coenosteum, and a very shallow fossa (Fig. 55). Plocoid coralla (Fig. 56) bear corallites circular in shape that are raised slightly above the common coenosteum, each corallite separated by 0.5-2.0 mm of intervening coenosteum. Branching coralla are relatively rare and may be the result of living at greater depth (calmer waters), or a response to high sedimentation, algal lesions, or simply the result of a particular substrate type, e.g., encrusting a dead, branching gorgonian axis (see Discussion in PETERS *et al.* 1988). Coralla rarely more than 7 cm in diameter, all corallites connected by a solid, continuous, often thick, common coenosteum. Regardless of colony morphology, corallites range in size from 2 to 7 mm, smaller corallites usually interspersed among larger corallites as well as flanking the edge of the colony, both types the result of extratentacular budding. Corallites that bud in centre of corallum often elevated above others, producing an irregular surface to the colony. Because of crowded nature of corallites and their often cerioid arrangement, costae usually not present; however, in some plocoid coralla faint, granular costae present near calicular edge and sometimes also cover intercorallite coenosteum. Coralla always white.

Septa hexamerally arranged in 4 cycles, the fourth cycle rarely complete, 30-36 being the most common number of septa. All septa strongly dentate, bearing tall, slender, obliquely oriented teeth from distal to lower axial edge. S1 independent; lower axial edges of S2 and S3 fuse to one another at columella; lower, axial edges of S4 fuse to common S3 about ⅔ distance to columella. Depth of fossa variable, ranging from shallow to moderately deep. Columella papillose, composed of 10-20 irregular elements that are slightly smaller in diameter than lower septal teeth.

Discussion: Although not discussed in my revision of the deep-water azooxanthellates (Cairns 1979), *A. poculata* was thoroughly monographed by Peters *et al.* (1988), which included an exhaustive synonymy, description, illustrations, and discussions of nomenclatural history, distribution, and the ecology of the species. Neotypes were also designated for *A. poculata* and *A. michelinii.* Therefore, only a short description of the species is given above and the present discussion is brief; however, the records on which the Peters *et al.* (1988) paper was based are documented for the first time below. The common name of this species is the 'northern star coral' (Cairns *et al.* 1991).

Three species of *Astrangia* occur in the western Atlantic, each with a discrete, but slightly overlapping geographic range. *A. poculata* is characteristic of the northern temperate region and is found from Maine to Texas. It is replaced in the tropical western Atlantic by *A. solitaria,* which overlaps the range of *A. poculata* only off southern Florida, and continues to the Abrolhos Islands, Brazil. *A. rathbuni* is the southern temperate species, found as far south as Mar del Plata, but co-exists with *A. solitaria* in the tropics as far north as Suriname. *A. poculata* is morphologically most similar to the allopatric *A. rathbuni,* not the partially sympatric *A. solitaria,* particularly in septal morphology. Nonetheless, *A. poculata* can be distinguished by its colony shape (closely adjacent corallites often arranged in a cerioid or plocoid manner), sometimes even forming branching colonies, its white corallum, and its fewer number of septa at a corresponding GCD.

Astrangia poculata is an extremely hardy coral, capable of living in salinities ranging from 10-40 ppt and at temperatures of –1.5° to 22°C (Cummings 1976) as well as being able to survive under low oxygen conditions. It is also one of the few coral species that can exist with or without zooxanthellae, the preference for one mode over the other being caused by genetics or environmental factors, such as temperature, light intensity, and/or sedimentation rate (see Peters *et al.* 1988 for review).

New Records: G-304, 1, USNM 80517; G-849, 1, USNM 80520; G-1002, 1, USNM 78507; G-1003, 2, USNM 80343; SB-1634, 1, USNM 95517; SB-3266, 1,

USNM 80232; SB-3278, 1, USNM 95520; SB-4428, 1, USNM 95518; Alb-2280, 1, USNM 80169; Alb-2285, 1, USNM 19082; Pelican 177-10, 1, USNM 79714; Pelican 180-5, 1, USNM 78509; Pelican 209-5, 2, USNM 96224; FH-770, 10, USNM 19189; FH-775, 2, USNM 3793; FH-842, 3, USNM 81928; FH-957, 4, USNM 13227; FH-958, 6, USNM 13226; FH-1237, 2, USNM 16242; FH-1686, 2, USNM 9286; FH-8339, 10, USNM 80486; FH-8371, 3, USNM 80177; FH-8499, 5, USNM 80178; FH-8592, 50, USNM 80179 and 80487; FH-8595, over 100, USNM 80180 and 80488 and 99173; FH-8596, 1, USNM 80181; FH-8602, 3, USNM 80182; FH-8826, 2, USNM 80183; FH-8827, 2, USNM 80184; Gos-1456, 1, USNM 79705; Gos-1483, 1, USNM 79702; Gos-1494, 2, USNM 79715; Gos-1503, 1, USNM 99115; Gos-1504, 1, USNM 79698; Gos-1507, 2, USNM 79711; Gos-1508, 1, USNM 79712; Gos-1509, 5, USNM 99116; Gos-1510, 1, USNM 79699; Gos-1514, 4, USNM 79710; Gos-1521, 2, USNM 79708; Gos-1535, 1, USNM 79716; Gos-1539, 1, USNM 79696; Gos-1541, 1, USNM 00117; Gos-1620, 1, USNM 79707; Gos-1624, 2, USNM 79709; Gos-1647, 4, USNM 79713; Gos-1686, 1, USNM 80414; Gos-1688, 1, USNM 99113; Gos-1689, 1, USNM 79703; Gos-1769, 1, USNM 79701; Gos-2027, 1, USNM 99114; Vineyard Sound, MA, 20, USNM 24889, 29527, and 80425; Buzzard's Bay, MA, 3, USNM 4127, 7052, and 80482; Woods Hole, MA, 25, USNM 6856, 31643, and 81094; Newport, RI, 6, USNM 80186; Fort Adams, RI, 2, USNM 36521; Narragansett Bay, RI, 5, USNM 3784; Newport Harbor, RI, 1, USNM 4039; Stonington, CT, 17-20 m, 7, USNM 19179 and 24823; Noank, CT, 10, USNM 25167; Fisher's Island, NY, 1, USNM 36510; Atlantic City, NJ, 1, USNM 82185; Cape May, NJ, 1, USNM 80424; Cape Henlopen, DE, 2, USNM 95516; Plum Point, MD, 1, USNM 80418; Smith's Island, VA, 1, USNM 36483; Beaufort, NC, 11, USNM 80806 and 80864; Myrtle Beach, SC, 1, USNM 80195; St. Augustine, FL, 1, USNM 79695; Western Dry Rocks, Dry Tortugas, FL, 1, USNM 78508; Loggerhead Key, Dry Tortugas, FL, 1, USNM 99381; Carrabelle, St. George Sound, FL, 1, USNM 80201; St. James Cut, FL, 1, USNM 80481; Punta Rasa, Charlotte Harbor, FL, 10, USNM 6944, 7410, and 7411; Marco, FL, 1, USNM 7403; Pass-a-Grille, FL, 1, USNM 36541; Pensacola, FL, 1, USNM 19194; Cape Romano, FL, 2, USNM 16152; Talbot Island, FL, 16 m, 1, USNM 80365; Dixon Bay, Panacea, FL, 3 m, 3, USNM 45680; Beach Ile Derniere, LA, 1, USNM 80419; Charland Pass, LA, 1, USNM 80187; Aransas Pass, TX, 3, USNM M547381; Port Aransas, TX, 1, USNM 80862; Rockport, TX, 1, USNM 36520; Galveston, TX, 1, USNM 36519.

Types: See PETERS *et al.* (1988).

Distribution: Entire eastern and southern coasts of U. S. from Maine to Texas, but not southern tip of Florida; ?Puerto Rico (VAUGHAN 1901); ?Martinique (THIEL 1941)(Fig. 3); 0-263 m (see PETERS *et al.* 1988). The specimen from Culebra, Puerto Rico reported by VAUGHAN (1901) was re-examined (USNM 45598) and found to be a typical plocoid specimen of *A. poculata*; however, it is difficult to understand this apparent disjunct distribution given the relatively well-known range of *Astrangia* in the western Atlantic. Likewise, the specimen from Martinique reported by THIEL (1941) was also examined (Institut Royal des Sciences Naturelles de Belgique, Coel. 10910) and also appears to be typical *A. poculata.* Elsewhere: ?Gulf of Guinea (CHEVALIER 1966).

A. poculata is the only coral likely to be encountered by swimming, snorkeling, or beach combing north of Onslow Bay, North Carolina.

Family **OCULINIDAE Gray, 1900**

Genus **Madrepora Linnaeus, 1758**

Diagnosis: Colonies formed by extratentacular, sympodial branching. Coenosteum dense; theca faintly costate, striate, or porcellaneous. Usually only 3 cycles of septa; paliform lobes may be present on first septal cycle. Columella rudimentary or absent.

Type Species: *Madrepora oculata* Linnaeus, 1758, by subsequent designation (Verrill, 1901).

Madrepora carolina (Pourtalès, 1871)

Lophohelia carolina Pourtalès, v*1871: 24, 26, pl. 1, figs. 6-7.
Oculina disticha. –Ludwick & Walton, 1957: 2081, fig. 13C2. [Not *O. disticha* Pourtalès, 1868]
Madrepora carolina. –Cairns, 1979: 42-43, pl. 4, figs. 1-4, Map 5 (synonymy and description). –Fricke & Meischner, 1985: 183, 184, figs. 11d, 12b. –Rezak et al., v.1985: 225 (listed: stn 118, Diaphus Bank). –Messing, 1987: 12, fig. –Cairns et al., 1991: 46 (listed). –Cairns et al., 1994: 4 (listed).

Diagnosis: Large (up to 36 cm in height and 3 cm in basal branch diameter), bushy or flabellate coralla formed from sympodially budded corallites; branch anastomosis extremely rare. Corallites 3.5-5.5 mm in diameter, flared distally, projecting well above branch coenosteum. In large uniplanar coralla, corallites tend to occur on only one side of flabellum. Coenosteum white, finely granular, and faintly striate; ridged C1-2 present near calicular edge. Septa hexamerally arranged in 3 cycles (S1>S2>S3), the S1 highly exsert and dimorphic in size, *i.e.*, two opposing pairs of S1 are wider than the remaining two S1, their lower axial edges almost touching across the fossa. S3 rudimentary. Fossa deep; no columella.

Discussion: In addition to augmenting many of the localities mapped by CAIRNS (1979: map 5) for this species, the records reported below also include range extensions for southwestern Louisiana, Roatán, Tobago and Bermuda, although specimens from the last locality had been previously reported by FRICKE & MEISCHNER (1985). Despite numerous collections, *M. carolina* is not known from the Lesser Antilles or the northern coast of South America, except for Tobago. According to a museum label written by R. H. HUBBARD (USNM 80977), the colour of the polyps of a specimen collected from Tobago is pink.

Another species of *Madrepora*, *M. oculata* L., 1758, was reported from the western Atlantic from 144-1391 m (CAIRNS 1979). The shallow end of that bathymetric range was based on a specimen from Gosnold-1750 (USNM 62046), consisting of a small, very worn branch fragment of three corallites. This record is herein reidentified as *Enallopsammia profunda*, which changes the known western Atlantic depth range of *M. oculata* to 300-1391 m, and therefore it is not further discussed in this paper. It does, however, produce an unusually shallow range for *Enallopsammia profunda*, otherwise known from 403-1748 m (CAIRNS 1979). It is suggested that this anomaly is due to a station error, the specimen probably being a remnant from Gosnold-1748, a station made at 524 m earlier on the same day, and from which a large amount of *E. profunda* was collected.

This species has been given the common name of 'Pourtalès' fan coral' by MESSING (1987).

New Records: BLM, SOFLA-29, 1 branch, USNM 72595; BLM, SOFLA-35, 12 coralla, USNM 72586, 72596-98; BLM, SOFLA-36, 10 coralla, USNM 72589, 72599, 75034, 75685, 76445; BLM, SOFLA-38, 72593, 72600, 84675; JSL-I-1354, 2 branches, USNM 93232; JSL-I-1355, 1 branch, USNM 73193; JSL-I-1360, 1 branch, USNM 73194; JSL-I-2582, 7 coralla, USNM 87783; JSL-I-2585, 4 colonies, USNM 87787; JSL-I-2586, 10+ branches, USNM 87791; JSL-I-2591, 4 branches, USNM 89354; Gos-33, Happy Grove, Portland Point, Jamaica, 100-240 m, 10+ branches, USNM 80976; Alvin-764, F17-F18, 1 large colony and many branches, USNM 49114, 49122; Circé 27-2, 1 branch, USNM 75655, Circé 28-1, 4 fragments, USNM 75657; Circé 29, 1 fragment, USNM 75662; Circé 31-2, 1 branch, USNM 75665; CSA Pinnacle site 9, 1 colony, CSA; BLM, LMRS, OS-05, several branches, USNM 72390; EJ81-21, 1, FSBC I; EJ81-22, 1, FSBC I; off George Town, Grand Cayman, 243 m, 2 coralla, USNM 75187; USGS VIII-A-1B, 2 fragments, USNM 62072; USGS VIII-A-2, 4 fragments, USNM 62073; Ocho Rios, Jamaica, depth unknown, 1 corallum, USNM 80974; Charlottesville, Tobago, 91-152 m, 1 colony, USNM 80977; off Varadero Beach, Cuba, 335 m, 1 colony, USNM 62079; 33°51'N, 76°31'W, 86-106 m, 2 colonies, USNM 80975; Castle Rocks, Bermuda, 250 m, 10 branches, USNM 48033; north side of Roatán, Honduras, 84 m, 1 branch, USNM 99118.

Types: See CAIRNS (1979).

Distribution: Bermuda; east coast of US from North Carolina (33°56'N, 76°27'W) through western Gulf of Mexico; Bahamas; Greater Antilles; northern Caribbean; Tobago; St. Peter and St. Paul Rocks; 53-801 m, although most commonly collected at depths of 100-300 m (CAIRNS 1979: map 5).

Genus **Oculina** Lamarck, 1816

Diagnosis: Colonies formed by extratentacular, sympodial branching; axial corallites absent. Coenosteum dense, costate. Usually 3 cycles of septa, with paliform lobes before first 2 cycles. Columella papillose.

Type Species: *Madrepora virginea* Lamarck, 1816 (=*Oculina diffusa* Lamarck, 1816), by subsequent designation (MILNE EDWARDS & HAIME 1850a: xix).

Oculina tenella Pourtalès, 1871

(Figs. 4, 57-60)

Oculina tenella Pourtalès, v*1871: 23, pl. 5, figs. 11-12; v.1878: 204. –Cairns, 1977b: 5, 18 (listed); 1978a: 10 (listed); 1979: 207 (listed). –Cairns et al., 1991: 46 (common name). –Humann, v.1993: 100-101, colour fig.
Lophohelia tenuis. –Thiel, 1941: 13-14, pl. 1, fig. 4. [Not *L. tenuis* Moseley, 1881]

Description: Corallum small and delicate; irregularly branched in three dimensions, rarely with branch anastomosis. One of largest colonies (USNM 93926) only 5 cm in height and 3 mm in basal branch diameter. Branch diameter ranges from 2-3 mm and does not significantly increase with proximity to base; branches usually equal or less than diameter of corallites they support. Most specimens reported below are broken, detached branches; attached colonies rarely collected. Coralla appear to attach to loose, unconsolidated sediment from which they easily detach. Corallites bud in alternate, opposite fashion (sympodially) and are well spaced, such that the distance between adjacent calicular centres is 3.5-5.5 mm, or approximately 1.0-1.5 CD apart. Distalmost 5-7 corallites directed anterolaterally, but older, more proximal corallites oriented perpendicular to branch and usually protuberant, projecting as much as 3.1 mm above branch surface, a height that is often greater than the diameter of the supporting branch. Corallites 1.8-2.7 mm in GCD, only slightly elliptical. C1-3 slightly ridged near calicular edge; otherwise theca uniformly granular, the small, conical, blunt-tipped coenosteal spines up to 70µm in height and 75µm in basal diameter. Corallum white.

Septa hexamerally arranged in 3 cycles (S1>S2>S3). S1 moderately exsert (about 0.4 mm), having a smooth, vertical axial edge and a small paliform lobe. S2 only slightly less wide and less exsert than S1, also having an axial paliform lobe that rises slightly higher in the fossa than the P1 and having a broader peripheral edge. S3 slightly less exsert and less wide than the S2, their lower axial edges sometimes fusing to their adjacent S2. P1-2 form an elliptical paliform crown; faces of paliform lobes bear tall spines. Fossa of moderate depth, containing a rudimentary papillose columella.

Discussion: *Oculina tenella* differs from *O. diffusa* Lamarck, 1816, in having a smaller, more delicate corallum and more sparsely budded corallites. Coralla of *O. diffusa* form robust colonies up to 35 cm in diameter, with increasingly large basal branches toward the attachment site, and their corallites bud from all 4 edges of a distal branch, producing a more crowded arrangement. Furthermore, *O. tenella* is assumed to be azooxanthellate, whereas *O. diffusa* is primarily zooxanthellate; however, it is quite possible that *O. tenella* may occur in the zooxanthellate form as well, specimens from the shallower depth range of 25-159 m being well within the range of a zooxanthellate species. *O. diffusa* is rarely known from deeper than 15 m (GOREAU & WELLS 1967; HUMANN 1993); however, HUMANN (1993: 100, 101) reported an anomalously azooxanthellate specimen (Fig. 61) from 25 m.

Another species, *O. varicosa* Leseuer, 1821, is known from the east coast of Florida (5-128 m), and, like *O. diffusa*, is a facultative zooxanthellate species, *i.e.*, shallow water coralla have zooxanthellae, whereas deep-water coralla do not (REED 1980). In deep water this species forms colonies several meters in height, which often coalesce to form extensive banks or thickets. REED (1982) found that the growth rate of the larger, azooxanthellate, deep-water form was higher than that of the shallow-water, zooxanthellate form. The highly variable *O. varicosa* is described, illustrated, and discussed by REED (1980, 1982) and HUMANN (1993), but not further discussed in this report. Four western Atlantic Scleractinia are thus known to be facultative zooxanthellates: *Astrangia poculata, Madracis pharensis, Oculina varicosa,* and *O. diffusa.*

Another species similar to *O. varicosa, O. valenciennesi* Milne Edwards & Haime, 1850b, known primarily from Bermuda but also reported from Jamaica (GOREAU & WELLS 1967) and Curaçao (ROOS 1971), was listed as an azooxanthellate species by WELLS & LANG (1973). But, because the taxonomy and ecological status of this species are so poorly known it is not considered as be azooxanthellate and thus is not treated in this account. Indeed, the taxonomy, nomenclature, and range of variation of the western Atlantic *Oculina* are complex and beyond the scope of this study.

According to HUMANN (1993:100), *O. tenella* occurs in areas of "rocky rubble, shell hash under ledge overhangs and shipwrecks" and is cream to white in colour. Its common name is the 'delicate ivory bush coral' (CAIRNS *et al.* 1991). Little more is known about the biology of this Florida species.

New Records: Alb-2374, 1 branch, USNM 10343; Alb-2405, 4 branches, USNM 16070; Alb-2406, 100+ branches, USNM 61999; Alb-2407, 7 branches, USNM 10466; Alb-2412, 2 branches, USNM 10482; Alb-2414, 6 branches, USNM 6191; SB-48, 10 fragments, USNM 62001; SB-2412, 1 branch, USNM 62000; G-1086, 1 branch, USNM 61998; BLM, SOFLA-3, 7 branches, USNM 72057, 72078, 72080; BLM, SOFLA-9, 25 branches, USNM 72058-61, 72079-81, 72594; BLM, SOFLA-17, 15 branches, USNM 72062-65, 72072-74; BLM, SOFLA-27, 16 branches, USNM 72066-69, 72076-77; Eastward, 27°51'N, 80°00'W, 83-93 m, 1 branch, USNM 85453; Hernan Cortez stn D, 1, FSBC I 33149; Hernan Cortez stn L, 12 branches: 2 (FSBC I 33150, 33151), 10 (USNM 84359-61); EJ81-8, 1, FSBC I; 29°56'N, 86°06'W, 37-38 m, 2 branches, USNM 84298; 29°57'N, 87°14'W, 37 m, 4 branches, USNM 93926; 25°16'N, 84°15'W, 159-166 m, 1 branch, USNM 83455; Dry Tortugas, FL, 2 branches, USNM 99172; 26°05'N, 83°46.1'W, 64 m, 3 branches, USNM 45356; off Sombrero Light, FL, 74-210 m, 1 branch, USNM 99171; off Alligator Reef, FL, 42 m, 2 branches, USNM 99119; Cedar Keys, FL, 55 m, 1 branch, USNM 62002.

Types: Five syntype branches, two of them numbered 5209, are deposited at the MCZ. Two more syntype branches are deposited at the BM (91.9.28.2 and 91.2.4.7). Type Locality: Bibb station 85 or 86: off Dry Tortugas, FL, 66 m.

Distribution: Known only from the continental shelf of Florida, from off Sebastian on the east coast to off Pensacola on the Gulf coast (Fig. 4); 25-159 m, but most commonly collected between 40 and 60 m.

Suborder **CARYOPHYLLIINA**

Superfamily **CARYOPHYLLIOIDEA Dana, 1846**

Family **CARYOPHYLLIIDAE Dana, 1846**

Genus **Caryophyllia Lamarck, 1801**

Diagnosis: Corallum solitary; attached (subcylindrical, ceratoid, trochoid) or free (cornute). Calice circular to compressed; thecal edge spines present in one subgenus. Septotheca usually costate and granular. Septal symmetry variable, but hexameral symmetry with 4 cycle of septa is most common. One crown on pali present before penultimate or antepenultimate (rarely) septal cycle. Columella fascicular.

Type Species: *Madrepora cyathus* Ellis & Solander, 1786, by subsequent designation (BRODERIP in BECHE 1828).

Caryophyllia berteriana Duchassaing, 1850

(Figs. 62-63)

Caryophyllia berteriana Duchassaing, *1850: 15. –Cairns, 1979: 47-49, pl. 6, figs. 4-8, pl. 7, fig. 1, Map 7 (description and synonymy; but not G-311 and G-711, =*C. polygona*). –Viada & Cairns, 1987: 132. –Cairns et al., 1991: 47 (listed); 1994: 4 (listed). –Stolarski, v.1995: 30-32, figs. 8A-H (microstructure).
Caryophyllia formosa Pourtalès, v*1867: 113.

Diagnosis: Corallum ceratoid and usually straight, narrowing to a robust pedicel (PD:GCD = 0.3-0.5), and firmly attached by a thin, encrusting base. Largest corallum (USNM 81012) 25.5 mm in GCD and 36 mm in height. C1-3 usually slightly ridged near calice or theca may be uniformly granular. Septa hexamerally arranged in 4 cycles (S1-2>S3>S4, 48 septa) or sometimes with 2-4 additional half-systems, resulting in 56 septa and 14 pali, or 64 septa and 16 pali (see Discussion). Axial edges of S1-2 and S4 moderately sinuous, whereas those of S3 highly sinuous. Pali (P3) wide and lamellar, with only slightly sinuous axial and peripheral edges, forming an elliptical palar crown surrounding a fascicular columella. Columella composed of 2-17 twisted elements arranged linearly or in an elliptical field.

Discussion: POURTALÈS (1867) described *C. formosa* but later (POURTALÈS 1880a) synonymised his species with *C. berteriana*; however, the taxon he described as *C. formosa* does differ from typical *C. berteriana* in several fairly consistent characters. *C. formosa* invariably has only 48 septa and 12 pali, whereas *C. berteriana* has 48-64 septa and 12-16 pali, most often 56 septa and 14 pali. The calicular edge of *C. formosa* is not lancetted, whereas that of *C. berteriana* is prominently lancetted with highly exsert S1-3. The columella of *C. formosa* is composed of discrete, slender, tightly twisted elements, compared to broader and looser, fused elements of *C. berteriana*. And finally, the theca of *C. formosa* is usually uniformly granular, that of *C.*

berteriana costate near the calice. Both forms occur in the same geographic areas, but in only one case (SB-3472) were they both collected at the same station; forma *formosa* is often found in deeper water, usually below 500 m. Despite the variation described above, *C. formosa* is considered to represent a form of *C. berteriana.* Previously reported records (CAIRNS 1979) of forma *formosa* include: G-23, G-261, G-663, G-1329, P-209, P-904, P-944, SB-3472, Combat-447, Alb-2152, Alb-2153, and (VIADA & CAIRNS 1987) are LGL WC7 and 9.

The additional records reported below slightly extend the westernmost range to '28 Fathom Bank', Texas, but otherwise do not significantly alter the known geographic or bathymetric range of the species as summarized by CAIRNS (1979) and VIADA & CAIRNS (1987).

New Records: **Typical form**: O-24237, 4, IRCZM 12-112; B-A DS4, 1, USNM 80819; BA-DS10, 3, USNM 80820; BLM, SOFLA-32, 4, USNM 71966-67, 72028; BLM, SOFLA-35, 3, USNM 71965, 71968; JSL-II-1720, 2, USNM 94725; CS "Electra", south of Barbados, depth unknown, 1, USNM 81012; 25°16', 84°15'W, 137-166m, 6, USNM 83433, 83447, 83453; off Boca Grande, FL, 176-179 m, 5, USNM 45317-19; off Barbados, 220-250 m, 2, USNM 81011; 27°53.2'N, 93°23.9'W, 99 m, 1, USNM 49032.- **Forma** *formosa*: JSL-I-2064, 1, USNM 91373; LGL WC6, 8, USNM 76831.

Types: See CAIRNS (1979).

Distribution: Common throughout Caribbean and Bahamas, south to Suriname; eastern and northern Gulf of Mexico (CAIRNS 1979: map 7). Northernmost Atlantic record 27°30'N (G-663); westernmost Gulf record off "28 Fathom Bank," TX; off southern coast of Caribbean only off Aruba; 99-1033 m.

Caryophyllia horologium Cairns, 1977

(Figs. 16, 64-65)

Caryophyllia horologium Cairns, *1977b: 10-11, pl. 1, figs. 4-6, 9 (description); 1978a: 10 (listed); 1979: 207 (listed); Cairns et al., 1991: 47 (listed). –Cairns et al., 1994: 4 (listed).

Diagnosis: Corallum ceratoid and usually straight to slightly curved proximally, narrowing to a slender pedicel (PD:GCD = 0.08-0.23), which is usually not attached to substrate. Largest corallum (holotype) 14.6 mm in GCD and 18.8 mm in height. C1-3 usually sharply ridged from calice to pedicel; coarse granules cover intercostal theca. Calicular margin lancetted. Septa hexamerally arranged in 4 cycles (S1-2>S3>S4, 48 septa). Axial edges of S1-2 and S4 moderately sinuous, whereas those of S3 highly sinuous. Pali (P3) wide and lamellar, equal to or wider than S3, and separated from S3 by a broad notch, the axial palar edge vertical, but the peripheral palar edge sloping away from its adjacent septum. Fossa shallow, containing a fascicular columella composed of 2-7 strongly fused twisted elements.

Discussion: *Caryophyllia horologium* is very similar to *C. berteriana*, and may represent its sister shallow-water analog or be a subspecies of *C. berteriana*; however, there is a slight overlap in the bathymetric ranges of the two species and both have been collected together at 2 stations (i.e., BLM, SOFLA-32 and 26°16.5'N, 84°03.5'W, 137-141 m). In general, *C. horologium* is found in shallower water than *C. berteriana*, but geographically their ranges completely overlap. *C. horologium* differs from *C. berteriana* in having a smaller corallum; a smaller pedicel, which is usually unattached; more sharply ridged costae; a shallower fossa; consistently 48 septa; and a broader notch between S3 and P3. This represents the only substantive report of the species subsequent to its original description and almost doubles its known bathymetric range.

New Records: BLM, SOFLA-32, 4, USNM 71970, 80100; BLM, SOFLA-36, 12+, USNM 71971, 71969; USGS VIII-A-2, 175 m, 1, USNM 80845 (record implied by CAIRNS 1978 for area 3); 28°11.2'N, 84°52.2'W, 1, USNM 45376; 27°18.4'N, 84°17.8'W, 102 m, 1, USNM 45351; 26°16.5'N, 84°03.5'W, 137-141 m, 5, USNM 83432; 25°00'N, 84°00'W, 126 m, 5, USNM 80202.

Types: See CAIRNS (1977b).

Distribution: Off western coast of Florida and near Alderdice Bank, southwestern LA; 55-175 m (Fig. 16).

Caryophyllia crypta, new species

(Figs. 16, 66-68)

Caryophyllia sp. cf. *C. antillarum.* –Goreau & Wells, v.1967: 449 (listed). –Wells & Lang, v.1973: 58 (listed). –Wells, 1973: 60. –Land, Lang & Barnes, 1977: 170 (isotopic analysis). [Not *C. antillarum* Pourtalès, 1874]

Caryophyllia C, new species Cairns, 1976: 64-66, pl. 8, figs. 3-7.

Caryophyllia smithi. – Zlatarski, 1982: 258-259 (in part: pl. 111, figs. 1-6, text-figs. 60-61). –Estalella, 1986: 20. [Not *C. smithii* Broderip in Beche, 1828]

Caryophyllia sp. Fenner, v.1993a: 14 (listed: USNM 81283).

Description: Corallum ceratoid, straight to irregularly bent, narrowing to a slender (PD:GCD = 0.2-0.5), monocyclic base. Largest specimen 11.5 x 10.3 mm in CD and 29 mm in height (SB-3494); however, most specimens in type series considerably smaller, the holotype measuring 7.6 x 6.6 mm in CD and 12.7 mm in height. C1-2 usually slightly ridged near calice; otherwise, costae barely distinguishable, the theca lacking intercostal striae and covered with low, glisteny granules. Theca and peripheral septa usually pigmented a light brown, the axial portions of the septa, pali, and columella being white.

Septa hexamerally arranged in 4 cycles. A specimen of GCD 1.6-3.0 mm has only 3 cycles of 24 septa and 6 pali, whereas the full fourth cycle of 48 septa and 12 pali is attained at a GCD of about 5.0 mm. Large coralla sometimes have several pairs of S5 (up to 50 septa and 14 pali), and coralla between 3 and 5 mm have a variable number of septa and pali. S1 highly exsert (1.6-1.8 mm), extend about ⅔ distance to columella, and have slightly sinuous axial edges. S2 less exsert (about 1.2 mm), about ⅘ width of S1, and have similarly shaped axial edges. S3 least exsert septa (about 0.5 mm), ⅘ width of S2, and have moderately sinuous axial edges. S4 about 1 mm exsert, each pair flanking an S1 fusing to that S1, which produces a lancetted calicular edge. S4 dimorphic in width, those adjacent to S1 usually slightly wider than S3, those adjacent to S2 being equal or slightly less wide than S3. Fossa deep, containing a well-defined, elliptical crown of broad (1.1-1.3 mm) and robust P3, the P3 being thicker than the septa and sometimes wider then their corresponding S3. Upper edges of pali terminate well below calicular edge. Columella deeply recessed in fossa, consisting of 1-6 slender (0.4-0.5 mm), tightly twisted elements that are usually linearly arranged.

Discussion: Among the approximately 56 valid Recent species of *Caryophyllia*, *C. crypta* appears to be morphologically closest to *C. crosnieri* Cairns & Zibrowius, 1997, a species known from the Indo-West Pacific at depths of 366-600 m. Among the species having an attached corallum with 4 cycles of septa these are the only 2 species to have hexamerally arranged septa in which the S1 are wider and more exsert than the S2, and S4 that are equal to or wider than the S3. They are also similar in corallum colour and size and in having a deep fossa, but *C. crypta* differs in having less exsert septa, a shallower fossa, and much wider pali.

Within the Atlantic *C. crypta* is most similar to *C. calveri* Duncan, 1873, known from the Mediterranean and northeast Atlantic at depths of 130-1050 m (ZIBROWIUS 1980). *C. crypta* differs in having a much deeper fossa (the distal edges of the pali and even the columellar elements of *C. calveri* often rise above the calicular edge), wider pali, S1 that are wider and more exsert than the S2, and fewer columellar elements.

Caryophyllia crypta is often found on the undersides of living and dead, platy reef corals, such as *Agaricia* and *Mycetophyllia*.

Etymology: The species name *crypta* (Greek *kryptos*, hidden, secret) alludes to the cryptic habit of this small species.

Types: G-703, holotype (USNM 46861) and 3 paratypes (USNM46862); P-405, 1 paratype, USNM 62526; P-439, 1 paratype, USNM 46054; SB-3494, 3 paratypes, USNM 99177; Eastward-30176, 1 paratype, USNM 99175; Eastward-30178, 12 paratypes, USNM 99183; DBL-993, Discovery Bay, Jamaica, 61 m, 1 paratype, USNM 99176; DBL-1198, Discovery Bay, Jamaica, 76 m, 1 paratype, USNM 46863; DBL-1199, Cardiff Hall, Jamaica, 40 m, 1 paratype, UMML 8.298; DBL-1200, Maria Buena Bay, Jamaica, 40 m, 1 paratype, USNM 81271; DBL-1311, Discovery Bay, Jamaica, 61 m, 3 paratypes, USNM 99178; DBL-1429, Discovery Bay, Jamaica, 73 m, 2 paratypes, USNM 99179; DBL-1472, Discovery Bay, Jamaica, 1 paratype, USNM 99180; DBL-1474, Discovery Bay, Jamaica, 1 paratype, USNM 99181; DBL, Discovery Bay, Jamaica, 40 m, 1 paratype, USNM 46864; Carrie Bow Cay, Belize, sand trough, 1 paratype, USNM 47809; Carrie Bow Cay, Belize, 14 m, 4 paratypes, USNM 99182; Carrie Bow Cay, Belize, 18-30 m, 2 paratypes, USNM 99184; Little Cayman, 1 paratype, USNM 81283; north of Georgetown, Grand Cayman, 12 m, 6 paratypes, USNM 99185; Church Hill Beach, Lucaya, Bahamas, 16 m, 1 paratype, USNM 46053;

Freeport, Grand Bahama, 35-60 m, 6 paratypes, USNM 99186; Santa Marta, Colombia, 17 m, 4 paratypes, USNM 99187; Salt River Canyon, St. Croix, VI, 15-21 m, 3 paratypes, USNM 99188; south of Bonaire, 24 m, 1 nontype, UMML 8.359. Type Locality: 26°29'N, 78°40'W (Northwest Providence Channel, Bahamas), 27-165 m.

Distribution: Bahamas and Caribbean (Fig. 16), but rare in Lesser Antilles; 12-183 m (the deeper records of 500-600 m from the Eastward stations are based on dead specimens).

Caryophyllia antillarum Pourtalès, 1874

(Fig. 70)

Caryophyllia antillarum Pourtalès, v*1874: 34, pl. 6, figs. 3-4. –Cairns, 1979: 52-53, pl. 5, figs. 8-10, map 9 (description, synonymy, and lectotype designation).

Diagnosis: Corallum ceratoid, straight, and firmly attached through a robust pedicel about half the CD. Lectotype 9.0 x 8.6 mm in CD and 11.9 mm in height. Theca covered with porcelaneous granules; costae usually inconspicuous; corallum white. Septa decamerally arranged in 3 cycles: 10:10:20 (=40 septa), septa of each cycle progressively narrower and less exsert; however, tertiaries only slightly narrower than secondaries. Axial edges of secondaries quite sinuous, each secondary septum bearing a bluntly tipped palus that forms an elliptical crown encircling the fascicular columella. Peripheral edges of pali overlap axial edges of primary septa. Fossa shallow; columella composed of 3-10 slender, tightly twisted elements, usually arranged in 2 parallel rows.

Discussion: The lectotype of *C. antillarum* (Fig. 70) is atypical in that it bears a pair of quaternary septa and a palus before the S3 that the 2 quaternaries flank, resulting in 42 septa and 11 pali.

Caryophyllia antillarum is one of 2 western Atlantic species having decamerally arranged septa, the other being *C. zopyros*. *C. antillarum* is distinguished by having a shallower fossa, a porcelaneous-granular theca (vs a non-porcelaneous, granular costate theca), and thicker P3, the peripheral edges of which overlap with the axial edges of the primary septa. The peripheral palar edges of *C. zopyros* do not overlap with the axial edges of any septa. A key to the western Atlantic species of *Caryophyllia* is given by CAIRNS (1979).

Only one new record from near Navassa Island is known for this species since it was redescribed by CAIRNS (1979). *C. antillarum* is more characteristic of slope depths (150-730 m), but is included in this report because POURTALÈS (1874, 1880a) recorded several specimens from 3 localities at depths slightly shallower than 200 m: BL-273 (188 m), BL-300 (150 m), and the syntype series (183 m). The depth record of 1000 m given by CAIRNS (1979) was based on a specimen from SME-1776, an identification that was questioned at that time and is excluded now.

New Record: O-22084, 1, IRCZM 12:122.

Types: See CAIRNS (1979).

Distribution: Antillean distribution (CAIRNS 1979: map 9), extending from Grand Bahama Island to the Grenadine Islands; 150-730 m.

Caryophyllia zopyros Cairns, 1979

Caryophyllia zopyros Cairns, *1979: 63-64, pl. 10, figs. 1-4, map 13.

Diagnosis: Corallum ceratoid to trochoid, straight, and firmly attached through a robust pedicel about half the CD in diameter. Coralla up to 10.5 mm in GCD and 15-17 mm in height. Broad, flat to slightly convex, non-porcelaneous granular costae present; upper corallum light brown, lower half white. Septa decamerally arranged in 3 cycles: 10:10:20 (=40 septa), septa of each cycle progressively narrower and less exsert. Axial edges of secondaries quite sinuous, each secondary bearing a narrow, lanceolate palus that together form an elliptical crown encircling the fascicular columella. Peripheral edges of pali usually do not overlap the axial edges of the primary septa and thus form a well-defined palar ring. Fossa of moderate depth; columella composed of 4 or 5 slender, tightly twisted elements.

Discussion: *Caryophyllia zopyros* is compared to the other decamerally symmetrical *Caryophyllia* in the account of *C. antillarum*. *C. zopyros* is rarely collected and nothing is known of its biology. Although it dos not have a previously assigned common name, the Greek root of the name would suggest 'the fireworks coral'.

No new records or literature citations are known for this species since its original description. *C. zopyros* is more characteristic of slope depths (73-618 m), but is included in this report based on two records from 73 m (DBL-1429, USNM 46056) and 188 m (BL-273, MCZ).

New Records: None.

Types: See CAIRNS (1979).

Distribution: Antillean distribution (CAIRNS 1979: map 13), extending from northwestern Cuba to the Grenadine Islands; 73-618 m.

Caryophyllia barbadensis Cairns, 1979

Caryophyllia barbadensis Cairns, *1979: 60-61, pl. 8, figs. 7-9, pl. 9, fig. 1, Map 11 (description and illustrations). -Zibrowius, 1988: 135 (listed). -Cairns et al., 1994: 8.

Diagnosis: Corallum subcyclindrical to ceratoid, straight to slightly bent, and firmly attached through a thick pedicel. Corallum relatively small, the holotype 6.0 x 5.5 mm in CD and 12.9 mm in height. Theca bears broad, slightly convex, granular costae; corallum white. Septa octamerally arranged in 3 cycles: 8:8:16 (=32 septa), the primary septa the largest and most exsert, but tertiaries equally as wide and only slightly less exsert than secondaries. Axial edges of all septa sinuous. Secondary septa bear pali, forming an elliptical crown of 8 pali that encircles a fascicular columella composed of 2-4 twisted elements. Septal faces bear prominent granules; axial edges of both septal and palar faces bear short menianes.

Discussion: Although there are 7 species of octamerally symmetrical *Caryophyllia* (see CAIRNS 1999a), *C. barbadensis* is the only one known from the Atlantic.

New Records: None.

Types: See CAIRNS (1979).

Distribution: Barbados; Green Canyon, southwestern Louisiana; ?off southern Brazil (ZIBROWIUS 1988); 129-249 m.

Genus **Premocyathus** Yabe & Eguchi, 1942

Diagnosis: Corallum solitary, cornute, sometimes with a costal ridge on convex thecal edge. Base open, the result of asexual budding. Theca costate. Septa arranged in 3 cycles but with very irregular symmetry, ranging from 6 to 12 primary septa and 24-48 septa. Pali in one crown before penultimate (second) septal cycle, but also very irregular in development, ranging from 0-12. Columella fascicular.

Type Species: *Premocyathus compressus* Yabe & Eguchi, 1942 (=*Placotrochides dentiformis* Alcock, 1902), by original designation. *Caryophyllia compressa* Yabe & Eguchi, 1932, the stated genotype, is a *nomen nudum*, later properly described, along with the new genus, by YABE & EGUCHI (1942) as the combination *Premocyathus compressus*.

Discussion: CAIRNS & ZIBROWIUS (1997) revised the genus *Premocyathus*, resulting in only one species in the genus: *P. dentiformis*. Although *Caryophyllia cornuformis* Pourtalès, 1868 does not have a highly compressed corallum resulting in a carinate convex thecal edge, it does have the characteristic open base and irregular septal and palar symmetry common to the type species, and is thus transferred to the genus *Premocyathus*.

Premocyathus cornuformis (Pourtalès, 1868), new combination

Caryophyllia cornuformis Pourtalès, v*1868: 133. –Cairns, 1979: 49-51, pl. 7, figs. 2-5, Map 8 (synonymy and description). –Zibrowius, v.1980: 66-67, pl. 26, figs. A-L (synonymy and description). –Zibrowius, 1988: 135 (listed). –Cairns et al., 1991: 47 (listed). –Cairns et al., 1994: 4 (listed). –v.Pires, 1997: 182. –Cairns, 1999a: 72.
Caryophyllia sp. cf. *C. cornuformis*. –Cairns & Keller, 1993: 235, pl. 3, figs. C, F.

Diagnosis: Corallum cornute (usually regularly curved about 90°), and unattached, having an open base 1.2-1.8 mm in diameter. Calice circular to only slightly elliptical (not compressed). Calicular edge uniformly serrate. Largest known corallum 10.2 mm in CD and 25 mm in height, but most specimens about half this CD. Costae slightly convex and finely granular, separated by very thin, shallow striae; costae sometimes porcelaneous; corallum white. Septa arranged in 3 cycles, septa of each cycle progressively narrower, but arranged with a very irregular symmetry, ranging from 6 to 12 primary septa, some of the more common septal complements being: 6:6:12 (24) and 7:7:14 (28 septa), the largest being 11:11:18 (38 septa). Axial edges of septa sinuous. Pali occur only before secondary septa that are flanked by a pair of tertiary septa. Because tertiary septa are often missing, there are often fewer pali than secondary septa, pali ranging in number from 0-12 and often asymmetrically placed. Occasionally an enlarged columellar element seems to substitute for a palus. Columella fascicular, composed of 2-9 slender, twisted elements.

Discussion: Although only one additional record of this species is reported herein, there have been several substantive reports of *P. cornuformis* since 1979. ZIBROWIUS (1980) summarized and discussed what is known about eastern Atlantic populations; CAIRNS & KELLER (1993) suggested that the species might also be legitimately recorded from off Mozambique; and PIRES (1997) extended the southernmost western Atlantic range to 24°35'S, 44°12'W (off Couves Island, São Paulo, 600 m).

Premocyathus cornuformis is more typical of slope depths (as deep as 2200 m), but is included in this report because of one specimen cited by CAIRNS (1979) from SB-2425 at 137 m, not 37 m as previously reported.

The common name of *P. cornuformis* is the 'lesser horn coral' (CAIRNS *et al.* 1991). POURTALÈS (1871, 1880a) reported living specimens attached to *Xenophora* shells at Sand Key.

New Record: JSL-I-1910, 1, IRCZM.

Types: See CAIRNS (1979).

Distribution: Western Atlantic: Straits of Florida; Bahamas; northern and eastern Caribbean; off Brazil from Recife to São Paulo; 137-931; northwest Atlantic from 46°-63° (Newfoundland, Labrador, Davis Strait) (CAIRNS 1979: map 8); 1065-1790 m. Elsewhere: northeastern Atlantic in area bounded by Celtic Sea, the Azores, and Morocco; 1300-2200 m (ZIBROWIUS 1980). ?off Mozambique; 91-347 m (CAIRNS & KELLER 1993).

Genus **Coenocyathus** Milne Edwards & Haime, 1848

Diagnosis: Colonial, corallites usually extratentacularly budded from a thick, common, basal coenosteum; occasionally from lateral edges of other corallites (e.g., *C. bowersi*); and rarely intratentacularly. Corallites cylindrical and usually stout, with no anastomosis. Septotheca costate and granular. Septa in 3 or 4 cycles of variable symmetry. A crown of well-formed pali occurs before penultimate septal cycle. Columella papillose or fascicular (twisted elements). Endotheca absent.

Type Species: *Coenocyathus cylindricus* Milne Edwards & Haime, 1848, by subsequent designation (MILNE EDWARDS & HAIME 1850a: xii).

Discussion: Seven species are currently assigned to this genus: *Coenocyathus cylindricus* Milne Edwards & Haime, 1848 (eastern Atlantic); *C. bowersi* Vaughan, 1906 (eastern Pacific); *C. goreaui* Wells, 1972 (Bermuda); *C. parvulus* (CAIRNS 1979) (western Atlantic); *C. brooki* Cairns, 1995 (Kermadec Islands); *C. humanni*, n. sp. (off Florida); and *C. caribbeana*, n. sp. (Caribbean). *Coenocyathus sagamiensis* Eguchi, 1968 was transferred to *Rhizosmilia* by CAIRNS (1994), and *Coenocyathus anthophyllites* Milne Edwards & Haime, 1848, is herein excluded from *Coenocyathus* on the basis of its possession of abundant endothecal dissepiments, a parasmiliine character. That species also has a predominantly bushy growth form, and poorly-defined paliform lobes. Although having some resemblance to the parasmiliine genus *Pourtalosmilia*, it may ultimately form the basis of an undescribed genus.

Coenocyathus humanni, new species

(Figs. 5, 72-76)

Coenocyathus n. sp. Humann, v.1993: 174-175, colour fig. (*in situ*).

Description: Holotypic colony consists of 22 corallites united by a common basal coenosteum, which is attached to a bivalve shell that is attached to an oxidized metallic structure. Corallites cylindrical and short, the largest corallite 5.6 x 5.0 mm in CD and 5.0 mm in height. Colony increase primarily through extratentacular budding, resulting in contiguous corallites (with fused walls) or corallites basally connected by coenosteum (sometimes reptoid in extant) but at a distance of 1-2 CD from one another. In one case a corallite appears to be in the process of intratentacular budding. Costae inconspicuous, separated by very faint intercostal striae, and covered with low granules. Corallum white.

Septal symmetry variable, but most common septal plans include: 10:10:16-20 (36-40 septa) and 12:12:16-20 (40-44 septa), the last cycle rarely complete. Primary septa highly exsert (1.2-1.5 mm), sometimes flared slightly outward, having a sinuous axial edge that reaches ¾ distance to columella. Secondary septa about 0.5 mm exsert and half width of primaries. Tertiary septa slightly less exsert but almost as wide as secondaries. Each secondary septum that is flanked by a pair of tertiary septa bears a well-formed palus 0.6-0.7 mm in width, the pali bearing tall granules and/or obliquely oriented menianes across their faces. Because the third cycle of septa is rarely complete, the number of pali is also correspondingly low. Fossa of moderate depth, containing a fascicular columella of 3-7 twisted elements that are fused to one another.

Discussion: Among the 6 other species listed in the discussion of the genus, *C. humanni* is most similar to *C. brooki*, but can be distinguished by lacking transverse thecal ridges and in often having a decameral septal symmetry. According to HUMANN (1993), it occurs on the undersides of ledge overhangs and cave ceilings, and the living coral is white with a pink tint. His common name for this species is the 'ornate cup coral'.

Etymology: This species is named in honor of PAUL HUMANN, who collected the holotypic specimen.

Types: Holotype: Humann stn 2WPB-7, 1 colony, USNM 92080. Paratype: one corallum consisting of 3 contiguous corallites on same substrate as holotype. Type Locality: off West Palm Beach, FL (on ceiling of a shipwreck); 21 m.

Distribution: Known only from the type locality (Fig. 5).

Coenocyathus caribbeana, new species

(Figs. 5, 77-80)

Caryophyllia smithi. –Zlatarski, 1982: 258-259 (in part: specimen 2686 from stn. 128, pl. 110, figs. 1-6). [Not *C. smithii* Broderip in Beche, 1828]
Coenocyathus bartschi. –Zlatarski, 1982: 259 (in part: specimen 314 from stn. 6a, pl. 113, figs. 2-3). [Not *C. bartschii* Wells, 1947]
Caryophyllia n. sp. –Humann, v.1993: 174-175, colour fig. (USNM 91667).

Description: Colonies consist of a thick sheet of coenosteum from which stout, widely spaced (2-3 CD apart) corallites are extratentacularly budded. Corallites cylindrical to barrel-shaped, the pedicel sometimes inflated to a greater diameter than the calice, in several coralla consisting of a spongy, non-dissepimental exothecal accretion. Largest corallite (USNM 99190) 14.4 x 12.6 mm in CD and 9.9 mm in height. Costae inconspicuous, flat, granular, and separated by very thin, shallow striae. Costae may also extend to intercorallite coenosteum or this region may be uniformly granular. At calicular edge C4 are broadest costae, 2-3 times width of a C1 or C2. Upper theca and upper axial regions of septa light brown; otherwise corallum white.

Septa hexamerally arranged in 4 complete cycles: S1>S2>S4>S3, the fourth cycle complete at a GCD of about 7 mm. Larger corallites sometime have up to 2 additional pairs of S5, resulting in 52 septa and 14 pali. Otherwise the hexameral symmetry of 48 septa and 12 pali is fairly constant. S1 highly exsert (up to 2.7 mm), having straight, vertical axial edges that extend about ⅘ distance to columella. S2 less exsert (about 2.2 mm), ⅗ width of S1. S3 least exsert (about 1 mm) and half width of S2, being the only septa with sinuous axial edges. S4 dimorphic in size, those adjacent to S1 about 1.3 mm exsert, forming a calicular lancet with the flanked S1, and slightly wider then the adjacent S3. S4 adjacent to S2 slightly less exsert than the other S4, and equal to or slightly wider than their adjacent S3, although usually less wide the those S4 adjacent to the S1. An elliptical crown of 12-14 pali (P3), each 1.5-2.0 mm wide, encircles a deeply recessed fascicular columella composed of 2-15 elements: some twisted, others pillar-shaped. Small, deeply recessed paliform lobes (P1-2) occasionally present before some septa of several coralla.

Discussion: *Coenocyathus caribbeana* is distinguished from its congenerics by its large size and by having S4 that are wider than the S3; however, it is remarkably similar to *Caryophyllia crypta* in many characters, including septal symmetry, relative septal size, palar and columellar morphology, and corallum pigmentation. A small, individual corallite of *C. caribbeana* might easily be confused with an adult *Caryophyllia crypta*, but a fully developed *C. caribbeana* can be distinguished by its colonial growth form, larger corallites, cylindrical (*vs* ceratoid) corallites, and unequal costal widths.

Records of *Coenocyathus* from the western Atlantic were previously reported by three authors: *Coenocyathus dohrni* Döderlein, 1913 (=*Caryophyllia inornata* Duncan, 1878, see ZIBROWIUS 1980) from off the northern Yucatan Bank at 34-55 m (KELLER 1975); *Coenocyathus* n. sp. from the outer shelf edge banks of Texas at 100 m (REZAK *et al.* 1985); and *Coenocyathus* sp. from off eastern Florida (AVENT, KING & GORE 1977). In all cases the species were only listed, not accompanied by description or illustrations, and the specimens are not available for further study. KELLER's material is purported to be at the Instituto de Oceanologia, Havana, Cuba, but cannot be accessed. It is possible that they are *Coenocyathus caribbeana* or perhaps *C. humanni*, whereas REZAK's (1985) specimens appear to be *Phyllangia pequegnatae*. The specimen reported by AVENT, KING & GORE (1977) may be *Pourtalosmilia conferta*.

HUMANN (1993) refers to this species as the 'button cup coral'.

Etymology: Named for the region in which occurs, the Caribbean Sea.

Records/Types: Holotype: Wagenaar Hummelinck 1334, Caracas Baai, Curaçao, attached to submarine buoy, 10 m: holotype (USNM 99189), 2 paratype colonies (USNM 99190); Humann stn CBH-13, San Salvador, Bahamas, 23 m, 1 paratype corallite, USNM 91667; Humann stn 2RC-10B, Roatán, Honduras, 20 m, 1 paratype corallite, USNM 92092; Humann stn

IC2d, Roatán, Honduras, 12 m (cave), 2 paratypes, USNM 99191; DBL-1470, Discovery Bay, Jamaica, depth unknown, 1 paratype corallite, USNM 99192; Barbados, 100 m, 1 paratype corallite, UMML 8.279. Type Locality: Caracas Bay, Curaçao, 10 m.

Distribution: Bahamas; Caribbean (Fig. 5); 5-100 m.

Coenocyathus parvulus (Cairns, 1979)
new combination

Caryophyllia parvula Cairns, *1979: 62-63, pl. 9, figs. 6-8, pl. 10, figs. 5-6, Map 12. –Rezak et al., v.1985: 225 (listed: stn. 120, Sidner Bank; stn. 118, Diaphus Bank, LA, 120 m). –Cairns et al., 1994: 6.

Diagnosis: Corallites extratentacularly budded from a thick, continuous, smooth basal coenosteum. Corallites small: largest known (JSL-I-2582) 6.8 x 5.6 mm in CD and 8.1 mm in height. Corallites ceratoid to subcylindrical, with a thick pedicel and even thicker basal region, the latter about same diameter as calice. C1-2 and usually C3 ridged. Upper theca and peripheral septa usually light brown; pali, columella, and basal coenosteum white. Septa of larger specimens hexamerally arranged in 4 cycles (S1>S2>S3>S4), but a full fourth cycle never attained; larger corallites having 42-44 septa. Smaller corallites pass through stages having 8-11 half-systems, some of these half-systems missing pairs of S4, resulting in corallites with 32-44 septa and 8-11 pali. S1-2 highly exsert; axial edges of all septa highly sinuous. Septal faces of S4 bear elongate menianes. Pali (P3) slender, quite sinuous, and usually also bear menianes. Fossa of moderate depth; columella papillose, composed of 5-12 slender, irregularly-shaped elements.

Discussion: Most previously collected specimens of *C. parvulus* were corallites broken from their bases, or founder corallites that had not yet formed colonies. However, a well-preserved corallum from JSL-I-2582 clearly shows the growth of the species to be colonial, with budding from a common basal coenosteum, which suggests a placement in *Coenocyathus*. In fact, corallites from the "Steamer Norseman", previously reported by CAIRNS (1979), also display a colonial mode. The papillose columella of this species is also more consistent with that of *Coenocyathus*. *C. parvulus* is distinguished from other species in that genus by its small size and carinate S4. Aside from the generic reassignment, the specimens reported herein provide a size record for the species (JSL-I-2582) and a slight northeastern range extension to Grand Bahama Bank.

New Records: SB-3467, 2, USNM 80234; JSL-I-2582, 9, USNM 87786; JSL-I-2585, 4, USNM 87789, 89358; BLM, SOFLA-32, 1, USNM 97331; USGS VIII-A-2, 4, USNM 80356.

Types: See CAIRNS (1979).

Distribution: Bahamas; northeastern Gulf of Mexico (Sidner Bank, LA (REZAK *et al.* 1985)); Caribbean, but rare in southern Caribbean; Brazil from Cumuruxatiba to Ilha de Sebastião (CAIRNS 1979: map 12); 97-399 m.

Coenocyathus goreaui Wells, 1972

(Figs. 5, 81-84)

Coenocyathus goreaui Wells, v*1972: 4-6, figs. 6-10. -Zibrowius, 1980: 73. -Cairns et al., 1986: 187, fig.
"*Coenocyathus*" *goreaui*. -Cairns, 1979: 207 (listed).

Description: Small (up to 5 cm diameter), densely branched colonies are composed of elongate (up to 26 mm), cylindrical corallites that bud from common basal coenosteum and edge zone of parent corallites. Corallites vermiform in shape and often anastomose laterally, producing many crevices. Calices circular to slightly elliptical in shape; largest calice (USNM 49235) 6.4 mm in CD; calicular edge finely and uniformly serrate. Costae flat and equal, separated by narrow, shallow intercostal striae; costae covered with low, rounded granules, 2 or 3 across width of a costa. Corallum white.

Septa octamerally arranged in 3 to 4 cycles, a full 3 cycles (32 septa) present in coralla 3-5 mm in CD, additional pairs of quaternary septa occurring in larger corallites, e.g., up to 42 septa in a corallite 6.4 mm in diameter. Primary septa about 1 mm exsert, having straight, vertical axial edges. Secondary septa up to 0.7 mm exsert, about ¾ width of the primaries, having slightly sinuous axial edges. Tertiaries equal to or only slightly smaller than secondaries. A crown of 8 broad, sinuous pali occurs before secondary septa, each palus about same width as septum it borders. When pairs of quaternary septa present, the palus orients with the flanked tertiary septum within that sector. Pali highly granular and bear obliquely oriented menianes. Fossa shallow to moderate in depth, containing a fascicular columella composed of 2-5 twisted elements. Endothecal dissepiments absent.

Discussion: The classification of this species in *Coenocyathus* was questioned by WELLS (*pers. comm.* 1976, 1977), CAIRNS (1979), and ZIBROWIUS (1980); however, no one has suggested an alternative genus. It is tempting to consider a reassignation to *Pourtalosmilia*, a genus resurrected by ZIBROWIUS (1980) after *C. goreaui* was described, based on the presumption that the elongate coralla of *C. goreaui* have endothecal dissepiments. However, the paratype illustrated by WELLS (YPM 8499), which contains corallites up to 26 mm in length, do not contain any trace of endothecal dissepiments. Thus, it would seem appropriate to keep this species in the genus in which it was originally described. It differs from congenerics in having octamerally arranged septa.

New Records: Harrington Sound, Bermuda, cave near Somers Hill, 2 m, 4 corallites, USNM 49234; Harrington Sound, Bermuda, Green Bay Cave, 5 m, 6 corallites, USNM 49235; Harrington Sound, Bermuda, Green Bay Cave, depth unknown, 1 corallite, USNM 80360; between Canton Point and Sam Halls Bay, Bermuda, 4 m, 2 corallites, USNM 80470; Myrtle Bank, Bermuda, depth unknown, 5 corallites, USNM 80359; Desecheo Island, Puerto Rico, cave, 6-9 m, 9 corallites, USNM 80367.

Types: The holotype and paratype are deposited at the YPM (8498 and 8499, respectively). Type Locality: "cavity in reef rock North East Breakers (Haversack, East), Bermuda."

Distribution: Bermuda; Desecheo Island, Puerto Rico (Fig. 5); 2-6 m.

Genus **Trochocyathus** Milne Edwards & Haime, 1848

Diagnosis: Corallum solitary; discoidal, turbinate, ceratoid or bowl-shaped; attached or free; costal spines present in some species. Transverse division present in some species. Septotheca costate, sometimes covered with a thin epitheca. Discrete pali occur before all but last cycle of septa in 2 or 3 crowns; columella papillose. No endotheca.

Type Species: *Turbinolia mitrata* Goldfuss, 1827, by subsequent designation (Milne Edwards & Haime 1850a: xiv).

Trochocyathus rawsonii Pourtalès, 1874

Trochocyathus rawsonii Pourtalès, v*1874: 35, pl. 6, figs. 7-10. –Cairns, 1979: 77-79, pl. 13, figs. 5-7, pl. 14, figs. 1-6, Map 17 (description and synonymy). –Cairns et al., 1991: 47 (listed). –Cairns et al., 1994: 4 (listed).

Diagnosis: Corallum usually bowl-shaped, with a rounded, often slightly twisted, base that is attached to a solid substrate or a smaller object. In the former case the PD:GCD is up to 0.33, in the latter case the pedicel or scar of attachment may have a PD:GCD as small as 0.09. Largest known corallum (G-1036) 25.9 x 22.5 mm in CD; the tallest corallum 33 mm. Costae usually masked with thin, wrinkled bands of epitheca to within 2-3 mm of calicular edge, above which costae are well defined, separated by deep intercostal furrows. Septa hexamerally arranged in 5 cycles, the fifth never complete: S1>S2>S3>S4>S5. The fourth cycle may be complete at a GCD as small as 9 mm and persist at this complement until a GCD of 16 mm, but larger coralla have additional pairs of S5 up to approximately 72 septa. Large coralla often have 2 pairs of S5 in each system, one pair flanking the S4 adjacent to each S1. Pali occur before all but the last cycle of septa in 3 crowns. Innermost crown composed of 6 P1 and 6 P2, the P2 about twice the width of the P1 but axial edges of all 12 P1-2 extend the same distance into fossa. Intermediate crown of 12 P3 slightly recessed from columella and rise higher in fossa than P1-2 crown, the P3 about the same width as the P2. Development of P4 crown incomplete, when present P4 more recessed from columella and project higher in fossa than P3, are of equal width, and their axial edges usually fuse to the axial edge of the adjacent P3. Columella papillose, composed of numerous robust granulated pillars.

Discussion: The records reported herein extend the known distribution of this species to Jamaica; Quintana Roo, Mexico; and slightly farther north in the Gulf of Mexico off Cedar Keys, as well as including the shallowest record of the species (55 m, off Cedar Keys) and the deepest (700 m, Gosnold 112/78). Approximately half of the known records of *T. rawsonii* occur shallower than 200 m, the majority of these between 100 and 200 m.

New Records: O-22084, 1, IRCZM 12:130; B-A DS10, 1, USNM 93185; Gos-112/78, 1, USNM 80912; BLM, SOFLA-32, 10, USNM 71990-94; BLM, SOFLA-35, 2, USNM 71995; 25°16'N, 84°15'W, 159-166 m, 8, USNM 83452; 26°16'N, 84°04'W, 139-148 m, 1, USNM 83446; west of Cedar Keys, FL, 55 m, 3, USNM 46094; Isla Contoy, Quintana Roo, Yucatan Peninsula, 100-200 m, 1, USNM 98467.

Types: See CAIRNS (1979).

Distribution: Southeastern US from off South Carolina (32°01'N, 79°24'W) throughout Bahamas and Antilles to off Maranhão, northeastern coast of Brazil (0°18'N, 44°17'W); southeastern Gulf of Mexico; off Jamaica, Nicaragua, and Venezuela (CAIRNS 1979: map 17); 55-700 m. –Elsewhere: ?southwest Indian Ocean (CAIRNS & KELLER 1993).

Trochocyathus laboreli, new species

(Figs. 17, 87-88)

?*Trochocyathus* sp. –Laborel, 1970: 155 (listed). –Tommasi, 1970: 56 (in part: fig. 5f).
?*Trochocyathus* n. sp. –Laborel, 1971: 175 (listed).
?*Trochocyathus rawsonii*. –Zibrowius, 1988: 135 (listed).

Description: Corallum ceratoid, usually cornute, having an elongate, slender pedicel 0.85-2.4 mm in diameter (PD:GCD = 0.09-0.20). Base monocyclic, containing 6 septa. Corallum usually free but occasionally weakly attached to substrate. Largest corallum 15.9 mm in CD and 20.6 mm in height (WB-5148). Costae equal in width, low, faintly granular, and separated by shallow intercostal furrows. Lower ⅘ of theca often encrusted with various calcareous epizoa; corallum uniformly white.

Septa hexamerally arranged in 4 cycles (S1>S2>S3>S4), even the largest coralla having no more than 48 septa. S1 only moderately exsert (about 1.8 mm); have vertical to slightly concave, sinuous axial edges; and bear a small palus of approximately 1 mm width. S2 equally exsert and only slightly narrower than S1, each bearing a palus about twice the width of the P1; however, P2 often missing from some or all systems within a corallum. P1-2 form the innermost palar crown, their axial edges extending the same distance into the fossa. S3 less exsert (about 1.1 mm) but only slightly narrower than S2, also having sinuous axial edges. Each S3 bears a palus about the same width of the P1, but recessed from the columella and rising higher in fossa than P1-2, the 12 P3 forming outermost of 2 palar crowns. S4 equally as exsert as S3 but only about half the width, rudimentary lower in fossa. Fossa of moderate depth, containing a papillose columella composed of 6-10 irregularly shaped, crispate elements that are often loosely fused to one another.

Discussion: Although similar to *T. rawsonii*, *T. laboreli* differs in having a smaller, cornute, often free corallum with a slender, elongate pedicel. Because of its smaller size it has fewer septa and pali. *T. laboreli* is known only from the state of São Paulo, Brazil, whereas *T. rawsonii* has a more northerly distribution, known from throughout the Caribbean and southeastern US, with a southern limit of off Maranhão, Brazil (0°18'N, 44°17'W).

Etymology: This species is named for Jacques Laborel, who first implied that this species was undescribed, and who did much of the early work on Brazilian deep-water corals (Laborel 1967, 1970, 1971).

Types: IOSP stn 1, 2 specimens: holotype (USNM 99193), paratype (USNM 99194); WB-2, 4 paratypes, USNM 99197; WB-318, 3 paratypes, USNM 99196; WB-5148, 10 paratypes, MNRJ 2443; WB-5192, 3 paratypes, MNRJ 2451; WB-5366, 60. Paratypes: 40 (MNRJ 2439), 20 (USNM 99195). Type Locality: 24°20'S, 44°40'W (off Ilha de São Sebastião, Brazil), 130 m.

Distribution: Known from a relatively small region just south of Rio de Janeiro (Fig. 17); 130-240 m.

Genus **Paracyathus** Milne Edwards & Haime, 1848

Diagnosis: Corallum solitary; conical; fixed or free. Septotheca costate. Three to 5 cycles of septa; paliform lobes before all but last cycle of septa, the lobes often bi- or tri-lobed. Columella papillose, sometimes indistinguishable from lower, axial paliform lobes.

Type Species: *Paracyathus procumbens* Milne Edwards & Haime, 1848a, by subsequent designation (Milne Edwards & Haime 1850a: xv).

Paracyathus pulchellus (Philippi, 1842)

(Figs. 89-91)

Cyathina pulchellus Philippi, *1842: 42.

Paracyathus pulchellus. –Cairns, 1979: 88-90, pl. 16, figs. 1-4, 6, Map 20 (synonymy of western Atlantic records and description). –Zibrowius, v.1980: 90-93, pl. 44, figs. A-K, pl. 45, figs. A-L (synonymy of eastern Atlantic records and description). –Rezak et al., v.1985: 225 (listed: stn 113, Coffee Lump; stn 115, 128, Geyer Bank; stn 118, Diaphus Bank; stn 120, Sidner Bank; stn 122, Alderice Bank). –Not Hubbard & Wells, v.1986: 133 (=*Polycyathus senegalensis*). –?Estalella, 1987: 8, 13, figs. 3A-B. –Prahl & Erhardt, 1989: 545. –Cairns et al., 1991: 47. –Fenner, v.1993a: 12, 14 (listed). –Cairns et al. 1994: 4 (listed).

Paracyathus defilippi Duchassaing & Michelotti, v*1860: 60, pl. 9, figs. 2-3. –Cerame-Vivas & Gray, 1966: 263 (listed). –Avent, King & Gore, 1977: 200, fig. 111. –Castañares & Soto, 1982: Table 1 (listed).

Paracyathus confertus Pourtalès, v*1868: 134.

Diagnosis: Corallum variable in shape, ranging from cylindrical (with a polycyclic base) to trochoid; always attached. Largest known corallum (O-1493) 16.2 x 13.6 mm in CD, 16.3 mm in height, and 5.7 mm in PD. Costae well developed and granular. Upper theca and calicular elements usually pigmented light brown. Septa hexamerally arranged in 5 cycles, the fifth cycle never complete. Number of septa roughly a function of GCD, the largest corallum having 92 septa. Septal formula: S1-2>S3>S4>S5; however, there is little difference in width among the S3-S5, all septa being about equally exsert. Paliform lobes occur before all but last cycle of septa, and in some specimens occur before septa of the last cycle as well (Fig. 91). P1-

2 narrowest and lowest paliform lobes; P3-4 about twice as wide and rise progressively higher in fossa. All classes of paliform lobes (*i.e.,* P1-4) may occur in the single or multilobate condition, the latter state consisting of a septum bearing 2-5 small paliform lobes, the lowermost lobe merging with the columella. Columella consists of up to 60 close-set, slender (0.20-0.25 mm diameter) elements often arranged in an elliptical, slightly convex field.

Discussion: *Paracyathus pulchellus* is a very common and variable species found throughout the western Atlantic. It is more fully described and illustrated by CAIRNS (1979) and ZIBROWIUS (1980). It may be confused with *Polycyathus senegalensis,* as discussed in the account of that species. To reiterate, *P. pulchellus* differs in having a solitary corallum and in having approximately equally exsert septa, the pairs of septa adjacent to the S1-2 (*i.e.,* S4-5) of *P. senegalensis* forming exsert lancets. The species is known by the common name of the papillose cup coral (CAIRNS *et al.* 1991).

New Records: P-705, 2, USNM 99390; SB-1956, 1, USNM 99200; SB-1959, 8, USNM 99201; SB-2009, 1, USNM 99389; SB-2405, 1, USNM 61906; SB-2425, 2, USNM 61894; O-1493 (labelling error?), 1, USNM 61915; O-1494, 5, USNM 99391; Alb-2320, 2, USNM 16125; Alb-2322, 3, USNM 16129; Alb-2330, 1, USNM 16127; Alb-2331, 2, USNM 16126; Alb-2394, 1, USNM 10423; Alb-2651, 1, USNM 14605; Combat-90, 1, USNM 99392; GS (Geology)-5, 1, USNM 46166; GS (Geology)-44, 36, USNM 46165; GS (Geology)-71-5, 16, USNM 46167; GS (Geology)-71-6, 2, USNM 46169; JSL-I-2582, 6, USNM 87784; JSL-I-2586, 2, USNM 89351; Circé 28-2, 1, USNM 75658; Circé 30-1, 1, USNM 75663; Circé 81-3, 3, USNM 75667; Circé 83-1-F, 5, USNM 75674; BLM, LMRS, O-S01, 1, USNM 67851; BLM, LMRS, O-S03, 3, USNM 67852; BLM, LMRS, O-S05, 2, USNM 71666; BLM, LMRS, 1-579, 2, USNM 72395; BLM, SOFLA-32, 2+, USNM 72643; BLM, SOFLA-35, 1, USNM 72647; BLM, SOFLA-36, 10+, USNM 72652; BLM, SOFLA-38, 10+, USNM 72656; BLM, SOFLA-39, 8, USNM 72657; BLM James Island Area Block 198-2, 5+, USNM 75696; BLM James Island Area Block 380-3, 7, USNM 75727; BLM James Island Area Block 380-11, 10+, USNM 75698; Combat-457, 4, USNM 61906; Triton 553-56, 1, USNM 95498; CSA Pinnacle site 2, 1, CSA; CSA Pinnacle site 4, 1, CSA; CSA Pinnacle site 7, 1, CSA; CSA Pinnacle site 9, 4, CSA; Dry Tortugas, FL, 59-71 m, 1, USNM 81300; off Key West, FL, 150 m, 100+, USNM 61918; 25°16'23"N, 84°15'17"W, 159-166 m, 20, USNM 83449; Palancar

Reef, Cozumel, Mexico, 1, USNM 75167; Santa Marta, Colombia, 55 m, 3, USNM 80890; South of Castle Roads, Bermuda, 60-90 m, 1, USNM 61899; Mississippi Mud Lump 90 (TU 977), 15,500 BP, 1 May 1969, 8, USNM 99387.

Types: See CAIRNS (1979).

Distribution: Western Atlantic: widespread throughout Caribbean and Gulf of Mexico, ranging from Cape Lookout, NC (34°37'N, 75°44.4'W) to off Maranhão, Brazil (0°18'N, 44°23'W). Although the western Atlantic depth range for this species was stated to be 17-838 m (CAIRNS 1979: map 20), the deepest record of 838 m (based on BL-271) is probably an error, since almost all subsequent records of this species occur at depths of 50-250 m. Elsewhere: eastern Atlantic from Mediterranean and area bounded by Portugal, the Azores, and the Gulf of Guinea; 40-1260 m, but rare below 200 m (ZIBROWIUS 1980).

Genus **Polycyathus** Duncan, 1876

Diagnosis: Corallum colonial, cylindrical to slightly conical corallites budded from a common coenosteum or from stolons. Septotheca costate. Three to 4 cycles of septa; pali present before all but last cycle of septa; columella papillose.

Type Species: *Polycyathus atlanticus* Duncan, 1876, by monotypy.

Polycyathus senegalensis Chevalier, 1966

(Figs. 17, 92-95)

Polycyathus senegalensis Chevalier, v*1966a: 971-974, pl. 4, figs. 7-8, text-fig. 21. -Best, 1968: 72 (listed). -Patriti, 1970: 124. -Wijsman-Best, 1970: 83-84. -Zibrowius, 1980: 94. -Hubbard & Wells, v.1986: 133-134, figs. 21-22. -Cairns et al., 1994: 7.

Polycyathus mullerae. -Hubbard & Wells, v.1986: 134, figs. 23-24. [Not *Polycyathus muellerae* (Abel, 1959)]

Paracyathus pulchellus. -Cairns, 1979: 88-90, pl. 16, fig. 5 (in part: P-650, 705, 707, 708, 709, 769). -Hubbard & Wells, v.1986: 133. [Not *Cyathina pulchellus* Philippi, 1842]

Description: Corallites bud from a common, continuous, thick (up to

1.5 mm) coenosteum as well as perpendicularly from lower half of theca of various corallites, the latter buds often deformed or stunted in growth because of proximity to other corallites. Coralla often encrust cylindrical objects such as antipatharian and gorgonian axes, or attach to rocks and shells. Corallites increase in diameter with height, the largest corallite up to 10.5 mm in GCD and 19 mm in height. Costae variable, often low and only slightly convex, covered with 3-5 small granules across their width and separated by narrow, shallow intercostal striae, but may also be ridged with intercostal regions equal in width to costae. Costae rarely extend to intercorallite coenosteum but granules usually present in this region. Basal coenosteum white, this colour gradually changing to light brown towards calicular edge; septa also light brown, but pali and columella white.

Septa hexamerally arranged in 4 to 5 cycles, a full fifth cycle never attained: corallites having a GCD of 2-3 mm have 24 septa, whereas 48 septa are present by a GCD of 6 mm, and the largest corallites have as many as 66 septa. S1 about 1.2 mm exsert, with straight, vertical axial edges that are slightly concave near the columella, in order to accommodate a thick, slender (0.40-0.45 mm wide), vertically oriented palus. S2 equally exsert but only about ¾ width of S1, each S2 also having a straight, thickened axial edge that bears a wider (0.60 mm), thick palus, the P2 rising slightly higher and being slightly more recessed farther from the fossa than the P1. S3 about 1 mm exsert and ¾ width of S2, each bearing a wide (0.6-0.7 mm), thick palus that rises even higher and is recessed from columella than the P2. P3 bear obliquely oriented ridges making them appear quite thick; their axial edges are often dissected into 2 or 3 additional lobes. S4 equally exsert as S3, each pair of S4 fused with their adjacent S1 or S2 at calicular edge, forming a lancetted calicular margin. Those S4 adjacent to S1 slightly wider than S3, whereas S4 adjacent to S2 slightly less wide than S3. When present, pairs of S5 usually confer an irregular outline to calicular perimeter, the S5 adjacent to the S1 or S2 being slightly more wide than an S4, the other S5 adjacent to the S3 being slightly narrower than an S4. Pairs of S5 within a half-system accompanied by presence of P4. Fossa deep and steep-sided, the vertical axial edges of the palar crown forming an inner fossa within which the papillose columella sits. Columellar elements large (0.4-0.5 mm in diameter), irregularly shaped, and finely granular. Columella usually consists of 12-18 elements, which are often laterally fused.

Discussion: HUBBARD & WELLS (1986:134) characterized *Polycyathus senegalensis* as a "quasicolonial *Paracyathus pulchellus* with smaller corallites". It is true that these species are very similar, and both HUBBARD & WELLS (1986) and I (CAIRNS 1979) have confused *P. senegalensis* with *P. pulchellus.* The main difference between the two species is that *P. senegalensis* forms a true colony (not a quasicolony) by budding from a common basal coenosteum, whereas *Paracyathus pulchellus* is solitary. Even closely settled *Paracyathus pulchellus,* which may resemble a bushy colony, can be distinguished because each individual has a discrete basal attachment. However, there are several other characters that serve to distinguish specimens that may have been broken from the substrate. *P. senegalensis* has larger and fewer columellar elements than *Paracyathus pulchellus*: 15-20 elements 0.4-0.5 mm in diameter vs a field of up to 50 elements 0.1-0.5 mm in diameter in *Paracyathus pulchellus.* Also the columellar elements of *P. senegalensis* are often fused laterally to other elements, have a more irregular shape, and are very finely dentate. Furthermore, the calicular edge of *P. senegalensis* is lancetted, that of *Paracyathus pulchellus* not; and the fossa of *P. senegalensis* is deeper and more steep-sided, that of *Paracyathus pulchellus* more open. Finally, as HUBBARD & WELLS (1986) implied, *Paracyathus pulchellus* may attain a larger size and thus contain more septa.

HUBBARD & WELLS (1986) also reported the Mediterranean species *Polycyathus mullerae (sic)* (ABEL 1959) from the same Trinidad localities as *P. senegalensis*, which they distinguished from *P. senegalensis* by having smaller, white corallites. However, it is not unusual for small corallites of *P. senegalensis* to be white (even large corallites from Alb-2120 are white), and the small corallites of their *P. muellerae* are very similar to juvenile corallites growing from the base of their figured specimen of *P. senegalensis.* I have therefore reidentified their specimens of *P. muellerae* as *P. senegalensis.* They are nonetheless very similar to the Mediterranean *P. muellerae,* but may be distinguished by their lancetted calicular margin, larger columellar elements, and more robust pali.

Two colonies from off Guyana (P-691 and Chain 35-39) contain several lenticular-shaped acrothoracican cirripede borings (Fig. 95).

New Records: P-650, 18 corallites, USNM 46156; P-691, 3 colonies, USNM 80241; P-705, 1 colony, USNM 80242; P-707, 3 colonies, USNM 46159; P-708, 1 colony, USNM 46129; P-709, 3 corallites, USNM 46128; P-769, 1 corallite, USNM 46160; SB-2008, 1 colony, USNM 77718; Alb-2120, 4 corallites, USNM 7598; Eastward-10868, 2 colonies, USNM 85439; Eastward-10881, 1 colony, USNM 85438; Chain 35-20, 20 colony fragments, USNM 99205; Chain 35-35, 1 colony, USNM 80415; Chain 35-36, 10 colony fragments, USNM 80416; Albatross III, 29 km off Cape Lookout, NC, 54 m, 1 colony, USNM 99204; Combat-90, 1 colony, USNM 99206; BLM, James Island Area Block 380-4, 4 colonies, USNM 75697; BLM, James Island Area Block 380-11, 4 colonies, USNM 99207; BLM, James Island Area Block 463-19, 1 corallite, USNM 97328; CSA 1347-1, 1, CSA; CSA 1347-2, 1, CSA; off Cape Canaveral, FL, 74-78 m, 1 colony, USNM 85440; 7°17.8'N, 54°04.0'W, 90-100 m, 1 colony, NNM Coel. 16248.

Types: The holotype and paratypes of *P. senegalensis* are deposited at the MNHN, Paris. Type Locality: 'region of Dakar', Senegal.

Distribution: Western Atlantic: Disjunct distribution, most records from Gulf of Paria, Venezuela to French Guiana (also Península de la Guajira, Colombia), but isolated records from off Mobile, AL; Cape Canaveral, FL; off James I., SC/GA; and Cape Lookout, NC (Fig. 17); 12-143 m. The Floridian record mentioned by Hubbard & Wells (1986) are documented above as USNM 85438-40. Eastern Atlantic: Senegal, Morocco; 46-100 m.

Polycyathus mayae, new species

(Figs. 4, 96-101)

Description: Corallum consists of up to a dozen slender, subcylindrical to ceratoid corallites united basally by a thin continuous sheet of coenosteum (if corallites are closely spaced) or united by broad, thin stolons (if corallites are more widely spaced). Holotypic colony consists of three corallites, the tallest 8.5 mm, the smallest just a bud 0.5 mm in height. Corallites usually 8-10 mm in height, but some may be quite elongate (*e.g.*, Alb-2354), reaching up to 27 mm in height. Calice elliptical, most less than 4.0 mm in GCD but largest corallite (part of holotypic colony) 4.6 mm in GCD. Corallites gradually increase in diameter with height, often somewhat flared at calicular end. C1-2 prominent, often slightly ridged, extending ½ to ⅔ distance to basal coenosteum; C3 convex. Theca often glisteny and relatively smooth, bearing very low, polished granules; basal coenosteum smooth. Upper half of corallites usually a very light brown, whereas lower theca and coenosteum white.

Septa hexamerally arranged in 3 cycles (S1>S-3), larger corallites (*i.e.*, those over 4.0 mm GCD) also having 1 or 2 pairs of S4 (26-28 septa). Disposition of septa within elliptical calice somewhat unusual, in that the greater axis of the calicular ellipse passes through two opposing S2, not S1, as is typical in most Scleractinia, resulting in an apparent 30° rotation of the septa from the normal position. The elongate columella, however, is aligned with opposing S1, which places it 30° off-line from the greater calicular axis. S1 highly exsert (up to 1.4 mm) in relation to calicular diameter and relatively thick (about 0.4 mm) at calicular edge. Axial edges of S1 vertical and sinuous, in larger corallites bearing short carinae on their faces bordering the axial edge. S2 similar to S1 but less exsert (1.0-1.2 mm) and ¾ width of an S1, having a peripheral edge that projects slightly outside calicular margin. S3 also similar in shape to other septa, slightly less exsert (about 0.6 mm) but equally as wide as S2. When present, S4 less exsert than S3 but of equal width. Slender (0.20-0.25 mm), sinuous, ridged P1 border the 6 S1; broader (0.50 mm), also slender and ridged P2 border the 6 S2. These 12 pali form a single crown, positioned such that their axial edges are all at the same distance from the corallite centre, but the distal edges of the P2 rise slightly higher in the fossa than the P1. Fossa deep and narrow, containing an elongate, papillose columella composed of 2-10 irregularly shaped elements 0.15 mm in diameter.

Discussion: Of the 17 valid species of *Polycyathus*, *P. mayae* is most similar to *P. norfolkensis* Cairns, 1995 (Norfolk Island, 10-20 m), one of 3 species having only, or predominantly, 3 cycles of septa. Both species also have a single crown of dimorphic pali, the same relative septal sizes, and approximately the same size corallites. *P. mayae* differs in having more exsert S1 with more sinuous axial edges, thicker and more columellar elements, and an off-centre alignment of septa and columella in relation to its calicular ellipse.

Etymology: This species is named for MAYA BOREL BEST (NNM), in recognition of her work with the species of the genus *Polycyathus*.

Types: Holotype: P-1143, colony of 3 corallites, USNM 99214. Paratypes: P-1303, 1 corallite, USNM 99215; P-1411, 1 corallite, USNM 99210; G-984, 1 corallite, USNM 99213; Alb-2161, 2 colonies, USNM 16131; Alb-2331, 1 corallite, USNM 99236; Alb-2354, 1 colony and 4 corallites, USNM 16116; Gos-39, 1 corallite, USNM 83467; Nekton (gamma) 232, 9 corallites, USNM 99212; Nekton (gamma) 244, 2 corallites, USNM 99216; JSL-I-3659, 1 colony, USNM 94763; JSL-II-3005, 18 corallites, USNM 99209; Endeavor-1, 10 corallites, USNM 77431; B-A DS9, 1 colony, NNM Coel. 23394; Bahia de Cochinos, Cuba, 182-274 m, 10 corallites, USNM 99208; Discovery Bay, 183 m, corallum with 11 corallites, USNM 99237; Barbados, 137 m, 2 colonies, USNM 99211. Type Locality: 20°54.5'N, 73°28.2'W (south of Great Inagua, Bahamas), 110-220 m.

Distribution: Antillean distribution from Arrowsmith Bank and Bahamas through the Antilles to Barbados (Fig. 4); 137-309 m.

Genus **Cladocora** Ehrenberg, 1834

Diagnosis: Bushy to irregularly-shaped coralla formed by extratentacular budding. Septotheca costate. Septa in 3-4 cycles; small paliform lobes before septa of all but last cycle. Columella papillose.

Type species: *Madrepora caespitosa* Linnaeus, 1767, by subsequent designation (MILNE EDWARDS & HAIME 1850a: xxxviii).

Discussion: The genus *Cladocora* is herein transferred from the family Faviidae to Caryophylliidae based on its morphological resemblance to genera such as *Polycyathus* and *Paracyathus*, a clade that is strongly supported by molecular analysis of the mitochondrial 16S and nuclear 28S ribosomal genes (ROMANO, *pers. comm.* 1997-8).

Cladocora debilis Milne Edwards & Haime, 1849

(Figs. 18, 102-107)

Cladocora debilis Milne Edwards & Haime, v*1849b: 308. –Pourtalès, v.1871: 30; v.1878: 205. –Moseley, v.1881: 184-185. –Not Vaughan, v.1901: 298 (=*Oculina* sp.). –Not Durham & Barnard, v.1952: 58 (=*C. pacifica* Cairns, 1991a). –Tommasi, 1970: 56, figs. 5d, 6a. –Leite & Tommasi, 1976: 101, fig. 2.BAvent, King & Gore, 1977: 200, fig. 11m. –Cairns, 1978a: 10

(listed); 1979: 207 (listed). –Zibrowius, v.1980: 31-33, pl. 11, figs. A-L (description, synonym of eastern Atlantic records). –Zlatarski, 1982: 116. –Hubbard & Wells, v.1986: 125-126, figs. 4-5 (see Discussion: sympodial form). –Cairns, 1991: 6-7. –Cairns et al., 1991: 46 (common name). –Not Humann, v.1993: 96-97, colour fig. (=*C. arbuscula*). –Cairns et al., 1994: 6. –Pires, 1997: 182.

Cladocora patriarca Pourtalès, v*1874: 42, pl. 7, fig. 7.

Cladocora paulmayeri Döderlein, *1913: 137, pl. 9, figs. 66-69b.

Cladocora coespidosa (sic). –Cerame-Vivas, 1966: 263 (listed).

Cladocora arbuscula. –Tommasi, 1970: 56, figs. 5-6. [Not *Cladocora arbuscula* (Lesueur, 1821]

Cladora (sic) debilis. –Zibrowius, 1988: 135 (listed).

Description: Corallum usually composed of 1 or 2 axial corallites, from which secondary corallites branch at right angle, and occasionally tertiary corallites from the secondaries. Secondary corallites often occur in pairs on opposite sides of primary corallite, sometimes resulting in a uniplanar colony with the longer secondary corallites progressively farther away from the calice of the primary corallite (Fig. 103; see also TOMMASI 1970: fig. 6a). However, beyond about 2-3 cm from the calice of the primary corallite, secondary corallites are often broken, resulting in short calicular nubs on the proximal parts of the primary corallite. Detached secondary corallites probably form new coralla, sometimes growing from both the calicular end and the broken proximal end, thus becoming a bipolar branch. Bipolar coralla are rare, however, because the broken ends of corallites and the proximal branches of intact colonies are usually quickly and completely encrusted with calcareous algae, bryozoans, barnacles, and serpulids. Primary and secondary corallites straight to slightly curved or bent; tertiary corallites usually short and straight. Branching not crowded and thus there is no branch anastomosis. Coralla recumbent, rarely collected attached to substrate. Coralla delicate and relatively small (usually less then 4 cm in height); however, some robust coralla from St. Peter and St. Paul Rocks (Chain 36-16) up to 7 cm in length and 5.4 mm in GCD. Corallites small, usually 2.8-3.8 mm in GCD, except for the robust colonies from St. Peter and St. Paul Rocks; branches cylindrical and of same diameter as calices, decreasing in diameter away from calice. C1-3 slightly convex or rarely ridged, and finely granular. Coenosteum light brown or white.

Septa hexamerally arranged usually in 3 cycles (S1>S2>S3), larger corallites with additional pairs of S4 up to 36 septa. S1 only slightly exsert (0.4-0.5 mm), having straight smooth axial edges, each bearing a discrete, narrow paliform lobe. S2 only slightly narrower and less exsert than S1, each bearing a paliform lobe of equal width but taller than the P1, all 12 forming a single palar crown. S3 slightly narrower and less exsert than S2. Fossa of moderate depth, containing a columella consisting of 5-8 discrete papillose elements.

Discussion: Although ZLATARSKI (1982) synonymised *C. debilis* with the more commonly collected, shallow-water *C. arbuscula*, there seem to be numerous differences between these two species aside from their bathymetric ranges. Most significantly, *C. debilis* has well-formed, discrete paliform lobes (P1-2) that form a single palar crown, whereas the S1-2 axial edges of *C. arbuscula* bear a series of small paliform teeth, not formed into a crown. The columellar elements of *C. debilis* are also much better formed and discrete. Furthermore, the colonies of *C. debilis* are small, sparsely branched, and irregular in shape (often uniplanar), whereas those of *C. arbuscula* are larger, densely branched in three dimensions, often resulting in a small bush. Also, there are usually 36 or less septa in a corallites of *C. debilis*, 36 or more in those of *C. arbuscula*. The corallites and branch diameters of *C. debilis* are usually smaller than those of *C. arbuscula*; however, equally robust colonies of *C. debilis* are known from St. Paul Rocks. Finally, *C. debilis* is considered to be an azooxanthellate species (ZIBROWIUS 1980) with a depth range of 32-480 m, whereas *C. arbuscula* is a zooxanthellate species having a shallower bathymetric range of 0.5-27 m (Cairns, 1982b). HUMANN's (1993) colour illustration of a *C. debilis* (USNM 92283, Jupiter Inlet, FL, 27 m) with the typical brown zooxanthellae pigmentation, is considered to be a deep water form of *C. arbuscula*.

Indeed, *C. debilis* is more similar to *C. pacifica* Cairns, 1991, a species described from the Galápagos and Cocos Islands (45-274 m), specimens of the Pacific species being almost indistinguishable from the robust form of *C. debilis* from St. Paul Rocks.

The specimens reported as *C. debilis* from Trinidad by HUBBARD & WELLS (1986) differ strikingly in growth form, each newly budded corallite curving 90°-180° downward before budding the next generation corallite(s) from its upper, convex thecal edge, sometimes forming up to 6 successive generations in this manner. This branching pattern not only produces a differently shaped corallum from *C. debilis* but one that lacks axial corallites, which distinguishes it from both *C. debilis* and *C. arbuscula*. Furthermore, its S3 bend toward and often fuse to their adjacent S2, a trait not seen in the other Caribbean *Cladocora.* On the other hand, the morphology of its septa, pali, and columella are more typical of *C. arbuscula.* Additional specimens of this phenotype, herein termed the 'sympodial form' of *C. debilis,* are known from P-705 (UMML 8.588), P-710 (USNM 62358), P-721 (UMML 8.1428), P-761 (USNM 62362), and P-778 (UMML 8.590), making its range the southern Caribbean from Península de Guajira, Colombia to the Gulf of Paria, Venezuela at depths of 9-81 m, a range that bridges the depth ranges of *C. debilis* and *C. arbuscula.* This peculiar, sympodially branched *Cladocora* is yet another example of the unique nature of the coral fauna of the southeastern Caribbean and may even represent an undescribed species.

The common name of *C. debilis* is the 'thin tube coral' (CAIRNS *et al.* 1991).

New Records: Alb-2316, 1 branch, USNM 36543; Alb-2317, 10 branches, USNM 16123-24; Alb-2336, 1 branch, USNM 80171; Alb-2405, 100+ branches, USNM 10452; Alb-2406, 4 branches, USNM 10462; O-3603, 1 branch, USNM 88856; O-3704, 10+ fragments, USNM 62344; O-4459, 3 branches, USNM 99219; O-5699, 1 branch, USNM 99378; SB-48, 6 fragments, USNM 99379; SB-1515, 2 branches, USNM 88853; SB-2368, 1 branch, USNM 88854; SB-4122, 2 branches, USNM 88855; P-112, 1 branch, USNM 62342; P-392, 1 branch, USNM 62349; P-624, 11 branches, UMML 8.593; P-707, 10 branches, USNM 62347; P-708, 10+ branches, USNM 62359; P-709, 10+ branches, USNM 62367; P-718, 5 branches, USNM 62343; P-727, 1 branch, USNM 62341; P-728, 4 branches, USNM 62350; P-734, 5 branches, USNM 62369; P-737, 5 branches, UMML 8.226; P-749, 2 branches, USNM 62351; P-759, 2 branches, USNM 62353; P-768, 20+ branches: USNM 62363 and UMML 8.342; P-772, 4 branches, USNM 62368; P-773, 9 branches, USNM 62352; P-775, 3 branches, USNM 62356; P-1369, 1 branch, UMML 8.604; G-602, 1 branch, USNM 62360; G-613, 1 branch, UMML 8.601; G-1086, 1 branch, UMML 8.581; Gos-1533, 3 branches, USNM 62346; Gos-1575, 1 branch, USNM 62367; Gos-1738, 1 branch, USNM 62354; Gos-1774, 8 branches, USNM 62364; Gos-1857, 4 branches, USNM 62366; Gos-1860, 7 branches, USNM 62355, 62365; BLM, SOFLA-7, 3 branches, USNM 86737; BLM, James Island Area Block 380-4, 4 fragments, USNM 75722; BLM, James Island Area Block 380-7, 7 fragments, USNM 75725; BLM, James Island Area Block 463-21, 1 branch, USNM 75723; BLM, LMRS O-S03, 20+ branches, USNM 67846-48, 68415; BLM, O-S06, 1 branch, USNM 88111; BLM, LMRS, 1-580, 1 branch, USNM 72389; Chain 35-15, 50+ branches, USNM 80813; Chain 35-16, 50+ branches, USNM 80814; WB-2, 1 branch, USNM 62360; WB-379, 10+ fragments, USNM 62370; BL-2, 2 fragments, USNM 5866; Delaware II-131, 10 branches, USNM 84404; Atlantis, 12°14'N, 70°20'W, 73 m, 10 XI 1958, 3 branches, USNM 80199; CSA 1347-1, 1, CSA; CSA 1347-2, 2, CSA; off Fowey Rocks, Biscayne Bay, FL, 25 branches, USNM 80431, 80456, 80458, 80460; Sand Key, FL, 73 m, 13 branches, USNM 80429; off Alligator Light, FL, 182-213 m, 8 branches, USNM 83080; Mississippi Mud Lump 90, 10+ fragments, USNM 83081; Mississippi Mud Lump 90 (TU 977), 15,500 BP, 1 May 1969, 50 fragments, USNM 99385.

Types: Four syntype branches of *C. debilis* are deposited at the BM (1974.6.15.2) (see ZIBROWIUS 1980). Type Locality: Madeira.

Syntypes of *C. patriarca* are deposited at the MCZ: 6 branch fragments (MCZ 5448) and 3 branch fragments (MCZ 2779). Type Locality: Cabo Frio, Brazil; 64 m.

Some syntypes of *C. paulmayeri* are deposited at the Stazione Zoologica Naples (#799) (see ZIBROWIUS 1980). Type Locality: Gulf of Naples.

Distribution: Western Atlantic: a disjunct distribution in four ranges: 1) off Cape Hatteras, NC (35°08'N, 75°08'W) to the Mississippi Delta; 2) southern Caribbean coast from south of Roatán, Honduras to Gulf of Paria, Venezuela; 3) southern coast of Brazil from Cabo Frio (23°S) to Rio Grande do Sul (34°35'S) (LEITE & TOMMASI 1976); and 4) St. Paul Rocks (Fig. 18); 32-480 m, but most records reported herein from 50-100 m. MOSELEY's (1881) record of *C. debilis* from off Rio de la Plata at 1097 m (Challenger-310) is probably a station error, as he implied. Likewise, his record of *C. arbuscula* from 795 m off Bermuda (Challenger-33) is probably also a station error. *C. debilis* has never been collected subsequently from those great depths. Elsewhere: eastern Atlantic from Mediterranean, off Morocco, Gulf of Guinea, Madeira, Canary Islands, Cape Verde, Ascension, and St. Helena; 28-100 m (ZIBROWIUS 1980).

The westernmost record in the Gulf of Mexico is from Mississippi Mud Lump 90, which occurs at 28°58'30"N, 89°09'40"W and was dated at approximately 15,500 yrs BP, or near the Holocene-Pleistocene boundary (HAMAN 1981). Other organisms collected from this lump indicated its origin to be the outer shelf at depths of 30-110 m, which is consistent with the depth range of Recent *C. debilis*.

Deltocyathus Milne Edwards & Haime, 1848

Diagnosis: Solitary, discoidal to patellate, usually free. Septotheca costate. Septa in 4-5 cycles, only the S1 being independent. Pali before septa of all but last cycle, the axial edges of higher cycle pali joining to faces of adjacent septa. Columella papillose.

Type Species: *Turbinolia italica* Michelotti, 1838, by monotypy.

Deltocyathus calcar Pourtalès, 1874

Deltocyathus agassizii variety *calcar* Pourtalès, v*1874: 35-36, pl. 6, fig. 11. [Not *D. agassizii* Pourtalès, 1867]
Deltocyathus calcar. –Cairns, 1979: 93-95, pl. 17, figs. 7-10, pl. 18, fig. 7, Map 22 (description and synonymy). –Viada & Cairns, 1987: 132. –Zibrowius, 1988: 135 (listed). –Prahl & Erhardt, 1989: 545. –Cairns et al., 1991: 47 (common name). –Cairns et al., 1994: 4 (listed). –Pires, 1997: 182.

Diagnosis: Corallum free, having no basal scar; corallum discoidal (flat base) to patellate (conical base); largest known corallum (O-4832) 16.1 mm in diameter, exclusive of costal spines. C1 twice as broad as other costae, usually bearing a prominent spine that may project up to the length of the calicular radius beyond calicular edge, the 6 C1 spines producing a distinctive stellate pattern. Costal spines of some specimens lacking or vestigially present only as small spurs on base of corallum, but invariably C1 are thicker than other costae. Costae well-delineated; costae and costal spines finely granular. Corallum white, but all or part of S2 and C2 usually dark brown. Septa hexamerally arranged in 4 cycles: S1-2>S3-4, S1 being the only independent septa. Axial edges of S4 join to S3 through several thin processes below the S3-P3 notch. Although all pali are about the same width, each successive crown is more recessed from the columella and rises higher in the fossa. Palar faces bear tall granules. Columella papillose, the papillae sometimes spatulate and aligned in series with each S2.

Discussion: The only substantive records of this species since 1979 are those of VIADA & CAIRNS (1987) and PIRES (1997). Those reports, as well as the records listed below, do not appreciably add to our knowledge of this species except to extend the known range of the species to southeastern Louisiana (VIADA & CAIRNS 1987) and the Netherlands Antilles (Alpha Helix-16). Most records of *D. calcar* are from depths greater than 200 m, but about 20% of collections are from shallower depths, the shallowest record being 81 m (SB-50).

The common name of *D. calcar* is the 'deep-sea star coral' (CAIRNS *et al.* 1991).

New Records: Endeavor-1, 19, USNM 77435; R/V Alpha Helix-16, 1, USNM 79507; Gos-39, 1, USNM 81023; EJ81-9, 4, FSBC I; EJ81-20, 1, FSBC I; EJ81-22, about 100: 93 (FSBC I) and 7 (USNM 88392); BLM, SOFLA-32, 5, USNM 72011-12; R/V Cape Florida, 27°31'N, 79°15'W, 350-400 m, 6, USNM 73918.

Types: See CAIRNS (1979).

Distribution: Common throughout tropical and warm temperate western Atlantic, from off Onslow Bay, NC (33°39'N, 76°44'W) to off São Sebastião Island, Brazil (25°15'S, 44°00'W), including Bermuda, the Bahamas, eastern Gulf of Mexico, and the Caribbean (CAIRNS 1979: map 22); 81-675 m.

Deltocyathus halianthus (Lindström, 1877), new combination

(Figs. 20, 108-112)

Leptocyathus ? halianthus Lindström, v*1877: 9-10, pl. 1, fig. 9. –Duncan, 1883: 364. –Lindström, 1884: 104.
Trochocyathus sp. Tommasi, 1969: 56 (in part: fig. 3).
Trochocyathus halianthus. –Cairns, 1979: 207 (listed).

Description: Corallum tympanoid, having a HT:GCD ratio of 0.3-0.5, and firmly attached by a polycyclic base of up to 5 cycles. Initial thecal wall only 1 mm in diameter, containing the first 2 cycles of septa; second ring formed at a diameter of about 3 mm, containing the third and sometimes fourth septal cycles; fourth thecal ring added at about 6 mm and contains all 4 cycles; a fifth ring is sometimes found in larger coralla. These successive thecal rings appear to serve the same interseptal strengthening function as synapticulae do in other corals. Coralla attach primarily to bivalve shells, but are also known to attach to gastropod shells and small bryozoan colonies. When the substrate is large, the corallum expands equally in all directions resulting in a cylindrical corallum, but if the substrate is small, the coral may completely envelope it and then expand outward, resulting in a trochoid-shaped corallum. Largest known corallum (illustrated syntype; Figs. 108-109) 10.7 mm in CD and 4.7 mm in height. Costae well defined, separated by deep intercostal furrows, each costa ornamented with a single row of small teeth, not unlike the costae of some turbinoliids; corallum uniformly white.

Septa hexamerally arranged in 4 complete cycles: S1>S2>S3>S4, S1 being the only independent septa. S1 1.5 mm exsert and quite broad, the tallest region of the S1 being its upper, axial edge. Upper and peripheral edges of S1 finely serrate; axial edge smooth, straight, and vertical, bordered internally by a small palus 0.2-0.4 mm in width, often indistinguishable from columellar elements. S2 similar to S1 but only about ¾ as wide, each bearing a palus about twice the width of a P1. Axial edges of both P1 and P2 contiguous with columella. S3 about ⅘ width of S2, each S3 usually having a small P3 about the same size of a P1, the axial edges of which are fused to the peripheral edges of its adjacent P2. S4 half width of S3, the axial edges of each pair of S4 fusing to its adjacent S3 through 2 or 3 digitiform processes far below the S3-P3 notch. Fossa shallow; columella papillose, consisting of 7-25 well-formed, granular pillars.

Discussion: In an acrimonious exchange between Duncan (1883) and Lindström (1884), Duncan queried the generic placement of *L. halianthus*, as well as questioned aspects of Lindström's (1877) original description. Lindström (1877: 9) reported this species to have columellar elements with a "semblance of paluli". According to Duncan, if this species had pali it should be classified as a *Trochocyathus*, and if lacking pali, as *Sabinotrochus* (=*Stephanotrochus*). Apparently Duncan did not examine Lindström's material. Ironically, Lindström (1884) responded that *L. halianthus* had no pali, but that it resembled a variety of *Deltocyathus agassizi*. Having examined the syntype series and additional material, I conclude that *L. halianthus* does have pali (P1-3), although the P1 and P3 are sometimes not well developed and may resemble columellar rods instead of the more typical palar lamellae. These pali are well illustrated by TOMMASI (1969: fig. 3). *Trochocyathus* and *Deltocyathus* are similar genera, both having pali before all but the last cycle of septa, but *Deltocyathus* always has P3 fused (in chevrons) to P2, S4 fused to P3 or S3, and a low (tympanoid/discoidal), unattached corallum. In these characters, *L. halianthus* resembles *Deltocyathus*, except that it has an attached, polycyclic base, which would make it unique in the genus. Also unique is its serrate upper margin of the S1. Both of these characters, as well as its shallow depth range, suggest an affinity with the rhizangiids. This species is one that would benefit from molecular analysis for correct familial placement and a final conclusion of the old argument between DUNCAN and LINDSTRÖM, but at present, I tend to agree with LINDSTRÖM (1884) that this species is a polycyclic *Deltocyathus*.

New Records: Alb-2762, 11, USNM 36473; WB-6, 6, USNM 62303; WB-302, 16: 15 (USNM 62302) and 1 (UMML 8.245).

Types: Seven coralla (syntypes) attached to 6 bivalve shells are deposited at the Swedish Museum of Natural History (#134). Type Locality: 22°47'S, 41°41'W (off Cabo Frio, Brazil), 55 m.

Distribution: Known only from off São Paulo, Brazil from off Cabo Frio to off Ilha de São Sebastião (Fig. 20); 46-130 m.

Genus **Desmophyllum** Ehrenberg, 1834

Diagnosis: Corallum solitary, trochoid, attached. Septothecate. Septa in 3-5 cycles. Pali absent; columella absent or quite reduced. Sparse endothecal dissepiments.

Type Species: *Madrepora dianthus* Esper, 1794, by subsequent designation (CAIRNS 1994).

Desmophyllum dianthus (Esper, 1794)

Madrepora dianthus Esper, *1794: pl. 69, figs. 1-3.
Desmophyllum cristagalli Milne Edwards & Haime, v*1848a: 253, pl. 7, figs. 10, 10a. -Jourdan, v.1895; 22. -Cairns, 1979: 117-119, pl. 21, figs. 7-8, pl. 22, fig. 8, Map 32 (description and synonymy). -Zibrowius, v.1980: 117-121, pl. 61, figs. A-O, pl. 62, figs. A-M (description and synonymy). -Cairns, 1981: 10. -Not Hubbard & Wells, 1986: v.136 (=*Javania cailleti*). -Messing, 1987: 12, fig. -Zibrowius, 1988: 136 (listed). -Cairns et al., 1991: 47 (listed).
Desmophyllum dianthus. -Cairns, 1994: 26-27, pl. 9, figs. a-d; 1995a: 77, pl. 21, figs. d-f.

Discussion: Although *D. dianthus* has been reported as shallow as 25 m in New Zealand fjords (CAIRNS 1995a) and at a range of 155-1939 m in the western Atlantic (CAIRNS 1979), the shallowest western Atlantic record is based on a specimen reported by JOURDAN (1895) from off Nova Scotia, all other records from the western Atlantic being much deeper than 200 m. The species is therefore not considered to be a true shallow-water azooxanthellate; nonetheless several additional records are reported below that extend the range of the species to Bermuda, and increase the western Atlantic bathymetric range to 2200 m. For a description of this commonly collected deep-water species see: CAIRNS (1979, 1982a, 1994, 1995a) and ZIBROWIUS (1980).

The other western Atlantic *Desmophyllum*, *D. striatum* Cairns, 1979, was listed in its original description to occur at 130-823 m. However, a reanalysis of the two records shallower than 200 m (Nekton-563 and P-1411) show the former to be *Thalamophyllia riisei* and the latter to be too small to confidently identify. Thus the revised depth range of *D. striatum* is 277-823 m, and is therefore not treated in this account.

New Records: Eastward-35948, 1, USNM 62311; Eastward-35985, 1, USNM 83001; Eastward-35992, 2, USNM 62312; Eastward-36023, 1, USNM 62309; Eastward-36259, 1, UCSC; Gos-2349, 1, USNM 77022; ASLAR, Oceanus-1, 2, USNM 78402; ASLAR, Oceanus (38°29'N, 73°01'W, 1990-2175 m), 1, USNM 78461; ASLAR, Gyre-4, 2, USNM 81407; ASLAR, Gyre-15, 1, USNM 81408; ASLAR, Gyre (34°13'N, 75°38'W, 1790-1880 m), 6, USNM 78463; Arctic Discoverer, 32°N, 77°W, 2200 m, 1, USNM 91933; 50°33'N, 46°11'36"W (Orphan Knoll, off Newfoundland, 29,270 yr BP), 1628 m, 3, USNM 86555; 44°52'N, 55°40'W, 162 m, 1, ROM; 44°52'N, 55°37'W, 458 m, 1, BM; off Bermuda, 457-609 m, 1, USNM 99383; off Bermuda, 1200 m, 1, USNM 83000; south of Dry Tortugas, FL, 1065 m, 3, USNM 80987.

Types: See CAIRNS (1979).

Distribution: Western Atlantic: common on seamounts and canyons off northeastern North America from east of Newfoundland to the Straits of Florida; Martinique; southeastern Brazil; not known from Gulf of Mexico and very few reports from Caribbean (CAIRNS 1979: map 32); 155-2200 m. Elsewhere: cosmopolitan, except off continental Antarctica; 25-2460 m (CAIRNS 1995a).

Genus **Thalamophyllia** Duchassaing, 1870

Diagnosis: Corallum colonial, forming reptoid colonies by extratentacular budding from stolons and occasionally from theca of parent corallites. Corallites ceratoid to cylindrical. Septothecate. Pali and columella absent.

Type Species: *Desmophyllum rusei* Duchassaing, 1860, by monotypy.

Thalamophyllia riisei (Duchassaing & Michelotti, 1860)

(Fig. 113)

Desmophyllum Rusei Duchassaing & Michelotti, *1860: 61, pl. 9, fig. 5.
Thalamophyllia riisei. –Duchassaing, 1870: 28. –Cairns, 1979: 121-123, Map 33 (description and synonymy; but not G-103, =*L. prolifera*). –Wood, 1983: 63, 120 (colour. fig.). –Hubbard & Wells, v.1986: 136-138, figs. 27-28. –Viada & Cairns, 1987: 132. –Messing, 1987: 12, 2 figs. –Humann, v.1993: 160-161, colour fig. –Fenner, v.1993a: 14 (listed). –Cairns et al., 1994: 9. –Bayer & Grasshoff, 1997: 11-12 (nomenclature comment).
Desmophyllum rusei. –Keith & Weber, v.1970: 271.
Desmophyllum riisei. –Colin, 1978: 289 (colour fig.), 290-291. –Castañares & Soto, 1982: Table 1 (listed).
Desmophyllum striatum Cairns, *1979: 121 (in part: Nekton-563).
Desmophyllum reesei (sic). –Bouchon & Laborel, 1986: 204 (listed).

Diagnosis: Corallum consists of up to 25 corallites usually connected basally by thin, delicate stolons; less frequently united by a contiguous basal coenosteum; and in rare cases corallites are budded from theca of parent corallites up to a fourth generation (see HUBBARD & WELLS 1986: fig. 27). Corallites ceratoid to cylindrical, with a narrow pedicel and flared calice. Largest corallite 13 x 11 mm in CD and 19.2 mm in height. C1-2 highly ridged; C3-4 usually broader and not ridged. Corallum white. Septa hexamerally arranged in 4 cycles (S1>S2>S3>S4), but fourth cycle never complete, 42 septa being the highest septal complement observed. S1 highly exsert, with straight, vertical axial edges that almost meet in centre of fossa. In the '*solidum*' form of the species, highest cycle septa (*i.e.*, S3 or S4) are least exsert but thickest septa, with corresponding wide costae, as much as twice the thickness of other septa. In the typical form, the highest cycle septa are the same thickness as all others and rather rudimentary. Fossa deep and narrow; no columella.

Discussion: *Thalamophyllia riisei* differs from *T. gombergi* by its highly exsert septa, thinner theca, ceratoid coralla, and ridged costae. Although CAIRNS (1979) listed 155-220 m as the depth range for *T. gombergi*, the confirmed depth range (a conservative adjustment for bathymetrically wide ranging trawls) is actually 188-220 m, and therefore *T. gombergi* is not treated in this paper. Individual corallites of *T. riisei* are similar in size and shape to *Desmophyllum striatum*, as noted by CAIRNS (1979), both species sometimes collected at the same station. *T. riisei* is distinguished by its vertical axial septal edges (no paliform lobes), more highly exsert septa, costate (not transversely ridged) theca, narrower pedicel, and stoloniferous growth form.

The unusual growth form of *T. riisei* illustrated by HUBBARD & WELLS (1986)(see also Fig. 113), characterized by several generations of buds originating from parent corallites instead of a basal stolon, produces an irregularly bushy corallum instead of a stoloniferous mat. This is but one example of the unusual fauna reported by HUBBARD & WELLS (1986) from Trinidad (see Historical Resume).

The bathymetric range of 18-1317 m reported by CAIRNS (1979) is herein modified to 4-914 m. The deepest record of 1317 m (CI-158) was based on a long-dead specimen and is therefore not reliable as a bathymetric record, and another deep record of 824 m (G-103) is reidentified as *L. prolifera*. However, there remain several deep records of the species (*i.e.*, 914 m off Golding Cay and 640 m from O-4297), although most records of this species are known from shallower than 200 m. The shallowest record of 4 m from Chankanaab Caves is, however, 27 m from a cave entrance. In fact, this species is most commonly found on the ceilings of caves and on the undersides of dead, platy corals. The geographic range of the species is not significantly extended by these new records.

The polyps of this species are reported to be lavender, white, pink, pale green, and purple; its common name is the 'baroque cave coral' (HUMAN 1993).

New Records: BL-296, 1 colony, USNM 6417; SB-437, 10 corallites, UMML; O-3494, 2, USNM 99220; Eastward-19497, 1, USNM 99225; Endeavor-1, 2, USNM 77433; JSL-I-1332, 3, IRCZM; JSL-I-1495, 1, IRCZM; JSL-I-2585, 1, USNM 89361; JSL-I-3618, 3, USNM 93949; JSL-I-3659, 1, USNM 94747; JSL-I-3660, 4, USNM 94743; Chankanaab Caves, Cozumel, Mexico, 4 m, 2 colonies, USNM 73915; Palancar Reef, Cozumel, Mexico, 1, USNM 77655; 16°48'N, 88°04'W, 128 m, 10, USNM 99223; Bahia Cochinos, Cuba, 183-274 m, 15, USNM 61797; DBL-1312, Discovery Bay, Jamaica, depth unknown, 1, USNM 80980; Discovery Bay, Jamaica, 183 m, 1 large colony, USNM 93183.

Types: See CAIRNS (1979).

Distribution: Antillean Distribution: throughout Bahamas and Caribbean, but not northern coast of South America; Panama; Gulf of Mexico (off LA, MS; Campeche Bank); northeastern South America from Trinidad to Suriname; 4-914 m (CAIRNS 1979: map 33);

Genus **Lophelia** Milne Edwards & Haime, 1849

Diagnosis: Colonial, forming large dendroid colonies by intratentacular budding. Coenosteum dense; costae poorly developed. Pali absent; columella absent or rudimentary. Sparse endothecal dissepiments.

Type Species: *Madrepora prolifera* Pallas, 1766 (=*L. pertusa* L., 1758), by subsequent designation (MILNE EDWARDS & HAIME 1850a: xx).

Lophelia pertusa (Linnaeus, 1758)

Madrepora pertusa Linnaeus, *1758: 797.
Madrepora prolifera Pallas, *1766: 307.
Lophohelia oculifera Whiteaves, 1901: 42 (*nomen nudum*).
Lophelia prolifera. –Cairns, 1979: 125-127, pl. 24, figs. 1-5, Map 34 (description and synonymy); 1981: 10. –Viada & Cairns, 1987: 132. –Zibrowius, 1988: 136 (listed). –Prahl & Erhardt, 1989: 547. –Cairns et al., 1991: 47 (listed). –Cairns et al., 1994: 4 (listed).

Lophelia pertusa. –Zibrowius, v.1980: 126-130, pl. 66, figs. A-L (description and synonymy). –Cairns, 1994: 27-28, pl. 9, figs. e-i.

Diagnosis: Corallum forms a bushy colony up to a meter in height, often with anastomosing branches. Corallites on distal branches sympodially arranged; those on proximal branches less regularly arranged. Great variation in branching pattern and corallite size, ranging from delicate branches with small, widely-spaced corallites to robust branches, with large, closely-spaced, thick-walled corallites. GCD range from 5-20 mm. Coenosteum bears fine granules producing a smooth texture; corallum white. Septa arranged in 3 cycles of non-hexamerally arranged septa: usually 7-9 primary septa, 7-9 secondaries, and 14-18 tertiary septa, although a full complement of tertiary septa is rarely achieved. Septa of each cycle progressively less exsert. Fossa deep and often curved. Columella usually absent, but may be present as 1-3 small rods.

Discussion: *Lophelia pertusa* is rarely reported in waters shallower than 300 m in the western Atlantic, most specimens having been collected from 500-800 m. The shallowest western Atlantic record of 95 m reported by Cairns (1979) was based on material from P-112, which is probably a labelling error for Gerda-112, which was made at 641-686 m. This correction is based on the circumstantial evidence that those specimens were collected with *Enallopsammia profunda*, which is not known from less than 400 m. Although the species is known from as shallow as 60 m in other regions of the world, the only legitimate record of *L pertusa* shallower than 200 in the western Atlantic is from *Delaware* II-137 (reported herein) at 146 m; all other new records listed below are from considerably deeper water. A western Atlantic depth record of 1200 m is reported herein from Bermuda. Geographic extensions of the species based on specimens reported herein include Bermuda, the western coast of Florida, and off southwestern Louisiana.

New Records: O-11705, 1 branch, USNM 99229; Gos-2366, 3, USNM 77010; Gos-2439, many branches, USNM 77028; Gos-2452, many branches, USNM 77025; Delaware II-137, 2 branches, USNM 99226; Alvin-761 (F27, 30), many branches, USNM 49117-19, -21; Alvin-762 (F13), many branches, USNM 49120; Alvin-1335, 1 branch, USNM 99228; Eastward-34957, 10 branches, USNM 80809; Anton Dorhn-6392, 3 branches, USNM 73766; Aleutian Bounty 83-165, 2 branches, USNM 84355; ASLAR, R/V Cape Hatteras, 31°50'N, 78°19'W, 625 m, 1 branch, USNM 81415; ASLAR, Grye, 40°21'N, 67°41'W, 800 m, 1 branch, USNM 99232; ASLAR, Gyre 87-G-2, 27°43'N, 91°16'W, depth unknown, 1 branch, USNM 78511; C-Hawk, 29°10'N, 88°20'W, 519 m, 2 branches, USNM 88393; Sea Probe, Eluethera, Bahamas, 671 m, 8 corallites, USNM 99230; Bermuda, 1200 m, 1 branch, USNM 99233.

Types: See CAIRNS (1979).

Distribution: Western Atlantic: from Nova Scotia (43°09'N, 60°13'W; VERRILL 1883) to southeastern Brazil (25°18'S, 44°45'W; CAIRNS 1979), including Bermuda, but absent from western Gulf of Mexico and western Caribbean, and most of northeastern South America from the Antilles to Rio de Janeiro; 146-1200 m (CAIRNS 1979: map 34). Elsewhere: cosmopolitan in tropical and temperate waters; 60-2170 m (CAIRNS 1995a).

Genus **Dasmosmilia** Pourtalès, 1880

Diagnosis: Corallum solitary; turbinate or trochoid in shape. Parricidal budding common, resulting in unattached coralla with open/fractured bases or bases still attached to inner theca of parent fragment. Theca very thin. Multiple paliform lobes on septa of all but last cycle. Trabecular columella formed from axial paliform lobes. Endothecal dissepiments present.

Type Species: *Parasmilia lymani* Pourtalès, 1871, by subsequent designation (WELLS 1933a).

Dasmosmilia lymani (Pourtalès, 1871)

(Figs. 114-116)

Parasmilia lymani Pourtalès, v*1871: 20, pl. 6, figs. 8-10.
Dasmosmilia lymani. -Wells, 1933a: 220-221, pl. 12, fig. 10. -Cerame-Vivas & Gray, 1966: 263 (listed). -Cairns, 1979: 132-134, pl. 25, figs. 1-3, 8-9, Map 37 (synonymy and description). -Zibrowius, v.1980: 70-71, pl. 28, figs. A-L, pl. 29, figs. A-L (synonymy and description).

–Cairns, 1981: 10 (figs. on p. 4). –Cairns et al., 1991: 47 (common name). –Cairns, 1994: 63. –Cairns et al., 1994: 4 (listed). –Zibrowius, 1988: 136 (listed). –Cairns, 1995a: 76, pl. 20, figs. g-i, pl. 21, fig. a. –Pires, v.1997: 182.

Diagnosis: Corallum ceratoid, often curved, and usually having a broken, open basal end or one that is still attached to inner theca of parent corallum. Coralla up to 28 mm in GCD and 30 mm in height, but most populations considerably smaller. Calices circular, elliptical, triangular, or rectangular in outline; calicular edge moderately lancetted. Costae usually equal in width and slightly ridged. Theca and septa quite thin (0.3-0.5 mm), resulting in a brittle corallum, easily fractured; corallum white to light brown. Septa hexamerally arranged in 5 cycles, larger coralla with some pairs of S6 (up to 106 septa): S1-3>S4>S5>S6. S1-3 often bear small paliform lobes, but S4 always bear a prominent lobe, which is sometimes divided into 2-5 smaller lobes. Fossa deep, containing a columella composed of the crinkled lower axial edges of the P1-4. Endothecal dissepiments present, especially noticeable in larger coralla.

Discussion: Despite numerous additional records of this species, specimens from only one station (Vema 16-65) extend the known distributional range of the species north from Massachusetts to Newfoundland, as well as slightly decreasing the known minimum bathymetric range from 48 to 42 m. *D. lymani* is usually found in relatively shallow water, most records being from 100-200 m, and is one of the few shelf-depth corals known off the northeastern US. In the western Atlantic, its distribution is essentially temperate to subtropical in both hemispheres, with one disjunct tropical record off Venezuela (P-722). Its common name is the 'splitting cup coral' (CAIRNS *et al.* 1991).

New Records: O-23271, 1, IRCZM 12:123; BLM-OCS A1, over 100, USNM 62636, 62646, 83422, 83430; BLM-OCS A2, 2, USNM 83426; BLM-OCS F1, 1, USNM 61686; BLM-OCS F2, 4, USNM 83425; BLM-OCS K4, 4, USNM 83419, 83423; BLM-OCS K5, 1, USNM 83428; BLM-OCS L4, 4, USNM 61677, 83421, 83429; BLM-OCS L5, 3, USNM 83418; FH-7282, 1, USNM 62238; FH-7516, 6, USNM 82997; Gos-1588, 6, USNM 99240; GS 74-04-94, 1, USNM 99239; GS 75-08-95, 2, USNM 82995; E-35941, 1, USNM 82996; Pelican 182-6, 2, USNM 99234; BLM, NEEB 24, 1, USNM 89167; BLM NEEB 27, 3, USNM 89168-69; Vema 16-65, 7, USNM 61816; off Ajax Reef, Florida Keys, 128-164 m, 10, USNM 62234; CSA Pinnacle site 2, 1, CSA; off Ajax Reef, Florida Keys, 146-183 m, 14, USNM 62233; Mississippi Mud Lump 90 (TU 977), 15,500 years BP, 1 May 1969, 78, USNM 80888; Mississippi Mud Lump 93, 6, Holocene, USNM 84295.

Types: See CAIRNS (1979).

Distribution: Western Atlantic: continental shelf of eastern US from St. Pierre Bank, Newfoundland (46°45'N, 56°22'W) to the Mississippi Delta (Holocene); one isolated record off Isla de Margarita, Venezuela; off Maranhão, Brazil; southeastern Brazil from Cabo de São Tomé to São Francisco do Sul (27°05'S, 46°53'W); 37-366 m (CAIRNS 1979: map 37). Eastern Atlantic: area bounded by Portugal, the Azores, and Spanish Sahara; 85-316 m (ZIBROWIUS 1980). Elsewhere: Japan; northern New Zealand; 168-1002 m (CAIRNS 1995a).

Dasmosmilia variegata (Pourtalès, 1871)

Parasmilia variegata Pourtalès, v*1871: 21, pl. 1, fig. 13.
Dasmosmilia variegata. –Cairns, 1979: 134-136, pl. 25, figs. 4-7, 10, pl. 26, fig. 1, Map 38 (synonymy and description). –Zibrowius, v.1980: 71-72, pl. 30, figs. A-K (synonymy and description); 1988: 136 (listed). –Cairns et al., 1991: 47 (listed). –Cairns & Keller, 1993: 247, 249, fig. 6C. –Cairns et al., 1994: 4 (listed). –Pires, 1997: 182.

Diagnosis: Corallum ceratoid to trochoid, usually straight, and invariably attached to fragment of parent corallum. Coralla up to 20.2 mm in GCD and 21 mm in height. Calices elliptical to irregular in shape; calicular edge highly lancetted. Costae well defined, separated by deep, thin intercostal striae. Theca quite thin (0.2-0.4 mm). Corallum white, but S1-2, C1-2, and P1-2 pigmented black. Septa hexamerally arranged 5 cycles, the fifth cycle only partially developed even in large coralla: S1-2>S4>S3 or S1-2>S3>S5>S4, the highest cycle of septa within a half-system always more highly exsert (lancetted) and wider than those of the penultimate cycle. S1-2 quite thick, as though swollen or inflated. Large, ornately sculptured and ridged paliform lobes occur on S1-2; smaller, more elongate paliform lobes occur on axial edges of S3-4. Columella composed of a central mass of axial paliform lobes. Endothecal dissepiments present in large coralla.

Discussion: Although *D. variegata* and *D. lymani* are similar in corallum fragility, tendency toward asexual reproduction through fragmentation, and distribution range, *D. variegata* differs in having thicker S1-2; thicker, more ornately sculptured paliform lobes; darkly pigmented S1-2, C1-2 and P1-2; and S4 (or S5) that are wider than S3 (or S4). *Dasmosmilia variegata* is collected much less frequently than *D. lymani*, but displays a similar geographic and bathymetric range, except that *D. lymani* is known from much farther north along the eastern coast of North America. The records reported below do not add much to the known distribution of the species, but the report of PIRES (1997) considerably extended the known distribution of *D. variegata* to southern Brazil.

New Records: O-22084, 2, IRCZM 12:116; southeast of Fowey Light, Florida, depth unknown, 1 fragment, USNM 82999.

Types: See CAIRNS (1979).

Distribution: Western Atlantic: Florida Keys; off Tampa, FL; off Península de Paria, Venezuela; off Maranhão, northeastern Brazil; off Ilha de São Sebastião, southeastern Brazil (CAIRNS 1979: map 38); 110-421 m. Eastern Atlantic: Cape Verde Islands; Azores; 185-600 m (ZIBROWIUS 1980). Elsewhere: off southwestern Madagascar; 330-335 m (CAIRNS & KELLER 1993).

Genus **Oxysmilia** Duchassaing, 1870

Diagnosis: Corallum solitary, attached through a broad base that increases in diameter by repeatedly adding exothecal dissepiments over raised costae, resulting in several concentric, chambered rings that encircle the base. Endothecal dissepiments also present in large specimens. Septotheca costate. Septa hexamerally arranged in 4-5 cycles. Paliform lobes often present before S3. Columella papillose.

Type Species: *Lophosmilia rotundifolia* Milne Edwards & Haime, 1848, by monotypy.

Oxysmilia rotundifolia (Milne Edwards & Haime, 1848)

(Figs. 117-120)

Lophosmilia rotundifolia Milne Edwards & Haime, v.1848c: 247, pl. 5, figs. 3, 3a.
Oxysmilia rotundifolia. –Duchassaing, 1870: 27. –Cairns, 1979: 73-75, pl. 10, figs. 7-9, pl. 11, figs. 1-4, Map 16 (description and synonymy). –Fricke & Meischner, 1985: 183, fig. 11b. –Rezak et al., v.1985: 225 (listed: stn 115, Geyer Bank; stn 119, Diaphus Bank). –Prahl & Erhardt, 1989: 544-545. –Cairns et al., 1991: 47 (listed). –Cairns et al., 1994: 6-7.

Diagnosis: Corallum variable in shape, including trochoid, ceratoid, and subcylindrical, but usually straight; firmly attached by a broad pedicel and a base composed of up to 6 concentric rings of raised costae covered with exothecal dissepiments (Figs. 117-118), often resulting in a base as wide or wider than the CD. Although solitary, several smaller coralla often settle on the theca of an older corallum, and thus may resemble a colony. Largest corallum (P-707) 35 x 27 mm in CD and 48 mm in height. C1-5 usually ridged; corallum uniformly white. Septa hexamerally arranged in 5 cycles (S1>S2>S3>S4>S5), the fifth cycle attained at a GCD of 18-20 mm, with additional pairs of S6 in largest coralla, the largest corallum having 26 S6, or 124 septa. Axial edges of S1-2 straight and vertical, reaching the columella; axial edges of S3-4 slightly sinuous; axial edges of S5 serrate. Small paliform lobes sometimes present on axial edges of S3 (antepenultimate cycle), but may be absent. Columella deep, containing a papillose columella consisting of 3-12 thick, finely granular elements that, in large specimens, are fused into a massive central structure. Large or elongate coralla contain endothecal dissepiments (Fig. 120).

Discussion: Although placed in the Caryophylliinae by VAUGHAN & WELLS (1943) and most subsequent authors, the presence of endothecal dissepiments in *O. rotundifolia* suggests a subfamilial placement in the Parasmiliinae, as originally placed by MILNE EDWARDS & HAIME (1848c). In fact, it is quite similar to *Rhizosmilia,* but differs in the consistent placement of paliform lobes before the S3 (even when S5 are present) and in being solitary. Species subsequently assigned to *Oxysmilia* should be re-evaluated for the presence of endothecal dissepiments.

The only significant new records of this species since 1979 are those from off Bermuda (FRICKE & MEISCHNER 1985) and several reports from the northern Gulf of Mexico (REZAK *et al.* 1985; CAIRNS *et al.* 1994). Although the species is known from as deep as 640 m (O-4297), most specimens were collected shallower than 200 m.

New Records: O-24237, 3, IRCZM 12:118; O-24238, 1, IRCZM 12:113; JSL-I-1334, 3, IRCZM; JSL-II-1724, 3, USNM 94730; BLM, SOFLA-36, 1, USNM; Barbados, 402-457 m, coll. LEWIS 1961, 1, USNM 80990.

Types: See CAIRNS (1979).

Distribution: From off Onslow Bay, NC (33°52'N, 76°29'W) to Suriname (CAIRNS 1979: map 16), including the Caribbean and northern Gulf of Mexico to Geyer Bank, Texas; Bermuda; 46-640 m.

Genus **Colangia** Pourtalès, 1871

Diagnosis: Colonies reptoid, producing buds extratentacularly via discrete stolons. Cylindrical corallites polycyclic and epithecate; theca smooth but often encrusted. Axial edges of S1-2 smooth; those of S3-4 finely dentate. Paliform lobes before penultimate cycle (P3) and occasionally retained before antepenultimate (P2) cycle. Columella lamellar or papillose. Endotheca absent.

Type Species: *Colangia immersa* Pourtalès, 1871, by monotypy.

Colangia immersa Pourtalès, 1871

(Figs. 6, 121-123)

Colangia immersa Pourtalès, v*1871: 31-32. –Pourtalès in Agassiz, 1880b: pl. 12, figs. 13-15. –Goreau & Wells, 1967: 448 (listed). –Porter, 1972: 112 (listed). –Wells & Lang, 1973: 57 (listed). –Land, Lang & Barnes, 1977: 170 (isotopic analysis). –Cairns, 1979: 207 (listed); 1982b: 290, fig. 128f. –Castañares & Soto, 1982: Table 1 (listed). –Hubbard & Wells, 1986: 129-130, figs. 13-16 (see Discussion). –Cairns et. al., 1986: 184, 186, pl. 55, fig. –Humann, 1993: 168-171, 3 colour figs. –Fenner, v.1993b: 12, 14 (listed).
Colangia sp. 1 Porter, 1972: 112.
Rhizosmilia maculata. –Cortés, 1992: 243, fig. 1; 1996: 331. [Not *Bathycyathus maculatus* Pourtalès, 1874]

Description: Corallum reptoid, composed of widely-spaced (1-20 mm), cylindrical corallites united by wide (6-7 mm) paper-thin stolons. Greater diameter of corallites usually ranges from 6-9 mm and corallite height usually less than 10 mm; however, height of corallum often difficult to determine due to encrustation of corallite base by adjacent encrusting organisms, such as calcareous algae, bryozoans, serpulids, sponges, and foraminifera, which also often obscure the connecting stolons. Corallites polycyclic, the first low wall established at a CD of about 2.5 mm, the second and usually outer epithecal wall formed outside and usually eccentric to the first. Epitheca originally smooth and often 'rimmed' but often later encrusted. Most corallites pigmented with black-brown granules 0.1-0.2 mm in diameter that cover the septal faces and stolons, the same pigmentation also occurring on the theca, but having no surface relief. In older corallites pigmentation often more intense, the colour occurring in curved bands that parallel the distal and axial septal edges. Only in rare instances are corallites not pigmented in this fashion (e.g., P-439 and USNM 76311), these coralla being homogeneously white. Paliform lobes and columella always white.

Septa hexamerally arranged in 4 cycles according to formula: S1>S2>S3>S4. A full fourth cycle (48 septa) is not attained until a GCD of about 7 mm, and larger corallites have some pairs of S5, but corallites less than 7 mm usually have an incomplete fourth cycle and less than 12 paliform lobes. S1 highly exsert (up to 2.6 mm) and relatively narrow, the straight, vertical axial edge reaching only about half distance to columella. S2 also exsert (up to 1.3 mm), about ⅔ width of the S1, also having straight continuous axial edges. S3 0.5-0.6 mm exsert, ⅓ – ½ width of an S3, having finely dentate axial edges. S4 equally exsert, fused to their adjacent S1 at the calicular edge contributing to a lancetted margin, but only about half width of an S3, and have dentate axial edges. In small coralla, in which half-systems have not yet formed S4, there is a prominent paliform lobe (P2) before the S2. However, when a pair of S4 form within a half-system, the P2 begins to realign itself with the flanked S3, eventually positioning itself before the S3 and serving as the P3. When the second pair of S4 forms within a system, the enclosed S3 also forms a paliform lobe of equal size. Eventually a crown of 12 wide (up to 1.3 mm, or 4-5 times the width of the S3) P3 are formed, each couple within a system slightly closer to one another than to those in adjacent systems, thus appearing to be paired. Paliform lobes have rounded distal edges and straight axial and peripheral edges. S2 of larger corallites usually do not have paliform lobes; however, in some corallites 6 independent P2 are formed in addition to the 12 P3, these secondary P2 being smaller (about ⅓ the width) and lower in fossa than the P3. Fossa of moderate depth, containing a lamellar or papillose columella, the papillae often aligned along the greater axis of the calice.

Discussion: *Colangia immersa* is a fairly common shallow-water species found throughout the Caribbean on the undersides of platy corals, under ledges, and in caves (especially ceilings). These cryptic environments are often highly competitive ones, shared with calcareous algae, bryozoans, serpulids, sponges, and foraminifera, all of which tend to encrust the smooth theca of *Colangia immersa*, often resulting in only the tentacular crown of the cylindrical corallites rising above the background epizoa. Polyps occur in a variety of colours, including: brown, light green, salmon pink, lavender, orange-brown, and white (Humann 1993). The common name of this species is the 'lesser speckled cup coral' (Cairns *et al.* 1991).

The specimens reported by Hubbard & Wells (1986) from Trinidad (USNM 68468 and 86746) were stated to be 'typical' of the species, but differ from all other specimens reported herein by having larger corallites (up to 11 mm in GCD), often having small P1 (paliform lobes) as well as P2 and P3, and in having relatively smaller P3 lobes. Because they are otherwise similar to *C. immersa*, they are considered to be an environmental variation or population difference from other more typical coralla.

New Records: Alb-2321, 1 colony, USNM 16111; P-439, 6 colonies: 5 colonies, USNM 80499 and 1, UMML 8.231; P-584, 2 corallites, USNM 92288; P-595, 2 corallites, USNM 92288; P-1196, 1 colony, USNM 80327; P-1202, 10 corallites, USNM 80328; P-1220, 1 colony, USNM 80329; P-1284, 3 colonies, USNM 99241; G-983, 1 corallite, USNM 92302; G-984, 2 corallites, USNM 92303; G-986, 3 corallites, USNM 80342; G-1246, 2 corallites, USNM 92304; SB-2447, 1 colony, USNM 92307; SB-2462, 1 colony, USNM 80231; SB-3494, 1 corallite, USNM 99245; JS-52, 1 corallite, USNM 80192; Eastward 30178, 3 corallites, USNM 61873; JSL-I-3659, 5 corallites, USNM 94739; CI-158, 2 corallites, USNM 92305; DBL-130, 131, Cardiff Hall, Jamaica, 30 m, 2 corallites, USNM 80883; DBL-624, Jamaica, depth unknown, 1 corallite, USNM 92313; DBL-637, Little Bay, Jamaica, 27 m, 1 colony, USNM 83854; DBL-995, Discovery Bay, Jamaica, depth unknown, 1 colony, USNM 80349; DBL-1424, Discovery Bay, Jamaica, 61-66 m, 1 colony, USNM 80917; DBL-2476, Discovery Bay, Jamaica, depth unknown, 1, USNM 99248; DBL-2485, Discovery Bay, Jamaica, depth unknown, 1, USNM 99252; Urchin Cove, Prosperity, Jamaica, 3 m, 2 corallites, USNM 76311 and 76309; Maria Buena Bay, Jamaica, 40 m, 1 colony, USNM 72369; Runaway Bay, Jamaica, 37 m, 5 corallites, USNM 80919; Cardiff Hall, Jamaica, 1 colony, USNM 80918; Montego Bay, 55 m, 2 corallites, USNM 80884; Punta Cahuita, Costa Rica, 6 m, 2 corallites, USNM 92312 (=Cortés, 1992); Chankanaab Caves, Cozumel, Mexico, 2 colonies, 0.5 and 18 m, USNM 73916 and 73917; Humann stn 2RC-5, Roatán, Honduras, 5 m, 4 corallites, USNM 92086; Humann stn 2RC-4, Roatán, Honduras, 26 m, 1 colony, USNM 92085; Humann stn CBH-4, Conception Island, Bahamas, 22 m, 3 corallites, USNM 91658; Humann stn 2RC-10A, Roatán, Honduras, 2 corallites, USNM 92091; Humann stn off Anguilla, 7 m, 2 corallites, USNM 99380; St. Lucia, 15-27 m, 1 colony, USNM 80345; Portomaribaai, Curaçao, 15 m, 3 colonies, USNM 80347; Palancar Reef, Cozumel, Mexico, 15 m, 8 corallites, USNM 75170 and 77652; La Paguera, Puerto Rico, 21 m, 3 colonies, USNM 80368; Cayman Islands, 4 corallites, USNM 81284; Roatán, Honduras, 15 m, 2 corallites, USNM 78498; John Smith Bay, Bermuda, 6-8 m, 2 colonies, USNM 80209.

Types: The holotype colony, consisting of 12 corallites, is deposited at the MCZ (2787). Type Locality: Double-Headed Shot Cay (Elbow Cays), western side of Cal Sal Bank, Bahamas; 315 fm (=576 m), however, POURTALÈS (1871) implied that the holotypic colony had certainly been transported to this depth after death.

Distribution: Throughout Caribbean; Bahamas; and Bermuda (Fig. 6); 0.5-347 m. Dead coralla of this species have been collected from as deep as 1317 m (USNM 92305), and the holotype was collected from 576 m, but the deepest live-collected colony is from P-584 at 347-353 m.

Colangia jamaicaensis, new species

(Figs. 6, 124-128)

Colangia n. sp. Humann, 1993: 170-171, colour fig.

Description: Corallum reptoid, composed of closely-spaced, cylindrical corallites united by thin stolons; however, interconnections among corallites usually obscured by entrusting organisms. Largest corallite (on holotypic colony) 7.1 x 6.5 mm in CD and 17.1 mm in height. Theca smooth near calice (not costate or granular), but usually encrusted below. Jamaican coralla uniformly white; single specimen from Honduras a light brown, but not speckled.

Septal symmetry variable: 10 of the 12 corallites reported have septa arranged hexamerally in 4 cycles (S1>S2>S3>S4, up to 48 septa); however, two corallites (DBL-2482 and 1 of 4 from DBL-2487) have septa arranged pentamerally in 4 cycles (S1°>S2°>S3°>S4°, up to 40 septa). In the hexameral forms, a full fourth cycle is achieved at a GCD of 5-7 mm, whereas corallites ≤6 mm GCD often lack 1-3 pairs of S4, resulting in corallites with 42-46 septa and 9-11 paliform lobes, respectively. S1 variable in exsertness, ranging from 0.7-2.1 mm, having straight, smooth axial edges that reach about half distance to centre of calice. S2 similar to S1 but slightly less exsert and ¾-⅘ width of the S1. S3 barely exsert, about ⅘ width of the S2, having straight but slightly dentate axial edges. S4 equally exsert, about ⅓ width of the S3, having highly dentate axial edges. Nine to 12 paliform lobes occur in a single, discrete crown before septa of penultimate cycle, usually the S3 (or before S2 in half-systems lacking a pair of S4). Paliform lobes about 0.9 mm wide, which is equal to or slightly less wide than the septa they border; lobes are thicker than septa, having straight edges and rounded distal edges. Fossa shallow, containing the palar crown and a reduced papillose columella; however, the columella is often lacking.

Discussion: *Colangia jamaicaensis* is distinguished from *C. immersa* by having a white or brown (non-speckled) corallum; narrower and thicker paliform lobes in relation to the septa they border; a reduced or no columella; less exsert S1; and proportionally wider S2 and S3 in relation to the S1. It is quite similar to *C. moseleyi* (Faustino 1927) (see Figs. 133-134), known only from one record at 55 m in the Philippines (see Cairns & Zibrowius 1997), but appears to differ in having a reduced or no columella, more robust P3, better developed S4, and in lacking paliform lobes on the S1 and S2.

According to Humann (1993), this species is found on the ceilings of caves and has a fairly transparent polyp; however, the species is rarely collected and thus poorly known. Humann named it the 'cryptic cave coral'.

Etymology: Named for the country from which it was first collected.

Records/Types: DBL-2481, holotypic colony of 4 live corallites, USNM 80925; DBL-2479, Rio Bueno, Jamaica, 20 m, 1 paratype, USNM 99246; DBL-2482, Discovery Bay, Jamaica, depth unknown, 1 paratype, USNM 99250; DBL-2483, Discovery Bay, Jamaica, depth unknown, 1 paratype, USNM 99251; DBL-2487, Discovery Bay, Jamaica, depth unknown, 4 paratypes, USNM 86544; Humann stn CQ18, Isla Cayos Cochinos, Bay of Islands, Honduras, 10 m, 1 paratype, USNM 99247. Type Locality: Rio Bueno, Jamaica, 20 m.

Distribution: Known only from the northern coast of Jamaica and Isla Cayos Cochinos, Honduras; 10-20 m (Fig. 6). HUMANN'S (1993) reference to specimens from Roatán is contradicted by the original label with the figured specimens, which indicates "Isla Cayos Cochinos, Bay Islands, Honduras".

Colangia multipalifera, new species

(Figs. 2, 6, 129-132)

Description: Reptoid corallum composed of elongate, widely-spaced, cylindrical corallites united basally by very thin stolons. Stolons often encrusted or obscured, making it appear that corallites are solitary in habit. Largest corallite (on holotypic colony) 9.1 x 8.9 mm in CD and 13.9 mm in height; whereas another corallite from same colony is taller (21.6 mm) but smaller in calicular diameter. Theca smooth, sometimes bearing small, low granules. Corallum white; nature and colour of polyp unknown.

Septa hexamerally arranged in 4 complete cycles in all specimens of type series: S1-2>S3>S4 (48 septa). S1-2 moderately exsert (1.3-1.5 mm), having straight, smooth, vertical axial edges that extend ½ to ⅔ distance to columella. S3 about 0.8 mm exsert, ⅔ width of the S1-2, having slightly dentate axial edges. S4 equally exsert but only about ⅓ width of the S3, having dentate axial edges. A narrow (0.5-0.8 mm wide) paliform lobe (P1-2) often, but not always, occurs before the S1-2, when present measuring only ¼ to ½ width of the septum it borders. Much larger paliform lobes 1.5-1.8 mm wide (2-3 times width of septum they border) and rising higher in the fossa than the P1-2, form an elliptical palar crown encircling the columella. The position of the larger paliform lobes is quite variable within a corallite, occurring before both the S3 and S4 in various half-systems (see Discussion). For instance, in the figured holotypic corallite, 3 half-systems contain only P4, 5 half-systems contain a mixture of 1 P3 and 1 P4, and 3 half systems contain 2 P4, for a total of 20 large paliform lobes. When a half-system has 2 P4 the flanked S3 usually has no paliform lobe. Fossa quite shallow, containing the elliptical palar crown and a papillose columella, the elements of which may be aligned or in an elliptical field.

Discussion: The arrangement of the large paliform lobes in this species is not unlike that for other species of *Colangia* and *Rhizosmilia* (see CAIRNS 1978b: text-fig. 1); however, the unique difference about *C. multipalifera* is that P4 form on S4 without the presence of flanking S5, resulting in paliform lobes often being present on the last cycle of septa, instead of the penultimate cycle of septa as is the case in other species of *Colangia* and *Rhizosmilia*. To reiterate, it would appear that a half-system composed of 1 S3 and a pair of S4 starts with a large P3 paliform lobe (Fig. 2a). Gradually, and without the acquisition of S5 to the half-system, this P3 lobe realigns itself with an adjacent S4, usually the one closest to the S2. At the same time an independent P4 begins to form before the other S4 in the half-system, the axial edges of both lobes often fused into a V-shaped structure (Fig. 2b-c). Eventually the original lobe is completely realigned with an S4 and the other P4 becomes independent and of equal size, forming a pair of P4 lobes within this system and no remaining lobe before the S3 (Fig. 2d).

Colangia multipalifera is distinguished from its congeners by its frequent retention of P1-2 and the acquisition of P4 paliform lobes without the insertion of S5, resulting in paliform lobes before septa of the last, not penultimate, cycle of septa.

Etymology: The species name *multipalifera* (Latin *multi*, many + *paliferus*, stake bearing), alludes to the many paliform lobes present in this species.

Records/Types: DBL-2474, holotypic colony of 3 corallites, USNM 99253; DBL-1471, Discovery Bay, Jamaica, depth unknown, 1 paratype, USNM 99254; DBL-2480, Rio Bueno, Jamaica, 20 m, 1 paratype, USNM 99256; DBL-

2516, Rio Bueno, Jamaica, 20 m, 1 paratype corallite, USNM 99255. Type Locality: Discovery Bay, Jamaica (Fig. 6); depth unknown.

Distribution: Known only from Discovery Bay and Rio Bueno, northern coast of Jamaica; 20 m.

Genus **Phyllangia** Milne Edwards & Haime, 1848

Diagnosis: Colonies form by extratentacular budding from common basal coenosteum. Septotheca costate and granular. Axial edges of septa finely serrate or smooth. Paliform lobes before septa of penultimate cycle, often poorly formed. Columella trabecular. Endotheca present.

Type Species: *Phyllangia americana* Milne Edwards & Haime, 1849, by subsequent designation (MILNE EDWARDS & HAIME 1850a: xliv).

Phyllangia americana americana
Milne Edwards & Haime, 1849

(Figs. 19, 135-140)

Phyllangia americana Milne Edwards & Haime, *v1849c: 182. –Milne Edwards, 1857: 616, pl. D4, fig. 6. –Not Gosse, 1858: 349 (=*Hoplangia durotrix* Gosse, 1860). –Duchassaing & Michelotti, 1864: 92. –Pourtalès, 1871: 30, 79. –Vaughan, 1901: 299. –Duerden, 1902: 555-558, pl. 5, fig. 46, text-fig. 9h (histology and description of living polyps). –Branner, v.1904: 266. –van der Horst, 1927: 59. –Vaughan & Wells, 1943: 178, –Wells, v.1947a: 169, pl. 2, fig. 6. –Goreau, 1959: 70 (listed). –Zans, 1959: 29, 35 (listed). –Almy & Carrión-Torres, 1963: 156, fig. 15b. –Roos, 1964: 48. –Laborel, 1967: 3. –Goreau & Wells, 1967: 448. –Weisbord, 1968: 68-71, pl. 10, fig. 3, pl. 11, fig. 1 (synonymy). –MacIntyre & Pilkey, 1969: 375. –Keith & Weber, v.1970: 270. –MacIntyre, 1970: 178. –Laborel, 1971: 201, pl. 6, fig. 2. –Smith, 1971: 87-88. –Roos, 1971: 74, pl. 36, figs. a-b. –Olivares & Leonard, v.1971: 64, pl. 8, figs. C-D. –Porter, v.1972: 111. –Wells & Lang, 1973: 57 (listed). –Erhardt, 1974: 406 (listed). –Weisbord, 1974: 403-405, pl. 46, figs. 4-5. –Grimm & Hopkins, 1977: 136 (listed). –Land, Lang & Barnes, 1977: 170 (isotopic composition). –Cairns, 1978a: 10 (listed). –Colin, 1978: 262-263, colour fig. (page 257). –Chassaing et al., 1978: 74, fig. 49. –Zibrowius, 1980: 137. –Cairns, 1982b: 290, fig. 128e. –Zlatarski, 1982: 127-129, pl. 41, figs. 1-5, pl. 42, figs. 1-3, pl. 43, figs. 1-6 (description and variation). –Castañares & Soto, 1982: Table 1 (listed). –Wood, 1983: colour fig. (page 109). –Cortés et al., 1984: 59 (listed). –Prahl & Erhardt, 1985: 102, fig. 83. –Cortés & Guzman, 1985: 75, fig. 28b. –Hubbard & Wells, 1986: 129, figs. 10-12 (in part: specimens RH 1, 2, 10, 13, and figured specimens). –Estalella, 1986: 20. –Bouchon & Laborel, 1986: 204 (listed). –Leão, 1986: 38, 2 figs (page 39). –Tunnel, 1989: 307. –Prahl & Erhardt, 1989: 542, fig. 1. –Humann, v.1993: 170-173, 3 colour figs. –Not Cairns et al., 1994:

8 (=*P. pequegnatae*, n. sp.). –Hetzel & Barreira e Castro, 1994: colour fig. (page 61). –Cortés, 1996: 331. –Pires, 1997: 184.
Syndepas Gouldii Lyman, *1857: 274-278.
Stellangia reptans Duchassaing & Michelotti, *1860: 80, pl. 10, figs. 1-2. –Quelch, 1886: 12 (listed).
Astrangia phyllangioides Duchassaing & Michelotti, v*1864: 91-92, pl. 10, figs. 1, 3-4.

Description: Corallum colonial, usually producing additional corallites by extratentacular budding from a thick, common, encrusting coenosteum (not stoloniferous). Occasionally corallites bud from lower theca of a parent corallite, and in several cases intratentacular budding was observed (Fig. 140), the latter in coralla that may have been under stress related to proximity of man-made facilities. Corallites cylindrical to trochoid and often closely spaced, the theca of adjacent corallites sometimes fused to one another. Largest known corallite 15.9 mm in GCD (USNM 8779). Theca costate and granular, in some corallites the costae (C1-3) forming discrete ridges; however, theca of most corallites encrusted with calcareous algae, bryozoans, sponges, and/or serpulids (Fig. 137). Despite encrustation, corallites rarely immersed in epifanua, as in *Colangia immersa*, often rising as much as 1 cm above substrate. All corallites bear a distinctive light brown colouration within the calice and on upper theca within 2-3 mm from the calicular edge. Lower theca and coenosteum white.

Septa hexamerally arranged in 5 cycles (S1>S2>S3>S4>S5), the fifth cycle complete only in corallites budding intratentacularly or otherwise abnormally developed. There is a direct relationship between GCD and number of septa, corallites passing through the 4-cycle stage (48 septa) at a GCD of 7-9 mm, and continuing to add pairs of S5 up to an observed maximum of 80 (USNM 72668) in normal corallites. S1 moderately to highly exsert (up to 2.5 mm), having a finely serrate upper (distal) edge and a smooth, straight axial edge, which is sometimes slightly concave lower in fossa, but fuses to the columella. In well-preserved, intact corallites, the distal exsert edges of S1 bear short granular ridges perpendicularly aligned to them. S2 less exsert (up to 1.5 mm), about ⅘ width of the S1, but otherwise similar to S1. S3 about 0.8 mm exsert and ⅔ width of S2. S4 adjacent to S2 equally exsert to S3, but only half width of S3, whereas S4 adjacent to S1 are about twice as exsert, each pair forming a rectangular lancet with its flanked S1. Small paliform lobes occur before the S3 in developing corallites, these P3 sometimes well formed but usually poorly distinguished from the septum they border and sometimes even broken into 2 or 3 smaller lobes. When a pair of S5 forms in a half-system, it is invariably adjacent to the S1 (not the S2) and is concurrent with the formation of a small paliform lobe before the flanked S4, the axial edge of which is usually fused to the adjacent P3. If the second pairs of S5 form within a half-system, the P3 realigns with this second flanked S4, leaving the S3 without a paliform lobe. Fossa moderately deep, containing a single, elliptical paliform lobe crown and a trabecular columella composed of poorly-formed, non-descript elements, the columella sometimes being slightly concave. Vesicular endothecal dissepiments present in larger corallites, which, along with a relatively thin theca, produces a light-weight corallum.

Discussion: *Phyllangia americana* is perhaps the most frequently collected and reported azooxanthellate coral in the western Atlantic (see Synonymy). Its commonness may be due to its proclivity to colonize submerged, man-made objects, such as pilings, docks, jetties, submerged wrecks, buoys, and even plastic and wood, which are often inspected by humans. Its natural substrate would appear to be bivalve shells, especially *Spondylus* and calico shells, and small rocks. Colour of polyps clear, brown, yellow-brown, or red-brown (HUMANN 1983). This species is known by the common name of the 'hidden cup coral' (CAIRNS *et al.* 1991).

Specimens from Bermuda and Bahia Mochina, Venezuela (OLIVARES & LEONARD 1971) have unusually small corallites (Fig. 136) and are considered as dwarf populations.

The distinction between the western Atlantic *P. americana* and the eastern Atlantic *P. mouchezii* (LACAZE-DUTHIERS, 1897) has always been difficult to quantify, authors such as BEST (1969) and ZIBROWIUS (1980) stating that the two species were very similar but not offering distinguishing criteria. However, CHEVALIER (1966a) did distinguish an eastern Atlantic population of *Phyllangia* from the western Atlantic *P. americana* at the subspecies level as *P. americana nazensis* (later synonymized as *P. mouchezii* by ZIBROWIUS 1980). According to CHEVALIER, *P. americana nazensis* differed from the nominate subspecies in four criteria: 1) its S1 and S2 were equal in size, 2) it often had more than 48 septa, usually 54-64 (up to 96 according to ZIBROWIUS 1980), 3) its septal face granules were not aligned on the distal septal margins, and 4) its columella was better developed. Having examined numerous specimens of *P. americana* from the western Atlantic (see New Records) and eastern Atlantic specimens from the Mediterranean and Madeira, it is clear that criteria 1 and 2 are not valid distinctions, and that criteria 3 and 4 are in general consistent, but trivial differences. To reiterate, the eastern Atlantic populations of *Phyllangia*, customarily called *P. mouchezii*, differ from typical *P. americana* in having a slightly more developed columella, in lacking short sepal face ridges, and, in some specimens, adopting a bushy corallum, unlike any examined in the western Atlantic. Given the geographic separation of the two taxa (see Distribution) and the slight, but consistent differences in morphology, I agree with CHEVALIER's subspecific distinction of the two forms: the western Atlantic *Phyllangia americana americana* and the eastern Atlantic *P. americana mouchezii*, new rank.

New Records: P-625, 3 corallites, USNM 99282; P-629, 5 colonies: 3, USNM 99285 and 2, UMML 8.227 and 344; P-1330, 1 corallite, USNM 99266; P-1335, 1 corallite, USNM 99262; P-1336, 1 colony, USNM 99260; P-1360, 1 colony, USNM 99277; P-1362, 1 colony, USNM 99273; SB-1125, 20 colonies, USNM 87777; SB-1697, 1 colony, USNM 91623; SB-1698, 1 colony, USNM 95491; SB-1710, many corallites, USNM 95489; SB-1952, 1 colony, USNM 95442; SB-2061, 3, USNM 99302; SB-3147, 1 colony, USNM 95490; SB-4195, 4 corallites, USNM 99265; O-933, 1, USNM 99303; O-4216, 2 colonies, USNM 99279; O-5398, 1 colony, USNM 95442; Alb-2617, 1 colony, USNM 19147 and 99275; Alb-2619, 3 colonies, USNM 19158; Gos-1540, 1 corallite, USNM 99269; Pelican 167-5, 1 colony, USNM 99281; Delaware II-008, 1 colony, USNM 99278; BLM, SOFLA-1, many corallites, USNM 72658; BLM, SOFLA-7, many corallites, USNM 87196; BLM, SOFLA-13, many corallites, USNM 72686; BLM, SOFLA-15, many corallites, USNM 72624; BLM, SOFLA-21, many corallites, USNM 72687; BLM, SOFLA-24, many corallites, USNM 72675; BLM, SOFLA-30, many corallites, USNM 72667; BLM, SOFLA-44, many corallites, USNM 84571; BLM, SOFLA-45, many corallites, USNM 84579; BLM, SOFLA-51, many corallites, USNM 84576; BLM, SOFLA-52, many corallites, USNM 84575; BLM, SOFLA-55, many corallites, USNM 87190; BLM, LMRS, MS-03, many corallites, USNM 67849; BLM, LMRS MS-04, many corallites, USNM 71701; BLM, LMRS, MS-06, many corallites, USNM 71740; BLM, LMRS, I-S05, many corallites, USNM 71694; Devonshire Bay, Bermuda, 1 m, 1 colony, USNM 87782; off Beaufort, NC, 34 m, 1 colony, USNM 93281; South Bight, Andros I., Bahamas, 11 m, 2 colonies, USNM 99258; 28°40'N, 90°14'W, 30 m, 1 colony, USNM 62536; off Baldwin County, AL, 30 m, 1 colony, USNM 95492; east of Pulaski Buoy, FL, 27-29 m, 1 colony, USNM 87779; Key West, FL, 1 m, 1 colony, USNM 99283; west of Venice, FL, 14 m, 1 colony, USNM 45302; Alligator Point, FL, 11 m, 1 colony, USNM 99274; Boynton Inlet, FL, 1 colony, USNM 99272; Bear Cut, Miami, FL, 1-3 m, 1 colony, USNM 87778; Bird Key, Tortugas, FL, 1 m, 1 colony, USNM 99276; Longboat Inlet, FL, 11 m, 3 colonies, USNM 45364; Sebastian Inlet, FL, 1 colony, USNM 80869; 27°29.6'N, 80°17.3'W (Pepper State Park, FL), 5 m, 1, IRCZM; Port Royal, Jamaica, 1 fragmented colony, USNM 80881; Negril Point, Jamaica, 3 colonies, USNM 80874; St. Lucia, wreck of "Lesleen M.", 18 m, several corallites, USNM 99280; La Paguera, Puerto Rico, 9 m, 1 colony, USNM 99263; off Egmont Key, FL, 30-46 m, 1 colony; Biscayne Bay (County Causeway), 1 m, 1 colony, USNM 99257.

Types: The holotypic colony of *P. americana* is deposited at the MNHN. Type Locality: Martinique, depth not reported.

Two syntypes of *Syndepas gouldii* are deposited at the YPM (429). Type Locality: Bay of Cumaná, Venezuela; wreck of the "San Pedro" (1814).

The types of *Stellangia reptans* were not traced. Type Locality: St. Thomas, Virgin Islands, depth not recorded.

The type of *Astrangia phyllangioides* is deposited at the MNHN. Type Locality: St. Thomas, Virgin Islands, depth not recorded.

Distribution: Typical subspecies: widespread in western Atlantic from off Beaufort, North Carolina (34°36'N, 76°36'W) to Rio de Janeiro, Brazil, including the Caribbean, Bahamas, the Gulf of Mexico, and Bermuda (Fig. 19); 0-53 m.

P. americana mouchezii: Mediterranean, eastern Atlantic between Portugal and Senegal, including Madeira and the Canary Islands (ZIBROWIUS 1980); 1-55 m (live).

Phyllangia pequegnatae, new species

(Figs. 7, 141-143)

Coenocyathus n. sp. Rezak et al., 1985: 225 (listed).
Phyllangia americana. –Cairns et al., 1994: 8. [Not *Phyllangia americana* Milne Edwards & Haime, 1849c].

Description: Corallum consists of a cluster of closely-spaced, cylindrical corallites that bud from a thick, common basal coenosteum. Largest colony (holotype) 6.6 x 5.3 cm in size, consisting of about 30 contiguous corallites, the largest corallite 9.7 x 8.3 mm in CD and 22 mm in height. C1-2 usually prominently ridged, especially near calicular edge; theca granular, but often encrusted with epifauna toward basal coenosteum. S1 and upper C1-2 often faintly speckled with a light brown pigmentation, although some coralla uniformly white.

Septa hexamerally arranged in 4 complete cycles (S1>S2>S3>S4), attaining the 24 septa stage at a GCD of about 3.5 mm and the 48 septa stage at a GCD of 5-6 mm. Only the largest corallites have pairs of S5, up to 52 total septa. S1 highly exsert in relation to CD, projecting up to 3.7 mm above calicular edge; axial edges straight, vertical, smooth, and often thickened. Faint ridges oriented perpendicular to the septal edge occur on distal margin of S1. S2 less exsert (up to 2.0 mm), ⅔ width of S1. S3 about 0.7 mm exsert, half width of S2, having finely dentate axial edges. S4 polymorphic in size, those adjacent to S1 the same width as S3 and as exsert as S2, each pair fusing with its adjacent S1 at calicular edge to form a tall, slender lancet. S4 adjacent to S2 rudimentary in width and about as exsert as S3, each pair also fusing with its adjacent S2 at calicular edge to form a smaller lancet. Small, often poorly-formed paliform lobes on lower, axial margins of S3. Fossa quite deep; columella trabecular, appearing to be formed from small lamella that border the S2, perhaps former paliform lobes (P2) from an earlier ontogenetic stage.

Discussion: Some of the specimens of the type series listed above were reported as an atypical variant of *P. americana* by Cairns *et al.* (1994); however, now having a better knowledge of the limits of variation of *P. americana*, this species is described as new. Although similar, *P. pequegnatae* differs from *P. americana* in having taller and more slender corallites, a maculated or white corallum, taller calicular lancets, and a deeper fossa. It also achieves the 48-septa stage at a smaller GCD than *P. americana*, and often has prominent C1-2, whereas the theca of *P. americana* is either smooth or has C1-4. Although their distributions overlap in the western Gulf of Mexico and off South Carolina (Figs. 7, 19), *P. pequegnatae* is more commonly collected in the western Gulf of Mexico, known from only 1 disjunct record off South Carolina, and usually occurs at greater depths than *P. americana*. Other Recent species in the genus include: *P. granulata* Koch, 1886 (Gulf of

Guinea); *P. consagensis* (DURHAM & BARNARD 1952) (tropical eastern Pacific); *P. dispersa* Verrill, 1864 (tropical eastern Pacific); *P. hayamaensis* (Eguchi, 1968) (Japan); and *P. papuensis* Studer, 1878 (South Pacific).

Within the western Atlantic it is more likely that *P. pequegnatae* would be confused with the two other maculated species: *Colangia immersa* and *Rhizosmilia maculata*. The corallites of *Colangia immersa* are approximately the same size as those of *P. pequegnatae* but can be distinguished by having much larger, discrete paliform lobes; noncostate theca, stoloniferous budding, and a polycyclic base. Furthermore, *Colangia immersa* is not yet known from the Gulf of Mexico. *Rhizosmilia maculata* has much larger corallites with more septa, discrete paliform lobes (usually P4), and a polycyclic base. It also is not known from the Gulf of Mexico.

Etymology: This species is named for LINDA H. PEQUEGNAT.

Records/Types: James Island Area Block 463-11, holotype colony, USNM 99286; SB-1125, 12 colonies, paratypes, USNM 99287; Pelican 117-1, 3 colonies, paratypes, USNM 87780; TAMU stn 76-68-II-1, 4 corallites, paratypes, USNM 87781; Circé GS27-1, 1 corallite, paratype, USNM 75656; 27°53'12" N,93°23'54" W, 99 m, 1 paratype, USNM 99268; Mississippi Mud Lump 90 (TU 977), 15,500 yrs BP, 1 May 1969, 1 paratype, USNM 99386. Type Locality: 32°29'52"N, 78°51'23"W (off James Island, SC), 50-54 m.

Distribution: Western Gulf of Mexico from Arcas Cays, Campeche Bay, Mexico to the Mobile Pinnacles, Alabama, with one disjunct record off South Carolina (Fig. 7); 48-112 m.

Genus **Rhizosmilia** Cairns, 1978

Diagnosis: Colonies formed by extratentacular budding from common basal coenosteum. Corallite base increases in diameter by adding exothecal dissepiments over raised costae producing concentric rings of partitioned chambers that resemble polycyclic development. Septotheca costate and granular. Axial edges of septa smooth. Paliform lobes present before penultimate septal cycle (usually P4). Columella papillose or lamellar. Vesicular endotheca present.

Type Species: *R. gerdae* Cairns, 1978, by original designation.

Discussion: In their discussion of the genus *Colangia*, HUBBARD & WELLS (1986: 130) stated that *Colangia* and *Rhizosmilia* are "scarcely distinct", probably because of the similarly of their palar formation, polycyclic base, and speckled pigmentation. Although these two genera have many characters in common, *Rhizosmilia* differs in having: a costate, septotheca (*vs* smooth epitheca); a common basal coenosteum (vs reptoid stolons); vesicular endotheca; smooth septal axial edges (vs dentate S3-4); and a method of basal expansion that resembles, but is not the same as, polycyclic development.

Rhizosmilia maculata (Pourtalès, 1874)

(Figs. 20, 144-147)

Bathycyathus maculatus Pourtalès, v*1874: 34-35, pl. 6, figs. 5-6. –Cerame-Vivas & Gray, 1966: 263 (listed). –Tommasi, 1970: 55 (listed). –Not Keith & Weber, v.1970: 271 (=*Pourtalosmilia conferta*).

Coenocyathus bartschi Wells, v*1947b: 170-171, pl. 11, figs. 1-3. –Werding & Erhardt, 1977: 106. –Zlatarski, 1982: 259-262, pl. 112, figs. 1-5, pl. 113, figs 1, 4-5 (not 2-3, =*Coenocyathus caribbeana*, n. sp.), pl. 114, figs. 1-6. –Prahl, 1985: 174, fig. 106. –Estalella, 1986: 20; 1987: 6-7, figs. 1A-B.

Caryophyllia maculata. –Cairns, 1977b: 9-10, pl. 1, figs. 1-3 (synonymy); 1977c: 86 (colour fig.). –Land, Lang & Barnes, 1977: 170 (isotopic composition). –Cairns, 1978a: 11 (listed). –Castañares & Soto, 1982: Table 1 (listed).

Rhizosmilia maculata. –Cairns, 1978b: 220, pl. 1, fig. 8. –Hubbard & Wells, v.1986: 132, figs. 19-20. –Prahl & Erhardt, 1989: 548, fig. 7. –Not Cortés, v.1992: 243, fig. 1 (=*Colangia immersa*). –Humann, v.1993: 168-169, 4 colour figs. –Cairns, 1995a: 78-79, pl. 21, figs. b-c. –Not Cortés, 1996: 331 (=*Colangia immersa*). –Pires, v.1997: 185.

Rhizosmilia gerdae. –Hubbard & Wells, v.1986: 132, figs. 17-18. [Not *R. gerdae* Cairns, 1978b]

Description: Corallum encrusting, composed of fairly closely spaced, cylindrical corallites united by a thick, common basal coenosteum that usually covers entire substrate between corallites. Corallites usually short and squat, attaining a GCD of 15-20 mm within the first cm of upward growth, corallite bases containing as many as 7 concentric thecal rings. However, some colonies (*e.g.*, those deep within caves, USNM 73913) produce elongate (up to 8 cm in height), yet robust (20 mm in GCD) corallites. Calices circular, elliptical, or irregular in shape, probably dependent on proximity of other corallites and competing epifauna. Largest known corallite (holotype of *Coenocyathus bartschi*, Fig. 144) 26.5 x 18.9 mm in CD and 21 mm in height. Septotheca covered with finely granular, low costae, the intercostal spaces being thin and shallow. Basal region of corallites and coenosteum between corallites increased in thickness by forming exothecal dissepiments that bridge adjacent raised costae, forming concentric or layered regions of chambered corallum (see Cairns, 1978b). Septal faces of S1-3 and upper theca of most corallites covered with black-brown granules (but see Discussion), producing the characteristic speckling of the corallum, much as in *Colangia immersa*; however, speckling does not occur on basal coenosteum or lower theca, as it does in *Colangia immersa*, and is not found on the paliform lobes or columella.

Septa hexamerally arranged in 5 cycles, the fourth cycle (48 septa) complete at a GCD of about 6-8 mm, the fifth complete at a GCD of 15-18 mm, and additional pairs of S6 often present in corallites over 20 mm in GCD. Corallites between 8-18 mm GCD have a variable number of S5, depending on area available within calice. S1 moderately exsert (about 2.5 mm), having straight, vertical axial edges that join the columella low in fossa. S2 usually equally exsert (at least in larger specimens), but slightly less wide than S1. S3 1.9-2.0 mm exsert, about ¾ width of the S2, having straight, vertical axial edges. S4 about 1.4 mm exsert, ¾ width of the S3, having smooth axial edges. S5 rudimentary, only 0.9 mm exsert and less than half width of an S4, having dentate axial edges. In smaller corallites (e.g. 6-18 mm GCD), in which none or only some of the S4 are flanked by pairs of S5, septa of the penultimate cycle (S3) bear rounded paliform lobes up to 1.7 mm in width, which are invariably less wide than the S3 they border. These P3 lobes have straight axial, upper, and peripheral edges. When a pair of S5 is inserted in a half-system, the P3 lobe realigns itself with the adjacent flanked S4, and eventually another P4 is formed within the half-system before the other flanked S4, the 2 P4 lobes within a half-system forming a closely adjacent pair (see CAIRNS 1978b). Fossa of moderate depth, in large coralla containing a crown of 24 paliform lobes (P4) and the axial columella. Columella composed of several irregularly-shaped papillae, sometimes fused into an elongate lamellar structure. Vesicular endotheca present.

Discussion: HUBBARD & WELLS (1986) identified both *R. maculata* and *R. gerdae* from the same habitat in Trinidad, but commented that "specific separation of these two forms is doubtful." Having re-examined their material, I conclude that the specimens they identified as *R. gerdae* are actually a non-maculated (white corallum) form of *R. maculata*, which would explain their difficulty in distinguishing the species. Whereas all other specimens of *R. maculata* have a speckled corallum, some of those in Trinidad apparently do not, which requires a re-evaluation of the criteria that separate these species. Although it is somewhat difficult to quantify, the corallites of *R. maculata* are shorter and squatter than those of *R. gerdae*: at a corallite height of 1 cm, the GCD of *R. maculata* may already be 15-17 mm, whereas that of *R. gerdae* would rarely exceed 10 mm, and the corallum would have corresponding fewer septa. In fact, the GCD of *R. gerdae* is not known to exceed 19 mm, whereas that of *R. maculata* grows up to 27 mm. Whereas both species occur as deep as 500 m, only *R. maculata* occurs at SCUBA depth as shallow as 0.5 m, the shallowest record of *R. gerdae* being 123 m. Finally, although it can no longer be used as a definitive difference, most corallites of *R. maculata* have a speckled corallum, whereas the corallum of *R. gerdae* is exclusively white.

Juvenile coralla of *R. maculata* (GCD 6-10 mm) may also be confused with adult coralla of *Colangia immersa*, both species having a speckled corallum, a similar type of paliform lobe formation, and approximately the same number of septa at this size. *R. maculata*, however, differs in having a common basal coenosteum that is not speckled (vs stolons that often are speckled); costae theca (*vs* smooth epitheca); wider S1 (*i.e.*, the S1 axial edges of *Colangia immersa* do not attain the columella); equally exsert S1-2; smooth, non-dentate septal axial edges (S3-4 of *C. immersa* are dentate); and much smaller paliform lobes in relation to the septa they border (the lobes of *Colangia immersa* are much wider than the septa they border).

Rhizosmilia maculata is common throughout the tropical western Atlantic, most often found attached to the ceilings of caves, under ledges, and beneath foliaceous reef corals. The colour of the polyps are orange-brown, brown, pink, lavender, and pale green (HUMANN 1993). The common name of this species is the 'speckled cup coral' (CAIRNS *et al.* 1991).

New Records: P-330, 1, USNM 92286; P-389, 3, USNM 92287; P-736, 1, USNM 92290; P-857, 6, USNM 92292; P-876, 1, USNM 92293; P-924, 1, USNM 99289; P-935, 1, USNM 92295; P-969, 3, USNM 92296; G-701, 1, USNM 92298; G-702, 1 colony, USNM 92299; G-882, 2, USNM 92301; G-985, 3, UMML 8.239;

SB-2446, 1, USNM 92306; O-4227, 6, USNM 99290; Alb-2146, 1, USNM 16113; Alb-2167, 2, USNM 16122; Alb-2319, 1, USNM 16112; B-A DS65, 1, USNM 92315; JS-16, 1, USNM 92317; DBL-83 and -84, Cardiff Hall, Jamaica, 40 m, 3 colonies, USNM 80802; Hummelinck-1443, 1 colony, USNM 92308; Str. Norseman, 12°48'S, 38°W, 49 m, 3 corallites, USNM 5376; Chankanaab Caves, Cozumel, Mexico, 0.5-4 m, 32, 20, and 40 m from cave mouth, numerous colonies, USNM 73912-14, respectively; Green Cay, Bahamas, 130 m, 1, USNM 92316; Middle Bight, Andros, Bahamas, depth unknown, 1, UMML 8.343; 13°52'N, 61°07'W (attached to a telegraph cable), 508 m, 25 corallites, MCZ 5101 and 5588; 'Caribbean', depth unknown, 1, USNM 92309.

Types: The holotype of *Bathycyathus maculatus*, a single corallite measuring 8.9 x 7.8 mm in CD and 8.3 mm in height, is deposited at the MCZ (2783). Type Locality: Abrolhos, Brazil, 55 m.

The holotype of *Coenocyathus bartschi*, a colony consisting of 1 large corallite (GCD = 26.5 mm) and 2 smaller ones, is deposited at the USNM (M547397). Type Locality: Dry Tortugas, Florida, 66-73 m.

Distribution: Southern Florida; Bahamas; Caribbean; Brazil to Abrolhos (Fig. 20); 0.5-508 m, the deepest record from specimens attached to a recovered telegraph cable off St. Lucia (MCZ).

Rhizosmilia gerdae Cairns, 1978

Rhizosmilia gerdae Cairns, *1978b: 219-222, pl. 1, figs. 1-7; 1979: 142-143, pl. 27, figs. 5-8, map 40. -Not Hubbard & Wells, v.1986: 132, figs. 17-18 (=*R. maculata*).

Diagnosis: Colony consists of an assemblage of corallites of different sizes, all united by a common basal coenosteum. Corallites tall and slender, cylindrical to subcylindrical, usually having a slightly larger calice than pedicel. Largest corallite (USNM 46818) 19.1 x 14.6 mm in CD, 10.3 mm in pedicel diameter, and 16.8 mm in height; however, most coralla narrower (e.g., 8-10 mm) and tall in relation to their CD. Corallum exclusively white; colour of polyp unknown. Septa hexamerally arranged in 5 cycles, the last cycle rarely complete. Only 4 cycles of septa (48) present in corallites up to 11 mm in GCD, with a gradually increasing number of S5 occurring in corallites up to 19 mm GCD. Septal formula: S1-2>S3>S4>S5. Paliform lobes occur before penultimate septal cycle, i.e., 12 P3 in small coralla, and a mixture of P3 and P4 in larger coralla having pairs of S5. Columella papillose or lamellar.

Discussion: Little can be added to the descriptions of this species given by CAIRNS (1978b, 1979); however, the records reported herein extend the known distribution from the Straits of Florida to southeastern Puerto Rico, St. Croix, and the Yucatan Channel. Comparisons to *R. maculata* are made in the account of that species, as well as a discussion of *R. gerdae* reported by HUBBARD & WELLS (1986).

New Records: P-594, 1 colony, UMML; G-704, 1 colony, UMML; O-24237: 8 colonies (IRCZM 12: 109), 2 colonies (USNM 83463); Alb-2331, 1 colony, USNM 10166; JSL-II-816, 1, IRCZM 12:150; St. Croix, Virgin Islands, 549-1280 m, 3 corallites, USNM 61871.

Types: See CAIRNS (1979).

Distribution: Insular Straits of Florida; Bahamas; Yucatan Channel; southeastern Puerto Rico; St. Croix, Virgin Islands (CAIRNS 1979: map 40); 123-549 m.

Genus **Phacelocyathus** Cairns, 1979

Diagnosis: Colonial, new corallites forming by extratentacular budding from common basal coenosteum. Endo- and exothecal dissepiments present. Septotheca costate, but costae often covered with stereome. Pali before septa of all but last cycle. Columella primarily papillose, secondarily lamellar.

Type Species: *Paracyathus flos* Pourtalès, 1878, by original designation.

Phacelocyathus flos (Pourtalès, 1878)

Paracyathus flos Pourtalès, v*1878: 201.
Phacelocyathus flos. –Cairns, 1979: 144-146, pl. 27, figs. 1-4, Map 41 (synonymy and description). –Cairns et al., 1991: 47 (listed). –Humann, v.1993: 174-175, colour fig. –Cairns et al., 1994: 4 (listed).
Caryophyllia flos. –Castañares & Soto, 1982: Table 2 (listed).

Diagnosis: Small corallites usually ceratoid (straight) and greatly flared; larger corallites usually cylindrical. Largest corallite (USNM 61943) 15.6 x 13.1 mm in CD, 15.4 mm in height, and 9.1 mm in PD. Costae inconspicuous, granular, often covered with smooth, translucent calcareous deposits. Upper quarter of corallum, including distal edges of all septa and theca near calice, usually pigmented black or reddish-brown; however, coralla of about 25% of specimens examined entirely white. Septa hexamerally arranged in 4 cycles (S1-2>S4>S3), up to 3 pairs of S5 (54 septa) present in largest corallites. S1-2 highly exsert and often thick, appearing swollen. S3 more exsert but slightly less wide than S4, the S4 adjacent to S1 being slightly wider than those adjacent to S2. P1-2 equal in size, narrow, and recessed low in fossa. P3 substantially larger (*i.e.*, 3 times as thick and 4 times as wide as P1-2) and stand much higher in fossa. P3 have broad, rounded distal edges; straight, vertical axial edges that extend closer to columella than P1-2; and thick peripheral edges that border not only S3 but the 2 adjacent S4 as well. Sometimes peripheral edge of the P3 is dissected into 3 components, as though paliform lobes (P4) are splitting from the P3 even before S5 form. Columella papillose, in older corallites some of the papillae fusing to form an elongate lamella.

Discussion: The records reported below extend the known distribution of *P. flos* to Mexico (Cozumel), Belize, and Puerto Rico, as well as establishing a shallower depth range of 20-355 m. The deeper range of 560 m reported by CAIRNS (1979), as well as several other records deeper than 400 m, were based on dead specimens and therefore are not now considered valid for establishing a depth range. Most records of this species are from less than 200 m, often from cave ceilings and the undersides of ledge overhangs (HUMANN 1983). Its common name is the 'twotone cup coral (HUMANN 1983).

New Records: P-1395, 1 corallum of 8 corallites, USNM 61938; Gos-39, 1, USNM 80996; Gos-112/78, 1, USNM 80994; JSL-I-1332, 1, IRCZM; JSL-I-3660, 12, USNM 94742; DBL-879, and 1022, Runaway Bay, Jamaica, 34-40 m, 6: 5 (USNM 80995), 1 (UMML 8.383); DBL-1428, Runaway Bay, Jamaica, 24 m, 2, USNM 46079 and 80979; Palancar Reef, Cozumel, Mexico, 20 m, 1, USNM 77654; Freeport, Grand Bahamas, 50 m, 1, USNM 61937; Margarite Reef, La Parguera, Puerto Rico, 90-92 m, 2, USNM 61943; 16°48.2'N, 88°04.5'W, 128 m, 2, USNM 99292.

Types: See CAIRNS (1979).

Distribution: Bahamas; northeastern Gulf of Mexico; Antilles; western Caribbean; off Guyana; off Recife, Brazil (CAIRNS 1979: map 41); 20-355 m.

Genus **Anomocora** Studer, 1878

Diagnosis: Corallum colonial and recumbent, producing relatively small but elongate corallites. New corallites tend to bud extratentacularly from edge zone with random periodicity, invariably detaching from parent before a third generation bud appears, resulting in corallites with open or broken bases. Theca thin and endothecal dissepiments widely spaced, resulting in a low density corallum. Paliform lobes usually present on higher cycle septa; columella trabecular.

Type Species: *Coelosmilia fecunda* Pourtalès, 1871, by monotypy.

Discussion: In the course of re-examining specimens of *Anomocora fecunda* and *Asterosmilia prolifera*, they were found to be inseparable regarding generic level characters, *i.e.*, they both bud extratentacular coralla from the edge zone, which detach from the parent corallum resulting in basally open corallites; and they have paliform lobes before the penultimate septal cycle; endothecal dissepiments; and a papillose columella. The genus *Asterosmilia* Duncan, 1867, based on the type species *A. abnormalis* (DUNCAN 1864), may still be retained for similar species that do not asexually bud daughter corallites, and would include species such as: *A. profunda* (Duncan, 1864) and *A. duncani* Vaughan, 1925, among others (see CAIRNS & WELLS 1987). But the following species, that were previously placed in *Asterosmilia*, all of which have asexual budding of coralla from the edge zone or parricidal budding resulting in coralla with open bases, and are transferred to *Anomocora*: *A. exarata* (DUNCAN 1867), n. comb.; *A. marchadi* (CHEVALIER 1966), n. comb.; *A. prolifera* (POURTALÈS 1871), n. comb.; *A. gigas* (VAN DER HORST 1931), n. comb.; and *A. irregularis* (CAIRNS 1995b), n. comb.

Anomocora fecunda (Pourtalès, 1871)

Coelosmilia fecunda Pourtalès, v*1871: 21-22, pl. 1, fig. 12, pl. 6, figs. 14-15.
Anomocora fecunda. –Ludwick & Walton, 1957: 2081 (listed). –Keith & Weber, v.1970: 271 (isotopic analysis). –Cairns, 1979: 127-129, pl. 24, figs. 6-8, Map 35 (synonymy and description). –Hubbard & Wells, v.1986: 138, figs. 29-30. –Viada & Cairns, 1987: 132. –?Estalella, 1987:13-14, figs. 4A-B. –Prahl & Erhardt, 1989: 547. –Cairns et al., 1991: 47 (listed). –Cairns et al., 1994: 4 (listed).
Coenosmilia fecunda. –Zibrowius, v.1980: 131-133 (in part: pl. 67, figs. A-K).

Diagnosis: Corallum elongate (up to 10 cm) and cylindrical (GCD up to 10 mm), tapering slightly towards base, which is invariably open or broken, the result of detachment from the theca of parent corallite. Coralla often slightly curved, lying in a recumbent posture, each parent corallite bearing several smaller buds oriented perpendicular to the parent, as well as scars of previous bud detachments. Budded corallites rarely exceed 20 mm in length before detachment. Costae low, continuous ridges; corallum white. Theca thin (about 0.3 mm) and tabular endothecal dissepiments widely spaced (1 every 4 mm), producing a low-density, brittle corallum. Septa hexamerally arranged in 4 cycles: S1>S2>S3>S4. Axial edges of S2 sometimes bear several elongate, ribbon-like paliform lobes that intermingle with the columella. Axial edges of S3 often bear a small, lamellar paliform lobe or several slender ribbons, as on the S2. S4 rudimentary or absent. Columella not well formed, composed of a loose mingling of ribbon-like elements.

Discussion: Like *Coenosmilia arbuscula*, *A. fecunda* is fairly common between 100-200 m. The minimum bathymetric range of the species may be extended to 37 m, based on the record from R/V Hidalgo-316, made at Gorda Bank, Honduras.

Although similar to *C. arbuscula*, *A. fecunda* differs in having more elongate, cylindrical coralla with costae forming thin, continuous ridges. Budding appears to be random, each bud detaching from the theca of its parent corallite before a third generation appears, resulting in a broken, often open, base of most corallites. Furthermore, *A. fecunda* has more widely spaced dissepiments and thus a lower density corallum; small paliform lobes (P2 and P3); and a poorly formed columella.

New Records: P-596, 6, USNM 80436; O-4225, 5, USNM 62510; BLM, SOFLA-32, 2, USNM 71964 and 71989; Hidalgo-316, 1, USNM 85738; Hidalgo-319, 12, USNM 85739; Aleutian Bounty, 26°30'N, 84°50'W, 640 m, 1, FSBC I; EJ81-24, 4, FSBC I; EJ81-29, 2, FSBC I; 26°16'N, 84°04'W, 139-148 m, 2, USNM 83441; 25°00'N, 84°00'W, 128 m, 12, USNM 62504.

Types: See CAIRNS (1979).

Distribution: Western Atlantic: Bahamas, Caribbean, eastern Gulf of Mexico, northeastern Brazil (off Maranhão), St. Peter and St. Paul Rocks (CAIRNS 1979: map 35); 37-640 m. Eastern Atlantic: Azores, Madeira, Canary Islands; 130-540 m (ZIBROWIUS 1980).

Anomocora prolifera (Pourtalès, 1871), new combination

(Figs. 148-150)

Ceratocyathus prolifer Pourtalès, v*1871: 19-20, pl. 3, figs. 8-10.
Asterosmilia prolifer. –?Alloiteau & Tissier, 1958: 243-245, pl. 2, figs. 4 a-b, 4'a-b.
Asterosmilia prolifera. –Kenny et al., 1975: 116, fig. 13. –Cairns, 1979: 138-140, pl. 26, figs. 5-6, 8, map 39 (synonymy and description). –Zibrowius, v.1980: 140-141, pl. 73, figs. A-N, pl. 107, fig. J (synonymy and description). –Hubbard & Wells, v.1986: 138-139, figs. 31-32. –Cairns & Wells, 1987: 38-39, table 3. –Prahl & Erhardt, 1989: 548. –Cairns et al., 1991: 47 (listed). –Cairns et al., 1994: 4 (listed).

Diagnosis: Corallum ceratoid (cornute), up to 17 mm in GCD and 50 mm in length. Some coralla attach through a slender pedicel to a substrate, such as a dead *Deltocyathus* corallum (Fig. 150), but most coralla originate by asexual budding from the edge zone just beneath calicular edge. Buds detach at a very small size, and are virtually never seen while still attached to parent corallum, but in exceptional circumstances (Fig.

149). Asexual budding results in a daughter corallum with a small, usually open, irregularly fractured basal end 1.0-1.2 mm diameter. Another result of bud detachment is that the parent corallum often bears several small, concave detachment scars, usually less than 1 mm in diameter, which may be aseptate. Parricidal budding also very common, resulting in 1, or sometimes 2, daughter corallites (Fig. 148) from a parent corallum. Costae usually well formed and granular; corallum white. Septa hexamerally arranged in 4 cycles (S1-2>S3>S4), larger coralla with some pairs of S5. Broad paliform lobes usually present before S3. Columella papillose, occasionally lamellar. Endothecal dissepiments present, especially in elongate coralla.

Discussion: The new records listed below extend the known distribution from southern Florida to off Onslow Bay, NC and add records to southwestern Florida and Suriname. The known bathymetric range is marginally increased from 32-311 m to 30-329 m. The bathymetric range of 5-1383 m given by PRAHL & ERHARDT (1989) is unsubstantiated and improbable.

New Records: O-3210, 20, USNM 80732; O-4302, 1, USNM 80733; O-5699, 1, USNM 80737; BLM, SOFLA-32, 2, USNM 71963; BLM, SOFLA-36, 20, USNM 71961-62; BLM, James Island Area Block 380-19, 2, USNM 75695; BLM OS-05, 3, USNM 71662-63; Alpha Helix-16, 9, USNM 79506; Delaware II-121, 1, FSBC I; west of Cedar Keys, FL, 55 m, 1, USNM 46803.

Types: See CAIRNS (1979).

Distribution: Western Atlantic: southeastern US from Onslow Bay, NC (33°49'N, 76°34'W) to off Pensacola, FL; Bay of Campeche, Mexico; northern coast of South America from Colombia to French Guiana and north to Martinique (CAIRNS 1979: map 39); 30-329 m. Eastern Atlantic: Madeira; Canary Islands; off Spanish Sahara; 110-125 m (ZIBROWIUS 1980).

Anomocora marchadi (Chevalier, 1966), new combination

Dasmosmilia marchadi Chevalier, v*1966a: 944-949, pl. 5, figs. 3-4, text-figs. 11-13.
Asterosmilia marchadi. –Cairns, 1979: 140-142, pl. 26, figs. 7, 9-10, Map 40 (synonymy and description). –Zibrowius, v.1980: 141-142, pl. 74, figs. A-K (synonymy and description).

–Cairns & Wells, 1987: 38-39 (Table 3). –Prahl & Erhardt, 1989: 548. –Cairns et al., 1991: 47 (listed). –Cairns & Keller, 1993: 249-250, figs. 6A. –Cairns et al., 1994: 7. –Cairns & Zibrowius, 1997: 131-132, figs. 17a-b (synonymy and description).

Discussion: *Asterosmilia marchadi* was recently described by CAIRNS & ZIBROWIUS (1997) and thus will not be redescribed herein. *A. marchadi* is similar to *A. prolifera*, has similar geographic and bathymetric ranges, and is sometimes found at the same stations. *A. marchadi* can be distinguished by having poorly developed P3, a junction of the axial edges of each pair of S3 before its adjacent S2, a brownish corallum, S1 more exert and broad than S2, and thecal buds that remain attached longer and have a larger base of detachment (*i.e.*, 1.5-2.0 mm diameter). Parricidal budding is also much less common.

New Records: P-710, 10, USNM 99295; P-711, 2, USNM 99296; P-717, 1, USNM 46789; P-718, 17, USNM 46784, 80506; P-761, 8, USNM 46798.

Types: See CAIRNS (1979).

Distribution: Western Atlantic: off northeastern Florida; off Pensacola, Florida; southern Caribbean from Colombia to Península de Paria, Venezuela; 35-229 m (CAIRNS 1979: map 40). Eastern Atlantic: from Spanish Sahara to Gabon; 32-85 m (ZIBROWIUS 1980). Elsewhere: Philippines, Indonesia, South China Sea, Maldives, southwest Indian Ocean; 32-210 m (CAIRNS & ZIBROWIUS 1997).

Genus **Coenosmilia** Pourtalès, 1874

Diagnosis: Corallum colonial, producing small, bushy colonies by extratentacular budding from edge zone just below calice. Pali and paliform lobes absent; columella trabecular. Tabular endothecal dissepiments present.

Type Species: *Coenosmilia arbuscula* Pourtalès, 1874, by monotypy.

Coenosmilia arbuscula Pourtalès, 1874

Coenosmilia arbuscula Pourtalès, v*1874: 39-40, pl. 7, fig. 1. –Cairns, 1979: 130-132, pl. 24, figs. 9-11, Map 36 (synonymy and description). –Rezak et al., v.1985: 225 (listed: stn 119, Diaphus Bank: 28°05'N, 90°41'W, 44-74 m). –Prahl & Erhardt, 1989: 547-548. –Cairns et al., 1991: 47 (listed). –Cairns et al., 1994: 4 (listed).

Coenosmilia fecunda. –Zibrowius, v.1980: 131 (in part: pl. 68, figs. A-F). [Not *Coelosmilia fecunda* Pourtalès, 1871]

Diagnosis: Each corallite bears 2-4 daughter corallites, which are equally spaced around its calicular perimeter. Because corallites remain firmly attached to their parent, a small bushy corallum often results, larger coralla composed of up to 5 successive generations. Corallites ceratoid, typically 10-15 mm in height and 7-10 mm in GCD; founder corallites sometimes larger. Costae ridged and finely dentate; corallum white. Theca robust (0.5-0.6 mm thick) and endothecal dissepiments closely spaced. Septa hexamerally arranged in 4 cycles: S1>S2>S3>S4. Axial edges of S1-2 straight and smooth, those of S3 slightly dentate, and those of S4 highly dentate. Columella well developed, papillose.

Discussion: This species is relatively common between 100-200 m, and is often collected together with *Anomocora fecunda* and *Asterosmilia prolifera.* The bathymetric range may be extended to as shallow as 74 m based on the report of *C. arbuscula* by REZAK *et al.* (1985) from Diaphus Bank (see synonymy). The record of '*Coenosmilia* n. sp.' by REZAK *et al.* (1985), however, is unsubstantiated.

New Records: SB-3467, 2, USNM 80235; B-A DS34, 1, USNM 80190; BLM, SOFLA-32, 3, USNM 71974 and 80099; BLM, SOFLA-35, 12, USNM 71972, -75, -79, -80, -83, 72688; BLM, SOFLA-36, 7, USNM 71973, -76, 75683; BLM, SOFLA-38, 20, USNM 71977, -78, -81, -82, -88; JSL-II-1845, 1, USNM 86802; JSL-I-2585, 4, USNM 89360; USGS, VIII-A-3, 1, USNM 80355; CSA Pinnacle site 4, 2, CSA; 26°16'N, 84°04'W, 139-148 m, 1, USNM 83443; 25°00'N, 84°00'W, 126 m, 3, USNM 99298; R/V Cape Hatteras, 15°32.4'N, 81°39.8'W, 50-85 m, 4, FSBC I.

Types: See CAIRNS (1979).

Distribution: Western Atlantic: throughout Bahamas and Caribbean to Guyana, South America; northern Gulf of Mexico to southwestern Louisiana (27°49'N, 91°54'W); 74-622 m (CAIRNS 1979: map 36). Eastern Atlantic: Azores, Madeira, Canary Islands; 130-540 m (ZIBROWIUS 1980).

Genus **Pourtalosmilia** Duncan, 1884

Diagnosis: Bushy colonies formed by extratentacular budding from near calicular margin; anastomosis of adjacent corallites common. Corallites subcylindrical and elongate. Septotheca granular. Septa usually arranged in 4 cycles, with a crown of pali before septa of penultimate cycle (P3). Columella well developed, fascicular. Vesicular endothecal dissepiments abundant.

Type Species: *Blastosmilia pourtalesi* Duncan, 1878 [=*Pourtalosmilia anthophyllites* (Ellis & Solander, 1786)], by monotypy. Although no species were listed by DUNCAN (1884) in the original description of *Pourtalosmilia,* this genus was established as a new name for the junior homonym *Blastosmilia* (Duncan, 1878, not Etallon, 1859), which included only one species: *B. pourtalesi.*

Pourtalosmilia conferta Cairns, 1978

(Fig. 22)

Bathycyathus sp. Ludwick & Walton, 1957: 2081, fig. 13C1.
Bathycyathus maculatus. –Keith & Weber, v.1970: 271 (USNM 46857). [Not *Bathycyathus maculatus* Pourtalès, 1874]
?*Coenocyathus* sp. Avent, King & Gore, 1977: 200 (listed).
Pourtalosmilia conferta Cairns, *1978a: 12, pl. 1, figs. 1-6; 1979: 207 (listed). –Cairns et al., 1994: 8.

Diagnosis: (from CAIRNS 1978a): Large, densely-branched colonies up to 22 cm tall and 19 cm in diameter. Elongate corallites up to 6 cm; corallites often anastomose laterally, producing a compact, reinforced corallum with many small cavities, the cavities providing niches for various other organisms. Calices up to 11 mm in GCD. Theca finely granular (not costate); corallum uniformly white. Septa hexamerally arranged in 4 cycles (S1-

2>S3>S4). A crown of 12 well-formed P3 encircles a fascicular columella. Vesicular endotheca abundant.

Discussion: Although not included in my revision of the deep-water Caribbean azooxanthellates (CAIRNS 1979), *P. conferta* was fully described and illustrated a year earlier (CAIRNS 1978a) and little can be added to that account, except for the added distributional records listed below.

New Records: JSL-I-1200: large colony (IRCZM 12:133), 1 fragment (USNM 75209); JSL-II-3104, 1 fossil slab carbon-dated at 13,170 yrs BP ± 80 years (USNM 93277), remainder of colony at DISL; Circé-25, 4 corallites, USNM 75654; Circé-28, 2 corallites, USNM 75659; Circé stn 29, 2 corallites, USNM 75661; CSA Pinnacle site 7, 3, CSA; USGS-AE-9701-77, 1 colony, USNM 99365.

Types: All types deposited at the NMNH (see CAIRNS 1978a). Type Locality: 34°57.5'N, 75°19.5'W (off Cape Hatteras, NC), 119-173 m.

Distribution: Despite the 6 additional records reported above and 2 previously overlooked references (LUDWICK & WALTON 1957 and KEITH & WEBER 1970), *P. conferta* is known from only 17 collections, a third of which are from the Mobile Pinnacles in the northeastern Gulf of Mexico. The distribution of this species is disjunct (Fig. 22), known from: off Cape Hatteras; east and south Florida coasts; north central Gulf of Mexico (off Louisiana, Mobile Pinnacles, and off Pensacola); near Rio de Janeiro; and St. Paul Rocks, Brazil; 55-191 m. The latitude of 25°05'N given by CAIRNS (1978a) for the location at Ilha Raza Guaratiba, Brazil should have read 25°05'S.

Family **TURBINOLIIDAE Milne Edwards & Haime, 1848**

Genus **Deltocyathoides Yabe & Eguchi, 1932**

Diagnosis: Corallum unattached, bowl-shaped, with a rounded base, and a calice circular in cross section; regeneration from basal fragments common but transverse division not present. Costae ridged and serrate; intercostal regions deep, narrow, and not pitted. Higher cycle costae originate by bi- or trifurcation. Septa hexamerally arranged in 4 cycles. Pali before all but last septal cycle; columella papillose.

Type Species: *Deltocyathoides japonicus* Yabe & Eguchi, 1932 (=*Deltocyathus orientalis* Duncan, 1876), by original designation.

Deltocyathoides stimpsonii (Pourtalès, 1871)

Leptocyathus stimpsonii Pourtalès, v*1871: 12, pl. 3, figs. 1-3.
Peponocyathus stimpsonii. –Cairns, 1979: 115-117, pl. 22, figs. 5-7, not pl. 20, fig. 11, Map 31 (synonymy and description). –Zibrowius, v.1980: 115-116, pl. 60, figs. A-M (synonymy and description). –Viada & Cairns, 1987: 132. –Cairns et al., 1991: 47 (listed).
Peponocyathus australiensis. –Cairns et al., 1994: 4 (listed). [Not *Deltocyathus italicus* var. *australiensis*]
Deltocyathoides stimpsonii. –Cairns, 1997:17, pl. 4, fig. g, pl. 7, fig. e.

Diagnosis: Corallum spherical, rarely exceeding 7 mm in CD. Base of corallum sometimes irregular or asymmetrical, caused by asexual budding from a parent fragment, but transverse division does not occur. Costae equal in width, each costa bearing a row of outward projecting granules, as well as much smaller spines that project into intercostal furrow. Corallum white. Septa hexamerally arranged in 4 cycles: S1>S2>S3>S4, axial edges of S4 fusing to their adjacent P3. Rod-shaped or lamellar pali usually present before S2 and S3. Columella composed of 6-8 granular papillae, 6 often aligned with the S1, resembling P1.

Discussion: The only substantive record of *D. stimpsonii* since 1979 was that of VIADA & CAIRNS (1987) from off southwestern Louisiana. This species was at one time thought to be synonymous with the Indo-Pacific species *Peponocyathus australiensis* (DUNCAN 1870) (see CAIRNS 1989, 1994), but was later (CAIRNS 1997) considered to be a separate species, geographically isolated from *D. australiensis* in separate oceans.

New Records: EJ81-20, 3, FSBC I; EJ81-22, 1, FSBC I; off Alligator Reef Lighthouse, FL, 182-213 m, 1, USNM 81000; 'east coast of Florida', depth unknown, 5, USNM 61854-56.

Types: See CAIRNS (1979).

Distribution: Western Atlantic: southeastern US from off Charleston, SC (31°52.8'N, 78°29.5'W) to southwestern Florida; off southwestern LA; Campeche Bank, Mexico; Straits of Florida; Lesser Antilles; one isolated record off Maranhão, Brazil; 110-553 m (CAIRNS 1979: map 31). Eastern Atlantic: Madeira; Azores; 200-600 m (ZIBROWIUS 1980).

Genus **Sphenotrochus** Milne Edwards & Haime, 1848

Diagnosis: Corallum cuneiform, with a rounded base and a calice elliptical in cross section. Costae variable in ornamentation (smooth or granular) and in length (continuous from calice to base, or fragmented into short, parallel ridges). Costae independent in origin; no thecal pits of pores. Septa in 3 or 4 cycles. Pali and paliform lobes absent; columella lamellar.

Type Species: *Turbinolia crispa* Lamarck, 1816, by subsequent designation (MILNE EDWARDS & HAIME 1850a: xvi).

Sphenotrochus auritus Pourtalès, 1874

(Figs. 21, 151-156)

Sphenotrochus auritus Pourtalès, v*1874: 37, pl. 6, figs. 14-15. –Moseley, 1881: 158 (mentioned) –Not Wells, 1956: F360, fig. 258, 1a-b (=*S. senni* Wells, 1945). –Laborel, 1970: 155 (listed); 1971: 175 (listed). –Cairns, 1979: 207 (listed). –Cairns, 1989: 38 (mentioned). –Cairns, 1997: (listed, compared).

Not *Sphenotrochus auritus* var. Lindström, v.1877: 11-12, figs. 21-22 (=*S. lindstroemi*, n. sp.). –Wells, 1935: 531 (listed). –Cairns & Wells, 1987: 36.

Sphenotrochus sp. Tommasi, 1970: 55 (listed). –?Zibrowius, 1988: 136 (listed).

Description: Each wedge-shaped corallum bears broad, planar thecal faces that meet in rounded or narrow, planar thecal edges, the edges consisting of 3 broad costae. Largest corallum (Monitaverão) 9.7 x 6.2 mm in CD and 13.4 mm in height; largest syntype (Fig. 155) 7.2 x 4.0 mm in CD and 7.3 mm in height, these 2 coralla representing the extremes in GCD:LCD. Calice elongate (GCD:LCD = 1.56-*1.65*-1.80), the corallum narrowing aborally to a thin, linear to fishtail-shaped base, the triangular fishtail projections extending as much as 2.2 mm (Figs. 151-152) but characteristic only of larger coralla. Coralla of less than 5 mm GCD usually have a rounded base. GCD:HT = 0.71-1.09. Costal ornamentation distinctive. On lower central region of both thecal faces, at a height of about 1.3 mm above the base (or about the height of the original substrate inclusion), 9 costae (C1-3) radiate upward as continuous ridges for approximately 2 mm (Figs. 152-153). The 2 principal C1 and their flanking C3, which form the edge of the corallum, do not radiate from this region. Each of these 18 costae (9 on each face) then fragments into shorter ridges and subsequently forms 2 parallel rows of elongate granules per costa. At a distance of 5-8 mm from the base a third row of granules is added to each costa, and at a distance of over 8 mm from the base a fourth row or granules may be added. Short costae also radiate downward (aborally), from the point of substrate inclusion to the base of corallum. Short, discontinuous costae also run perpendicular to the C2 that is closest to the edge (principal) C1, this costal ornamentation associated with the 4 C3 adjacent to the 2 edge C1 and covers the fishtail-like spurs. Corallum white.

Septa hexamerally arranged in 3 cycles (24 septa): S1-2>S3. S1-2 moderately exsert (about 1.2 mm), having vertical axial edges that appear to be thick, but instead are the result of rather large granules on axial edge. Lower axial edges of the 2 S2 and 4 S1 associated with central faces of corallum solidly fused to columella, whereas axial edges of the 4 S2 located toward the narrow edges of the corallum fuse to the columella but less strongly and lower in fossa. Axial edges of the 2 edge S1 usually do not fuse to columella. S3 only slightly less exsert and about ¾ width of S1-2, but all septa equal in thickness at calicular edge; S3 have thin, dentate axial edges. Fossa relatively shallow, containing a well-developed, blade-like lamellar columella with a smooth, continuous distal edge.

Discussion: *Sphenotrochus auritus* is compared to *S. lindstroemi* in the account of the latter species, but small coralla of *S. auritus* (before the formation of basal spurs) are remarkably similar to *S. senni* Wells, 1945, known from the Middle Miocene to Late Pliocene of the Caribbean (CAIRNS & WELLS 1987). *S. senni* may well be the ancestor of *S. auritus* or even be conspecific; more specimens of both forms are needed to make this evaluation.

The records listed below are believed to be the first legitimate records of *S. auritus* since it was described in 1874.

New Records: P-686, 1, USNM 87612; O-2075, 92 juvenile coralla, USNM 87613; Emilia-251, Baia de Ilha Grande, Brazil, 18 m, 5: 4, MNRJ 570, 1, USNM 99301; Saldanha 031, 19°43'S, 39°34'W, depth unknown, 5, MNRJ 613; Saldanha-1743, 3, USNM 84353; Akaroa-92, 3, USNM 99300; "Station 8201", 34°35'S, 54°02'W, 15 m, 25 II 1992, 2, MNRJ 569; Astro Garoupa-15, 22°10'34"S, 40°58'55"W, 30 m, 4, MNRJ.

Types: Seven syntypes from Hassler station 20 off Cabo Frio, Brazil are deposited at the MCZ: 6 numbered 2755 and 1 numbered 2788. Two additional uncataloged syntypes, also from the Hassler 1871-1872 expedition (stations 9-10?), from 11°49'S, 37°10-27'W, are also deposited at the MCZ. Type Localities: Cabo Frio, Brazil (64 m) and 11°49'S, 37°10'W (off São Cristóvão, Brazil), 22-33 m.

Distribution: Known only from the Atlantic coast of South America from Suriname to Uruguay (Fig. 21); 15-64 m.

Sphenotrochus lindstroemi, new species

(Figs. 21, 157-161)

Sphenotrochus auritus var. Lindström, v.1877: 11-12 (in part: specimens from St. Barthelemy, figs. 21-22). -Wells, 1935: 531 (listed). -Cairns & Wells, 1987: 36.

Description: Corallum pocket-shaped, having slightly convex thecal faces that meet laterally in gently rounded thecal edges and aborally in a full (not compressed), rounded base. Opposing thecal edges and faces roughly parallel to each other above a height of about 4 mm. Holotype 6.4 x 3.9 mm in CD and 11.6 mm in height. Of the 2 large specimens, the range of GCD:LCD is 1.64-1.79 and the GCD:HT is 0.55-0.70. Intercostal furrows distinctive only within 2-3 mm of calicular edge, where they define equal-width costae 2 or 3 granules in width, the granules being short and usually oblique in orientation. Remaining theca covered with smooth, longitudinally oriented granules 0.1-0.8 mm in length and 0.1 mm in width that are not arranged in any particular pattern or radiation. Corallum white.

Septa hexamerally arranged in 3 cycles (24 septa): S1-2>S3. The morphology of the septa and columella is the same as described for *S. auritus*.

Discussion: Three Recent and one Neogene Caribbean species of *Sphenotrochus* are characterized as having short, discontinuous costae, each costa composed of up to 4 parallel, aligned granules: *S. auritus* Pourtalès, 1874; *S. gilchristi* Gardiner, 1904 (southwest Indian Ocean); *S. senni* Wells, 1945 (Middle Miocene to Late Pliocene, Caribbean); and *S. lindstroemi.* Species having this morphology were previously placed in the subgenus *Eusthenotrochus* (see CAIRNS 1997). *S. lindstroemi* is most similar to *S. gilchristi,* differing in having a slightly differently shaped corallum (the thecal edges and faces of *S. gilchristi* diverge outward), and in having spinose axial septal edges. *S. lindstroemi* is easily distinguished from *S. auritus* and *S. senni* by its simple longitudinal arrangement of costal granules, lack of fishtail basal spurs, and its fuller corallum. And, although not many records are known of either species, *S. lindstroemi* appears to occur north of *S. auritus.*

The largest of the 7 specimens reported as *S. auritus* var. by LINDSTRÖM (1877) from St. Barthelemy (SMNH 120) is only 4.1 mm in GCD (Figs. 160-161), but it would appear to be a juvenile specimen of *S. lindstroemi,* not the fossil species *S. senni,* as suggested by CAIRNS & WELLS (1987).

Etymology: This species is named in honor of GUSTAF LINDSTRÖM, for his pioneering work on the deep-water corals of St. Barthelemy and the Virgin Islands (LINDSTRÖM 1877).

Types: Holotype: Chain 35-43, USNM 87609. Paratypes: P-775, 1, USNM 87611; St. Barthelemy, 22 m, 7, SMNH 120. Type Locality: 8°53'N, 59°04'W (off Guyana), depth unknown.

Distribution: Península de Guajira, Colombia; ?Tortola, Virgin Islands (LINDSTRÖM 1877); St. Barthelemy, Leeward Islands (LINDSTRÖM 1877); off Guyana; 22-78 m (Fig. 21).

Sphenotrochus andrewianus moorei, new subspecies

(Figs. 7, 162-167)

Sphenotrochus sp. Cairns, 1978a: 11 (listed). –Cairns et al., 1994: 4 (listed).

Description: Corallum triangular, having slightly convex thecal faces, rounded thecal edges, and an acutely angled basal region (edge angle 12°-25°), unless the corallum incorporated an irregularly-shaped sand grain in its base, producing a globular or spatulate shape to the basal end. Corallum small, the holotype only 3.1 x 2.1 mm in CD and 4.5 mm in height; largest corallum (USNM 89365) 3.4 x 2.5 mm in CD and 5.6 mm in height. GCD:LCD = 1.36-1.74; GCD:HT = 0.61-0.69. Among the 111 specimens available, there were no cases of asexual budding. Costae fragmented on basal 1 mm of corallum, but above this level costae smooth and continuous to calicular edge, about 0.2 mm in width, and separated by deep and narrow (75 µm in width) intercostal furrows. Occasionally, as in the holotype, the 2 principal edge costae (C1) and their flanking C3 are composed of short, discontinuous granules from base to calice, or, particularly in the case of the C3, progressively discontinuous near the calice. Corallum white.

Septa hexamerally arranged in 3 cycles (24 septa): S1-2>S3, the complete third cycle inserted at a GCD of about 1.2 mm. S1-2 moderately exsert (about 0.35 mm), having slightly sinuous axial edges that connect to the columella through a series of processes, not a solid fusion (Fig. 162). As with other species of western Atlantic *Sphenotrochus*, the 6 S1-2 originating form the lateral faces fuse to columella highest in fossa, the 4 S2 in the end half-systems fuse slightly lower, and the 2 principal S1 lower still. S3 less exsert (0.25 mm) and about ⅓ width of S1-2, having irregularly dentate axial edges. Fossa shallow, containing a prominent lamellar columella.

Discussion: Comparison of *S. andrewianus moorei* to typical eastern Atlantic *S. andrewianus* show very few differences. Coralla of the western Atlantic populations appear to be more diminutive, the typical subspecies attaining a GCD of 5.5 mm. Also, there seems to be a tendency for a more consistent fragmentation of the edge costae of *S. a. moorei*, whereas they are usually continuous in the eastern Atlantic subspecies; however, there is overlapping variation in both subspecies. *S. andrewianus andrewianus* is known from the western Mediterranean, and the region bounded by Great Britain, the Azores, and Senegal at depths of 12-150 m (ZIBROWIUS 1980). Based on the size difference and the pronounced geographic separation of the two populations, the western Atlantic form is considered to be a subspecies.

Etymology: This subspecies is named for DONALD R. MOORE (1921-1997), distinguished mollusk paleontologist, who collected some of the specimens in the type series.

Records/Types: Holotype: Hillsborough Bay, Florida, 23 m, 30 August 1974, USNM 87614. Paratypes: as for holotype, 2, USNM 99305; Alb-2619, 5, USNM 14436; FH-7106, 36, USNM 22022; FH-7123, 1, USNM 99306; SB-48, 2, USNM 99307; BLM-OCS 4C, 6, USNM 49143, -45; BLM-OCS 5B, 19, USNM 49149-52, -54, -58; BLM-OCS 5C, 7, USNM 49155; between second and third reefs, off Broward County, FL, 18 m, 20, USNM 89365; 26°01'N, 80°06'W (Lloyd State Park, FL), 15 m, 12, USNM 87593; 29°42'N, 84°11'W, 15 m, 1, UMML; Hawk Channel, near Fowey Light, FL, 9 m, 1, UMML; 1.6 km off Miami Beach, FL, 24 m, 1, UMML; Virginia Key, FL, depth unknown, 1, UMML. Type Locality: Hillsborough Bay, Florida, 23 m.

Distribution: Continental shelf of southeastern US from North Carolina (33°38'N, 77°36'W) to Cape San Blas, FL (Fig. 7); 9-42 m.

Superfamily **FLABELLOIDEA Bourne, 1905**

Family **FLABELLIDAE Bourne, 1905**

Genus **Flabellum Lesson, 1831**

Diagnosis: Corallum solitary; fixed or free; conical, campanulate, or highly compressed. Epithecate, lacking costae but usually bearing fine, chevron-shaped growth ridges that peak at major septa. Base not reinforced with stereome or thecal rootlets; transverse division lacking. Calicular edge smooth to lacerate. Pali and dissepiments lacking. Columella rudimentary, composed of the fusion of lower, axial edges of lower cycle septa.

Type Species: *Flabellum pavoninum* Lesson, 1831, by monotypy.

Flabellum (F.) floridanum Cairns, 1991

Not *Flabellum cuneiforme* var. *fragile* Vaughan, v*1900: 63.
Flabellum fragile Cairns, *1977b: 14-15, pl. 2, figs. 1, 4-9; 1979: 148-149, pl. 29, figs. 1-3, 7, Map 43 (synonymy and description). –Cairns et al., 1991: 48 (listed). –Cairns, 1991b: 34.
Flabellum floridanum Cairns, *1991b: 34. –Cairns et al., 1994: 5 (listed).

Diagnosis: Corallum trochoid to turbinate, sometimes becoming cylindrical with continued growth. Small specimens occasionally attached to substrate, but most coralla unattached, having an elongate, often bent, cylindrical pedicel up to 4 mm in length and 1.7-2.0 mm in diameter (PD:GCD = 0.09-0.11), and a slightly broader basal disc up to 2.9 mm in diameter, containing 6 septa. Calicular edge of well-preserved coralla slightly serrate, a small apex corresponding to each septum. Largest corallum (USNM 48297) 19.6 x 17.7 mm in CD and 29 mm in height. Epitheca usually encrusted with serpulids, foraminiferans, sponges, and/or bryozoans. Corallum white. Septa hexamerally arranged in 4 complete cycles in every corallum examined: S1-2>S3>S4. Axial edges of S1-3 usually slightly sinuous. Fossa deep, containing an elongate rudimentary columella uniting the axial edges of the S1-2.

Discussion: Although several new records are reported below, the known distribution of *F. floridanum* is not expanded. All but one lot of this species were collected from 80-183 m. The questioned locality of "? off São Paulo, Brazil" (see CAIRNS 1979:149), based on specimens from *Wladimir Besnard*-318 (USNM 62154), were re-examined and found not to be conspecific, having a much narrower corallum and only 3 cycles of septa.

The name *F. floridanum* was introduced by CAIRNS (1991b) as a replacement name for *F. fragile* Cairns, 1977, in order to avoid homonymy with *Flabellum cuneiforme* var. *fragile* Vaughan, 1900.

New Records: BLM, SOFLA-32, 8, USNM 72013, -15-17; BLM, SOFLA-36, 13, USNM 72014, -18, -19, 76444; 26°16'28"N, 84°03'31"W, 137-141 m, 6, USNM 83431; 26°16'34"N, 84°04'22"W, 139-148 m, 1, USNM 83442; EJ77-136, 192 m, 1, USNM 48297.

Types: All types are deposited at the USNM and FSBC I (see CAIRNS 1977b).

Type Locality: 27°37'N, 84°21'W (west of Egmont Key, western coast of Florida), 91 m.

Distribution: Western coast of Florida from Florida Keys to Panama City; Campeche Bank; 80-366 m (Cairns 1979: map 43).

Genus **Javania** Duncan, 1876

Diagnosis: Corallum solitary; attached; ceratoid to trochoid. Epithecate, base and pedicel reinforced with layers of stereome; transverse division lacking. Calicular edge lacerate. Pali and dissepiments absent. Columella rudimentary fusion.

Type Species: *Javania insignis* Duncan, 1876, by monotypy.

Javania cailetti (Duchassaing & Michelotti, 1864)

(Figs. 168-169)

Desmophyllum cailleti Duchassaing & Michelotti, *1864: 66, pl. 8, fig. 11.
Desmophyllum eburneum Moseley, v*1881: 162, pl. 6, figs. 1, 1a-b.
Desmophyllum nobile Verrill, v*1885: 150-151.
Javania cailleti. –Cairns, 1979: 154-157, pl. 28, figs. 8-12, pl. 30, figs. 1, 4, Map 44 (synonymy and description). –Zibrowius, 1980: 157-159, pl. 82, figs. A-L (synonymy and description). –Cairns, 1982a: 46-49, pl. 14, figs. 9-12. –Rezak et al., v.1985: 225 (listed: stn 115, Geyer Bank). –Zibrowius, 1988: 136 (listed). –Prahl & Erhardt, 1989: 549. –Cairns et al., 1991: 48 (listed). –Cairns, 1994: 29-30, pl. 10, figs. g-i. –Cairns et al., 1994: 5 (listed). –Stolarski, v.1995: 34-36, figs. 10A-J (microstructure).
Desmophyllum cristagalli. –Hubbard & Wells, 1986: 136, figs. 25-26. [Not D. cristagalli Milne Edwards & Haime, 1848]
Not Javania cailleti. –Pires, 1997: 183 (=Polymyces fragilis).

Diagnosis: Corallum ceratoid, straight, and slightly flared. Corallum firmly attached, the pedicel reinforced with concentric layers of dense textura, the PD:GCD ranging from 0.2-0.6. Calicular edge lacerate, a triangular apex corresponding to each S1-3. Largest known corallum (holotype of *D. nobile*) 36 x 32 mm in CD (exclusive of costae), 21.5 mm in PD, and 51 mm in height. Theca usually smooth and porcelaneous; however, some coralla bear ridged costae (C1-3) in upper corallum, in some cases becoming quite prominent (see Discussion). Corallum white. Septa hexamerally arranged in 4 complete cycles (48 septa): S1-2>S3>S4, larger coralla sometimes having pairs of S4 in end half-systems resulting in 64 septa. S1-2 highly exsert, having straight vertical axial edges; S3 moderately exsert, with straight to slightly sinuous axial edges; S4 often not exsert. Fossa deep; columella a fusion of lower axial edges of S1-2.

Discussion: The holotype of *J. nobile* (VERRILL 1885) is noteworthy as being the largest known corallum, the northernmost record in the western Atlantic, and the corallum with the most highly developed costae and most exsert septa, up to 5 mm and 15 mm, respectively. Similarly large and prominently costate specimens are known from Lydonia Canyon (USNM 82015-016), off Jamaica (USNM 80964; Figs. 168-169), and Burdwood Bank (see CAIRNS 1982a: pl. 14, figs. 11-12), although the last mentioned corallum is relatively small. Although these coralla are interpreted as extreme variations of *J. cailleti*, they are herein referred to as the *'nobile'* form of the species.

The shallowest western Atlantic record of *J. cailleti* (30 m) was reported by HUBBARD & WELLS (1986), and the deepest (1809 m) herein (USNM 82015). Only about 15% of known collections were made at depths shallower than 200 m. The records listed below do little to extend the known distribution of the species, but the 2 *Alvin* records are the first reports of the species in the gap between Nova Scotia and Georgia.

New Records: BLM, SOFLA-32, 1, USNM 72001; BLM, SOFLA-35, 1, USNM 72002; BLM, SOFLA-36, 5, USNM 71996-97, 72008, 75684, 76451; BLM, SOFLA-38, 47, USNM 71998-72000, 72003-07; JSL-I-1354, 1, IRCZM; JSL-I-1355, 1, IRCZM; JSL-I-1500, 1, USNM 73191; JSL-I-2582, 1, USNM 87785; JSL-II-809, 1, IRCZM 12:148; BL-203, 1, USNM 5822; Gos-1643, 1, USNM 99304; Gos-112/78, 3, USNM 80991, 80964; Alvin-1268, 1, USNM 82015; Alvin-1270, 1, USNM 82016; BLM-OCS 6H, 2, USNM 49160-61; CSA Pinnacle site 7, 1, CSA; 25°16'23"N, 84°15'17"W, 159-166 m, 20, USNM 83448.

Types: See CAIRNS (1979).

Distribution: Western Atlantic: from Banquereau Bank, Nova Scotia (44°28'N, 57°13'W) to Suriname, including Caribbean and eastern Gulf of Mexico to southwestern Louisiana; southeastern Brazil off southern Rio

Grande do Sul (CAIRNS 1979: map 44); 30-1809 m. Elsewhere: widespread, including eastern Atlantic; Burdwood Bank: southern Chile; Galápagos; British Columbia; Japan; Arabian Sea; 400-2165 m (CAIRNS 1994).

Genus Polymyces Cairns, 1979

Diagnosis: Corallum solitary; attached; ceratoid to trochoid. Epithecate, basally reinforced by symmetrically or asymmetrically arranged, contiguous, hollow rootlets; transverse division lacking. Calicular edge lacerate to serrate. Pali absent and dissepiments absent. Columella rudimentary fusion.

Type Species: *Rhizotrochus fragilis* Pourtalès, 1868, by original designation.

Polymyces fragilis (Pourtalès, 1868)

(Figs. 171-172)

Rhizotrochus fragilis Pourtalès, v*1868: 134-135.
Rhizotrochus tulipa Pourtalès, v*1874: 39, pl. 6, figs. 10-19.
Monomyces fragilis. –Cerame-Vivas & Gray, 1966: 263 (listed).
Polymyces fragilis. –Cairns, 1979: 158-160, pl. 30, figs. 2-3, 5-8, Map 45 (synonymy and description). –Zibrowius, 1988: 136 (listed). –Cairns, 1991a: 22 (listed). –Cairns et al., 1991: 48 (common name). –Cairns et al., 1994: 8.
Javania cailleti. –Pires, v.1997: 183. [Not *D. cailetti* Duchassaing & Michelotti, 1864]

Diagnosis: Corallum invariably attached, the pedicel reinforced with 6 pairs of rootlets (see Discussion), the rootlets increasing the PD to 3.2-6.0 mm, resulting in a PD:GCD of about 0.3. Calicular edge moderately serrate, those of forma *tulipa* being lacerate. Largest corallum (P-876) 29 x 27 mm in CD and 52 mm in height. Inner theca of some specimens thickened with stereome. Colour of corallum variable: most coralla homogeneously white, but about 20% of specimens examined have a reddish brown corallum with white rootlets, and those specimens from Barbados (forma *tulipa*) often have a black striped theca. Septa hexamerally arranged in 4 complete cycles: S1>S2>S3>S4. S1-2 slightly exsert, the S1 only slightly wider than the S2. Axial edges of septa highly sinuous. Fossa deep; columella rudimentary.

Discussion: *Polymyces fragilis* is very similar to *Flabellum floridanum*, the 2 species almost indistinguishable in calicular view. *P. fragilis* is distinguished by having basal rootlets and thus an attached mode; a slight dichotomy in the sizes of the S1 and S2; a slightly more serrate calicular edge; a flared, not subcylindrical, corallum; a less frequently encrusted theca; and a much wider geographic distribution. Although their ranges overlap, they were rarely collected at the same stations.

A cross section or fracture through the base of a corallum reveals 2 concentric thecal walls, the inner theca about 1.6 mm in diameter, containing the 6 S1, and the outer theca 3.2-4.1 mm in diameter, which is divided into 6 compartments by complete, vertical partitions resembling septa that are aligned with the S2. Thus the 6 S1 of the inner core are offset from the outer 6 "S2" partitions. The 6 chambers formed by these partitions extend 3-4 mm above the base, at which point another 6 partitions originate between the outer and inner theca, these upper partitions aligned with the S1. This has the effect of bifurcating the 6 basal chambers into 12 chambers. These 12 chambers (rootlets) extend upward another 4-5 mm, gradually narrowing to a distal aperture of about 0.5 mm. With height, each of the 12 upper rootlets bends toward its adjacent S2, the 'right hand' bifurcated rootlet of each basal chamber coming to be placed adjacent to the 'left hand' bifurcated rootlet of the adjacent chamber. Thus the individual components of these 6 apparent pairs of rootlets actually have their origin in different basal chambers. The distal tips of each of the 12 rootlets communicate with the inner polyp via small (about 0.5 mm in diameter) pores flanking each S2 about 8-9 mm above the base. The ontogenetic development of rootlets, however, is opposite to the order described above, rootlets appear to form from top-down, not down-up. Few coralla of the proper developmental stage are available for analysis, but one extraordinary juvenile specimen from Gos-1863 (Fig. 172) shows that rootlet development probably occurs as follows. At a corallum height of 7-9 mm 12 strands of tissue extend over the calicular edge from 12 small vertical slits, one on both sides of each of the 6 S2. Already at this stage there are ridges (the future internal partitions of the outer chambers) on the lower corallum resembling costae, the ridges associated with the S2 extending to the base, those associated with the S1 extending only about halfway to the base. Thus as the 12 strands of tissue grow downward they are channelized into 6 chambers. In time, small sheets of theca form perpendicular to the

S1-2 costae/partitions, adjacent sheets eventually fusing with one another to form the outer theca of the rootlets, as well as growing downward to the base of the corallum. With a slight increase in corallum height, the 12 calicular slits are formed into pores that maintain connection of the rootlets to the inner polyp. Thus, quite small coralla less than 5 mm in height will not have rootlets, but may have already developed some incipient S1-2 partitions that resemble ridged costae. This developmental sequence is also supported by a specimen from off South Carolina (USNM 78447), which, at a height of 2-3 mm, was encrusted by a stylasterid on one side of its pedicel preventing rootlets from forming directly adjacent to the pedicel. Instead, rootlets formed on the stylasterid, but did not reach the base of the corallum, which remained of small diameter.

Despite the additional records reported below, the geographic and bathymetric ranges of this species are not increased beyond that which was previously known. The common name of *P. fragilis* is the 'twelve-root cup coral' (CAIRNS *et al.*, 1991).

New Records: Eastward-10892, 68-72 m, 6, USNM 80905; Combat-457, 1, USNM 61990; JSL-I-2586, 1, USNM 89352; B-A DS32, 2, USNM 62230; BLM, James Island Area Block 198-2, 1, USNM 99320; BLM, James Island Area Block 380-11, 1, USNM 99351; Vema 15-1, 7, USNM 61811 and 61971; Endeavor-1, 1, USNM 77434; R/V Cape Hatteras SA-6/3, 31°23'N, 78°57'W, 498-512 m, 4, USNM 78440; R/V Cape Hatteras SA-6/4, 31°37'N, 78°41'W, 440-450 m, 1, USNM 78447; FH-7282, 5, USNM 99352; stn "L2", off Cape Lookout, NC, 110 m, 10, USNM 45662; Isla Contoy, Quintana Roo, Mexico, 100-200 m, 1, USNM 98468; 32°44'N, 78°05'W, 204-213 m, 1, USNM 79501; off Sambo Key, FL, 216 m, 7, USNM 61974; off Sombrero Light, FL, 183-210 m, 5, USNM 61973; off Alligator Reef, FL, 182-213 m, 20, USNM 81302; south of Key West, FL, 165 m, 3, USNM 61963; Western Dry Rocks, FL, 20, USNM 61969.

Types: See CAIRNS (1979).

Distribution: Warm temperate and tropical western Atlantic from off Cape Hatteras (35°08'N, 75°10'W) to Rio Grande do Sul, Brazil (30°59'S, 49°51'W); eastern Gulf of Mexico; throughout Caribbean (CAIRNS 1979: map 45); 75-822 m.

Family **GUYNIIDAE Hickson, 1910**

Genus **Guynia Duncan, 1872**

Diagnosis: Corallum solitary; ceratoid to cylindrical (scolecoid); free or laterally attached, sometimes producing chains of individuals. Epitheca longitudinally and circumferentially ridged. Rows of murals spots occur in every interseptal space. Two cycles of septa. Pali absent; columella a twisted ribbon (see CAIRNS 1989: table 3).

Type Species: *Guynia annulata* Duncan, 1972, by monotypy.

Guynia annulata Duncan, 1872

(Figs. 170, 173)

Guynia annulata Duncan, v*1872: 32, pl. 1, figs. 1-8. –Cairns, 1979: 164-165, pl. 32, figs. 1-3, Map 48 (synonym and description). –Zibrowius, v.1980: 161-162, pl. 83, figs. A-Q (synonymy and description). –Castañares & Soto, 1982: table 1 (listed). –Rezak et al., 1985: 225 (listed). –Cairns et al., 1986: 187-188, 3 figs. –Cairns & Wells, 1987: 42-43, pl. 11, figs. 8-9, 12-13 (fossil occurrence). –Cairns et al., 1991: 48 (listed). –Cairns et al., 1994: 5 (listed). –Cairns & Zibrowius, 1997: 150 (synonymy). –Cairns, 1999b: Table 1 (fossil occurrence listed).

Diagnosis: Corallum cylindrical and quite small, rarely over 1 cm in length and 1.3 mm in CD, although longest known corallum (Alpha Helix-16) 13 mm long (Fig. 173). Coralla sometimes firmly attached to a substrate (*e.g.*, a bivalve shell, another coral, an echinoid spine) along entire thecal edge, but more often attached to small sand grains and/or foraminiferans randomly along theca. Theca usually bears 2 sets of ridges: 8 longitudinal ridges that correspond to the primary septa; and numerous closely-spaced (21 in 3.6 mm), transverse, circumferential ridges, both kinds of ridges forming a grid-like pattern of rectangles. Within each rectangle are 2 chalky white spots, symmetrically arranged on either side of the S2. These spots correspond to small depressions (dimples) on the inner theca, and transform to thecal pores early in digenesis. Septa usually octamerally arranged in 2 cycles, the primary septa being much thicker and more exsert than the secondary septa, their axial edges being very sinuous. Secondary septa recessed in calice, often difficult to see in an intact corallum. Columella consists of a single twisted lath or a trefoil ribbon.

Discussion: This small, inconspicuous coral, once known only from the North Atlantic, is now known to occur in almost all tropical and temperate regions (CAIRNS & ZIBROWIUS 1997). It is easily overlooked because of its resemblance to a serpulid worm tube. The records listed below extend the known distribution of this species to the southern Caribbean (Aruba: Alpha Helix-16) and off Guyana (Chain 35-43).

New Records: P-931, 1, part of USNM 62995; B-A DS10, 2, USNM 79503; B-A DS45, 1, USNM 99319; JSL-II-2582, 1, USNM 99317; Wagenaar Hummelinck-1442, 1, USNM 99316; Chain 35-43, 1, USNM 99315; Alpha Helix-16, 108, USNM 79508; DBL-998, Discovery Bay, Jamaica, 60 m, 1, USNM 83720; DBL-2501, Discovery Bay, Jamaica, depth unknown, 2, part of USNM 80354; Discovery Bay, Jamaica, 183 m, 1, part of USNM 93183; BLM 1974-17, 1, UMML 8.1440; BLM 1974-18, 2, UMML 8.1441; BLM-1974-19, 3, UMML 8.1442; BLM 1974-22, 2, UMML 8.1443; BLM 1974-33, 11, UMML 8.1442; due east of Tampa, FL, 5, UMML; west of Anna Maria Key, FL, 1, UMML.

Types: See CAIRNS (1979).

Distribution: Western Atlantic: Bermuda; Gulf of Mexico; Bahamas; Caribbean (CAIRNS 1979: map 48); Guyana; 30-653 m. Early Pliocene of Dominican Republic (CAIRNS & WELLS 1987), Costa Rica, and Panama (CAIRNS 1999b). Elsewhere: cosmopolitan in tropical and temperate regions; 28-384 m (CAIRNS & ZIBROWIUS 1997).

Genus **Schizocyathus** Pourtalès, 1874

Diagnosis: Corallum solitary and ceratoid (often slightly curved). Longitudinal parricidal budding very common. Epithecal wall smooth or hispid, bearing 12 rows of mural spots, one row flanking each S2. Three cycles of septa. Paliform lobes on S3; columella absent or papillose (see CAIRNS 1989: table 3).

Type Species: *Schizocyathus fissilis* Pourtalès, 1874, by monotypy.

Schizocyathus fissilis Pourtalès, 1874

(Figs. 176-177)

Schizocyathus fissilis Pourtalès, v*1874: 36-37, pl. 6, figs. 12-13. –Cairns, 1979: 166-167, pl. 32, figs. 4-7, Map 49 (synonymy and description). –Zibrowius, v.1980: 166-167, pl. 85, figs. A-Q (description). –Viada & Cairns, 1987: 132-133. –Cairns et al., 1991: 48 (listed). –Cairns et al., 1994: 5 (listed). –Cairns, 1995b: 545, figs. 27-29 (fossil occurrence); 1999b: Table 1 (listed).

Description/Discussion: Corallum ceratoid, becoming subcylindrical and usually cornute with greater size. Largest known corallum 25 mm in length; coralla rarely exceed 3.5 mm in diameter. Virtually all coralla examined attached to an elongate, wedge-shaped fragment of a parent corallum, sometimes 3 or 4 generations still attached to one another. Only one daughter corallum buds from the distal region (usually near upper edges of a pair of P3) of a sector (⅙, 2/6, or 3/6) of its parent corallum, the parent corallum longitudinally dividing into 2-6 fragments in the process of asexual reproduction. The longitudinal fracture is accomplished by a linear dissolution of the theca on either side of each S2, eventually isolating a thin (0.15 mm), elongate piece of theca that bears only the rudimentary S2 (see CAIRNS 1979: pl. 32, fig. 5). When these slivers fall away from the theca, the corallum is predisposed to fragment into 6 equal wedges, each of which contains an S1 and 2 flanking S3. Each of these wedges is capable of asexually producing another corallum (as mentioned above), but the 6 slivers that bear only the S2 do not appear to be capable of further propagation. Epitheca usually smooth, but occasionally may be hispid (Figs. 176-177) or finely corrugated. Theca bears 6 pairs of thin, closely-spaced, opaque white lines that flank each S2 (the lines of future dissolution), as well as 12 rows of small (0.15 mm), opaque, white spots, a row flanking each S1. Calice circular, the epitheca rising to level of upper peripheral septal edges.

Septa hexamerally arranged in 3 cycles: S1>S3>S2. S1 thick and slightly exsert, sometimes bearing a small, papillose paliform lobe. S2 rudimentary (0.10 mm wide) and nonexsert, having a minutely serrate axial edge. S3 slightly exsert and about ⅔ width of the S1, but lower in fossa each S3 bears a broad paliform lobe that increases the width of the septum 2 to 3-fold, the upper edges of the P3 horizontal and minutely serrate. Axial edge of a P3 from one system fuses with that of another P3 from an adjacent system, forming a solid, V-shaped fusion, the apex of which is aligned with the flanked S1. Thus, when the corallum fragments into 6 sectors, these 2 solidly fused P3, along with the enclosed S1 and peripheral theca form a self-contained volume, triangular in cross section. A columella is usually absent, but some specimens have a small, papillose columella.

The new records reported herein do not extend the geographic or bathymetric ranges for this species. *S. fissilis* is more commonly known from depths greater than 200 m, but at least 8 lots have been collected at depths shallower than 200 m, the shallowest (Oregon-3203) at 88 m (CAIRNS 1979).

New Records: B-A DS10, 2, USNM 82017; Eastward-26533, 1, USNM 61931; LGL, E2-2, 1, USNM 76839; mid-west coast of Barbados, 183 m, 2, USNM 94735; Barbados, depth unknown, 8 fragments, USNM 80986.

Types: See CAIRNS (1979).

Distribution: Western Atlantic: east coast of US from Cape Kennedy, Florida to southwestern Louisiana (27°45'N, 92°29'W); Bahamas; Antilles; Yucatan Channel; off Honduras (not southern Caribbean); 88-640 m (CAIRNS 1979: map 49). Late Pliocene of Panama (CAIRNS 1995b). Eastern Atlantic: area bounded by Portugal, the Azores, and Morocco; 410-100 m (ZIBROWIUS 1980).

Genus **Stenocyathus** Pourtalès, 1871

Diagnosis: Corallum solitary; cylindrical; attached initially, but usually becoming free. Base and pedicel reinforced with granular coenosteum. Rows of thecal spots occur in every interseptal region. Three cycles of septa. Pali before S2; columella one twisted lath (see CAIRNS 1989: table 3).

Type Species: *Coenocyathus vermiformis* Pourtalès, 1868, by monotypy.

Stenocyathus vermiformis (Pourtalès, 1868)

(Fig. 178)

Coenocyathus vermiformis Pourtalès, v*1868: 133-134.
Stenocyathus vermiformis. –Cairns, 1979: 168-170, pl. 32, figs. 8-10, pl. 33, figs. 1-2, Map 50

(synonymy and description; not record from 21°48'S, 40°03'W). –Zibrowius, 1980: 163-165, pl. 84, figs. A-Q (synonymy and description). –Cairns et al., 1991: 48 (common name). –Cairns et al., 1994: 8. –Cairns, 1995a: 94-95, pl. 30, figs. c-g (synonymy and description).

Diagnosis: Corallum cylindrical, maintaining the same diameter from base to calice; elongate, up to 54 mm in length (G-1102), but rarely exceeding 3 mm in CD; and scolecoid, usually having an irregular course with frequent episodes of rejuvenescence. Most western Atlantic coralla examined are free, having broken from their original attachment, the broken face usually regenerating a calice, which results in a bipolar corallum having 2 opposite calices. In the few attached specimens observed (Fig. 178), often 2 coralla will originate at right angles from a common granular basal coenosteum. Theca smooth, but occasionally attached to foreign objects by a granular coenosteum. A row of opaque white spots occurs on the theca in each interseptal space, the rows paired on either side of an S2. Septa hexamerally arranged in 3 cycles (S1>S2>S3), but pairs of S3 often missing, even in large coralla, resulting in 22, 20, and 18 septa, and 5, 4, and 3 pali, respectively. Axial edges of S1-2 highly sinuous, whereas those of S3 straight. The 6 P2 are also highly sinuous and the columella is a single twisted lath, or may be absent altogether.

Discussion: The only substantive western Atlantic records of this species reported since 1979 were those reported by CAIRNS *et al.* (1994) from off southwestern Louisiana. Although *S. vermiformis* is known to occur as shallow as 30 m in the Pacific (CAIRNS, 1995a), the only record from shallower than 200 m in the western Atlantic are those from G-703 (see CAIRNS 1979) at 165 m, most other records concentrating between 200 and 400 m. The shallower (128 m) and also southernmost western Atlantic record previously reported by CAIRNS (1979) from off Cabo de São Tomé, Brazil, was incorrectly identified.

The common name of *S. vermiformis* is the 'worm coral' (CAIRNS *et al.* 1991).

New Record: Atlantis 20-28, 12, USNM 80984.

Types: See CAIRNS (1979).

Distribution: Western Atlantic: southeastern US from off Charleston, South Carolina (31°49.6'N, 78°45.8'W) to southwestern Louisiana (27°48'N, 91°34'W); Bahamas; off Havana, Cuba; Yucatan; Lesser Antilles; St. Peter and Paul Rocks; Brazil (Maranhão and off Recife); 165-835 m (CAIRNS 1979: map 50). Elsewhere: widespread in all oceans except for eastern Pacific and Antarctic; 30-1229 m (CAIRNS 1995a).

Superfamily **VOLZEIOIDEA Melnikova, 1974**

Family **GARDINERIIDAE Stolarski, 1996**

Genus **Gardineria Vaughan, 1907**

Diagnosis: Corallum solitary, cylindrical to turbinate, attached by a polycyclic base and/or short, contiguous basal rootlets; rejuvenescence not uncommon. Epitheca finely wrinkled, epitheca of upper calicular edge separated from upper peripheral septal edges by a shallow, circular groove. Internal stereome sometimes present. Paliform lobes present before S2 and sometimes S3. Columella papillose or absent.

Type Species: *Gardineria hawaiiensis* Vaughan, 1907, by original designation.

Gardineria paradoxa (Pourtalès, 1868)

(Figs. 183-184)

Haplophyllia paradoxa Pourtalès, v*1868: 140-141.
Duncania barbadensis Pourtalès, v*1874: 45, pl. 9, figs. 5-7. –Fowler, 1890: 405-409, pl. 28, figs. 1-3 (histology).
Gardineria paradoxa. –Wells, v.1973: 51. –Cairns, 1979: 160-161, pl. 31, figs. 4-6, 10, Map 46 (synonymy and description). –Cairns et al., 1991: 48 (listed). –Cairns, 1999a: 128-129, fig. 22b (synonymy).

Diagnosis: Corallum initially trochoid, becoming cylindrical with greater height. Polycyclic base asymmetrically developed, resulting in a baso-lateral attachment to substrate (Fig. 183; see Discussion). Corallum up to 16 mm in CD and 41 mm in height. The smooth, circular epitheca rises above level of septa, forming a circular groove separating it from upper, peripheral septal edges. Most coralla show evidence of rejuvenescence, manifested by a series of up to 22 successive ridges, or lips, that encircle the theca. Internal stereome well developed. Corallum white. Septa irregularly developed: 19-22 (usually 20) primary septa and an equal number of rudimentary secondary septa. Primary septa sometimes distinguishable as 10 larger and 10 slightly narrower septa, the narrower septa bearing 1-3 paliform lobes, the larger primary septa without axial lobes. Rudimentary secondary septa developed only in largest coralla, otherwise represented by low, slightly convex ridges in smaller coralla. Fossa shallow; columella papillose, consisting of 2-35 elements.

Discussion: The asymmetric polycyclic base of this species, which results in a baso-lateral attachment, appears to result from a top-down process similar to that of rootlet formation in *Polymyces*, not the result of several concentric thecal walls that originate from the basal disc, as in *G. minor*. In *G. paradoxa*, the tissue must repeatedly overflow the theca but always on one side of the corallum, resulting in a series of partial, compartmentalized rings that increase the attachment to the substrate. These rootlet-like structures differ from those of *Polymyces* in that they are irregular in shape and occur in layers.

No new records of this rarely collected species have been reported from the western Atlantic since 1979; however, 2 records were reported from the western Pacific (CAIRNS 1999a). *G. paradoxa* is more commonly collected at depths greater than 200 m, only 3 records known from less than 183 m.

New Records: None.

Types: See CAIRNS (1979).

Distribution: Western Atlantic: Florida Keys; throughout Greater and Lesser Antilles; Yucatan Channel; 91-700 m (CAIRNS 1979: map 46). Elsewhere: Banda Sea; Vanuatu region; 285-498 m (CAIRNS 1999a).

Gardineria simplex (Pourtalès, 1878)

(Figs. 22, 180-181)

Colangia simplex Pourtalès, v*1878: 206-207, pl. 1, figs. 18, 18a (in part: BL-22); 1880a: 97 (listed). -?Goreau & Wells, 1967: 448 (listed). -?Wells & Lang, 1973: 57 (listed). -Zibrowius, 1974: 24. -Castañares & Soto, 1982: Table 1 (listed).
Gardineria minor Wells, v*1973: 49-53 (in part: figs. 36 e, g). -Cairns, 1979: 162-163 (in part: pl. 31, figs. 7-9; G-889, G-899, G-983, G-984, G-986, P-1387, SB-3494, Alb-2324, USNM 46632, Theodore Tissier-187).
Gardineria simplex. -Cairns, 1978a: 11 (listed); 1979: 163 (lectotype designated), 207. -Cairns et al., 1994: 5 (listed). -Stolarski, v.1996: 362 (listed).

Description: Corallum initially ceratoid or trochoid, often becoming cylindrical with greater height. Polycyclic base asymmetrically developed, resulting in a baso-lateral attachment; however, asymmetry in a basal cross section may result from rootlets that have developed on only 1 side of the corallum, as in *Polymyces* and *G. barbadensis.* Largest known corallum (lectotype) cylindrical, measuring 10.6 x 10.4 mm in CD and 11.5 mm in height. Epitheca finely wrinkled and often encrusted. Rejuvenescence not common; internal stereome not present; corallum white.

Septa hexamerally arranged in 3 cycles (S1>S2>S3), the third cycle complete at a CD of about 4 mm and some indication of a fourth cycle appearing at a CD of 8 mm, but when present, S4 are rudimentary and irregularly developed, often occurring only deep within fossa. The smooth-edged, circular epitheca usually rises above the level of S1, forming a circular groove separating it from upper, peripheral edges of all septa. Inner edges of S1 straight and vertical, bearing 1 small paliform lobe at its lower axial edge. S2 about ⅔ width of the S1, have slightly irregular axial edges, and bear 2 or 3 paliform lobes on their lower axial edge. S3 not well developed, consisting of a series of 5-8 elongate septal spines. In the largest of coralla, S4 are expressed as a series of small, disjunct septal spines, usually occurring low in fossa. Fossa deep, containing a papillose columella consisting of 2-15 cylindrical elements.

Discussion: *Gardineria simplex* and *G. minor* are very similar and may eventually be found to be ecological variants or subspecies separated by depth. Their similarity has caused confusion in previous identifications (see synonymy). *G. simplex* appears to be the larger of the 2 species, attaining a CD of 10.6 mm vs 5.9 mm for *G. minor. G. simplex* also appears to insert septa at a slower rate, S4 beginning to appear only at a CD of about 7 mm vs 3.1 mm for *G. minor.* (*G. minor* has a full fourth cycle at a CD of 4-5 mm, whereas *G. simplex* never attains a full fourth cycle). Also, *G. simplex* seems to have less exsert septa, a deeper fossa, and fewer columellar elements. Bathymetrically, *G. simplex* is usually found in deeper water (46-241 m), whereas *G. minor* is usually collected in shallower water (2-146 m).

The records of *Colangia simplex* from Jamaica at 12 m (GOREAU & WELLS 1967; WELLS & LANG 1973) pertain to specimens later identified as paratypes of *G. minor* (USNM 53505), but are nonetheless herein considered to be valid *G. simplex.* This would be the shallowest record of *G. simplex,* but there is a second label with this lot indicating a greater collection depth of 30 m. The records below are then the only valid records of the species since its original description.

New Records: G-956, 6, USNM 99356; Eastward-19483, 1, USNM 80897; Eastward-30178, 1, USNM 99357; DBL-1425, Discovery Bay, Jamaica, 91 m, 1, USNM 80895; Discovery Bay, Jamaica, 183 m, 1, attached to USNM 93183.

Types: The lectotype of *C. simplex,* designated by CAIRNS (1979:163), is deposited at the MCZ (5566). The two paralectotypes (MCZ) from a Blake station off Havana were reidentified as *G. minor* by CAIRNS (1979). Type Locality: 23°01'N, 83°14'W (off Bahia Honda, Cuba), 183 m.

Distribution: Bahamas; Antilles; Yucatan Channel (Fig. 22); 46-241 m, although one dead and worn specimen was collected from 505 m (Eastward-30178).

Gardineria minor Wells, 1973

(Figs. 179, 182, 185-187)

Gardineria minor Wells, v*1973: 49-53 (in part: figs. 36a-d, f; not USNM 53505). –Cairns, 1979: 162-163, Map 47 (in part: not pl. 31, figs. 7-9, and not G-889, G-899, G-983, G-984, G-986, P-1387, Alb-2324; USNM 46632, Theodore Tissier-187, which are all *G. simplex*; synonymy and description). –Cairns, 1982b: 299, pl. 132, fig. d. –Zlatarski, 1982: 262-263, pl. 115, figs. 1-6, pl. 116, figs. 1-6. –Castañares & Soto, 1982: Table 1 (listed). –Estalella, 1986: 18, fig. 6. –Cairns et al., 1994: 5 (listed). –Cairns, 1995b: 543, figs. 21-26 (Pliocene). –Stolarski, 1996: 362 (listed). –Cairns, 1999b: Table 1 (listed).

Diagnosis: Corallum usually short and squat (tympanoid), cylindrical to subcylindrical. Base of corallum increases in diameter by forming 3 concentric thecal rings (symmetrical polycyclic development): the first thecal ring 0.5-0.6 mm in diameter, containing 0-12 septa; the second ring about 1.3 mm in diameter, containing 12 septa; and the third and usually last thecal ring up to 3.0 mm in diameter, containing 12-48 septa (Fig. 185). Initial thecal ring short and often decreases in diameter with height. Corallum increases in CD by upward growth and expansion of outermost thecal ring. Largest known corallum (holotype) 5.9 mm in CD and 4.4 mm in height. Epitheca finely wrinkled, forming a circular groove between its upper edge and the upper, peripheral edges of the S1-2. Rejuvenescence not common; internal stereome not well developed; corallum white. Septa hexamerally arranged in 4 cycles (S1>S2>S3>S4), the fourth cycle beginning to appear at a CD of 3.5 mm, and a complete fourth cycle present only in large coralla of over 5 mm CD. S1 usually exsert, as much as 0.8 mm, having straight, vertical axial edges. S2 also slightly exsert, about ¾ width of the S1, having a small lobate upper region, dentate axial edge, and bearing 1-3 irregular paliform lobes near columella. S3 laciniate for entire length. When present, S4 rudimentary, composed of several aligned, discontinuous septal spines located well below calicular edge. Fossa shallow, containing a papillose columella consisting of 1-20 interconnected papillae.

Discussion: Comparisons to *G. simplex* are made in the account of that species. The records listed below extend the known distribution of *G. minor* to the Gulf of Campeche. Reidentification as *G. simplex* of some specimens previously reported as *G. minor* (see synonymy) reduces the known depth range of *G. minor* to 2-146 m.

G. minor is most often collected in caves and under platy reef corals, such as *Agaricia* and *Mycetophyllia*. Its polyps are pale pink (Wells 1973).

New Records: SB-961, 1, UMML; Churchill Beach, Grand Bahama Island, 15-17 m, 4, USNM 46631; off St. Lucia, 15-27 m, 5, USNM 46630; Carrie Bow Cay, Belize, 18-31 m, 2, USNM 86019; DBL-1213, Discovery Bay, Jamaica, 79 m, 2, USNM 80993; north of Georgetown, Grand Cayman, 12 m, 5, USNM 99312; off Havana, Cuba, 21 m, 1, USNM 99311.

Types: See CAIRNS (1979).

Distribution: Bahamas; Caribbean; Gulf of Campeche (CAIRNS 1979: map 47); 2-146 m, although most commonly collected in less than 50 m. Late Pliocene (Moín Formation) of Limón, Costa Rica (CAIRNS 1995b).

Suborder **DENDROPHYLLIINA**

Family **DENDROPHYLLIIDAE Gray, 1847**

Genus **Balanophyllia S. Wood, 1844**

Diagnosis: Corallum solitary, ceratoid to trochoid, fixed or free. Synapticulotheca often costate and/or covered with epitheca. Septa arranged in a Pourtalès plan. Pali/paliform lobes may or may not be present; columella papillose to spongy.

Type Species: *Balanophyllia calyculus* S. Wood, 1844, by monotypy.

Balanophyllia floridana Pourtalès, 1868

(Figs. 9, 188-191)

Balanophyllia floridana Pourtalès, v*1868: 137. –Wells, v.1933b: 32, 35, pl. 1, figs. 8-11. –Cerame-Vivas & Gray, 1966: 263 (listed). –?Goreau & Wells, 1967: 449 (listed). –Not Porter, v.1972: 113 (=*Rhizopsammia* sp.). –?Wells & Lang, 1973: 58 (listed). –Avent, King & Gore, 1977: 200, fig. 11k. –Cairns, 1977a: 134-136, pl. 1, figs. 1-3 (synonymy and description); 1977b: 16-17, pl. 2, figs. 7-8 (synonymy); 1978a: 11 (listed); 1979: 207 (listed). –Zibrowius, 1980: 217 (listed). –Not Castañares & Soto, 1982: Table 1. –Not Hubbard & Wells, v.1986: 142, figs. 36-37 (=*B. cyathoides*). –Cairns et al., 1991: 48 (common name). –Humann, v.1993: 164-165, colour fig. –Cairns et al., 1994: 5 (listed)

Diagnosis: Corallum ceratoid to trochoid, straight, and usually attached by a thick pedicel (PD:GCD = 0.15-0.50) and expanding base. However, if corallum attaches to a small object, the base may completely envelop it and thus be unattached. Largest corallum 23.0 x 17.4 mm in CD and 42 mm in height (WELLS 1933b: USNM 81003). Costae thin and equal in width, spiny as well as porous, and separated by deep intercostal grooves. Lower third to half of theca often worn and encrusted with other organisms. Corallum white. Septa hexamerally arranged in up to 5 cycles, the fourth cycle complete at a GCD of about 6-7 mm, and the fifth cycle complete at a GCD of about 18 mm, pairs of S5 first appearing in end half-systems. S1 and S2 equal in size. Axial edges of each pair of highest cycle septa (S4 or S5) within each half-system fuse, the fused part bearing a paliform lobe aligned with the S3; axial edge of lobe touching columella. Fossa shallow, containing a robust, elongate columella formed of numerous fused, twisted elements.

Discussion: *Balanophyllia floridana* is the most commonly collected of the 9 *Balanophyllia* species known from the western Atlantic, and the only one that occurs in temperate waters off southeastern US, and one of 2 species (along with *B. palifera*) known to occur in the Gulf of Mexico.

One lot of specimens from Alb-2318 (Fig. 190) contained 25 coralla that were affixed to 13 shells of the gastropod *Xenophora conchyliophora* (Born), an average of 1.9 corals per shell. In most cases the corals remained alive and continued to grow after fixation. Four of the 25 coralla were affixed in the radial (down) position (*i.e.*, with the calice directed outward from the gastropod's apex), whereas 21 were affixed in the lateral position: 16 in the 'out' orientation (*i.e.*, calice directed along the axis of gastropod growth), and 5 in the 'in' orientation (*i.e.*, calice directed opposite the axis of gastropod growth), the out position being the more common direction for most laterally affixed corals (FEINSTEIN & CAIRNS 1998).

The common name of this species is the 'porous cup coral' (CAIRNS *et al.* 1991).

New Records: Alb-2313, 9, USNM 10075; Alb-2316, 2, USNM 49096; Alb-2317, 15, USNM 10086; Alb-2318, about 100, USNM 10088; Alb-2387, 2, USNM 10386; Alb-2388, 4, USNM 10818; Alb-2596, 15, USNM 19083 and 19108; Alb-2617, 3, USNM 99384; Alb-2619, 2, USNM 19158; Alb-2639, 1, USNM 14522; Alb-2640, 2, USNM 14601; Alb-2641, 1, USNM 48971; Combat-283, 4, USNM 48971; Combat-384, 4, USNM 48988, and 48991; Combat-457, 21, USNM 48974; O-2727, 3, USNM 48986 and 49010; O-3147, 8, USNM 88893; O-3621, 1, USNM 49011; SB-37, 2, USNM 49008; SB-1571, 2, USNM 48998; SB-1788, 3, USNM 88885; SB-1789, 7, USNM 48980; SB-1902, 1, USNM 48969; SB-1970, 1, USNM 48985; SB-1996, 1, USNM 48994; SB-2008, 10, USNM 88887; SB-2009, 10, USNM 48981; SB-2010, 2, USNM 48997; SB-2020, 2, USNM 48968; SB-2432, 1,

USNM 48993; SB-2523, 2, USNM 49007; SB-2547, 1, USNM 48978; SB-2813, 15, USNM 48972; SB-3033, 1, USNM 88888; SB-3191, 1, USNM 48982; SB- 3284, 15, USNM 48996; SB-3407, 10, USNM 49009; SB-4122, 4, USNM 88889; SB-4419, 2, USNM 88890; SB-4420, 1, USNM 88891; SB-5107, 2, USNM 88892; Gos-1481, 13, USNM 48975; Gos-1533, 12, USNM 48976; Gos-1564, 10, USNM 49003; Gos-1575, 5, USNM 61734; Gos-1716, 4, USNM 61735; Gos-1860, 13, USNM 48987, -977; Gos-1866, 20, USNM 48973; Delaware II-008, 1, FSBC I 33155; Delaware II-010, 6, USNM 80494; Delaware II-012, 1, FSBC I 33157; Delaware II-023, 4, USNM 84362; Delaware II-029, 1, USNM 84364; Delaware II-062, 2, USNM 84367; Delaware II-067, 1, USNM 84366; Delaware II-074, 2, USNM 84363; Delaware II-075, 2, USNM 84365; Delaware II-121, 2, USNM 84368; Delaware II-126, 1, FSBC I 33152; Delaware II-132, 1, FSBC I 33153; Delaware II-138, 1, FSBC I 33154; Delaware II-140, 2, USNM 80493; Delaware II-147, 1, FSBC I 33156; FH-7516, about 200, USNM 22037; Pelican 169-7, 1, USNM 48989; Pelican 204-3, 5, USNM 48990; Grampus-5118, 1, USNM 80489; CSA, James Island Area Block 463, stns 4-7, 9, 11, 14, 16, 18-20, about 100 specimens, USNM; BLM, LMRS, O-S01, 13, USNM 88112-116; BLM, LMRS, O-S03, 11, USNM 67853 and 68416; BLM, LMRS, O-S06, 3, USNM 88117; off Fowey Light, FL, 73-155 m, about 450, USNM 48984, 48995, 49002, 49013, 49019, 80457, 80459; south of Key West, FL, 110 m, about 150, USNM 36926, 48970, 48992, 49001, 49015, 49018.

Types: Twenty syntypes of *B. floridana* from 'Bibb'-52 are deposited at the MCZ (5475 and 5585) (see CAIRNS 1977a). The syntype from off Havana could not be located. Type Locality: 24°26'N, 81°47'W (off Sand Key, FL), 47 m.

Distribution: Western Atlantic: southeastern US from Cape Hatteras, North Carolina (35°09'N, 75°10'W) to Mississippi; off Havana, Cuba; southeastern Caribbean (Barbados and north of Península de Paria, Venezuela); Rosalind Bank (between Honduras and Jamaica); Holocene of Mississippi Delta off Louisiana (WELLS 1933b; and Mississippi Mud Lumps) (Fig. 9); 13-220 m, although most records from 50-100 m. Eastern Atlantic: off Senegal; Gulf of Guinea; 29-95 m (CHEVALIER 1966b).

Although extremely common off the southeastern coast of the US, *B. floridana* is known from only 5 records in the entire Caribbean. The listing of this species from Panama (PORTER 1972: Pillsbury-405) is incorrect (see synonymy) and those from Jamaica (GOREAU & WELLS 1967; WELLS 1973) and the derivative listing by CASTAÑARES & SOTO (1982) cannot be verified and therefore are not considered valid. The specimen reported by SQUIRES (1959) from Bermuda is deposited at the AMNH but is too damaged to identify; its depth of 798 m argues against this identification.

Balanophyllia cyathoides (Pourtalès, 1871)

(Fig. 192)

Dendrophyllia cyathoides Pourtalès, v*1871: 45-46, pl. 1, figs. 8-9.
Balanophyllia cyathoides. –Cairns, 1977a: 136-138, pl. 1, figs. 5-8, (synonymy and description); 1979: 172-173, pl. 33, figs. 9-10, pl. 34, figs. 1-2, Map 52 (synonymy and description).
Balanophyllia floridana. –Hubbard & Wells, v.1986: 142, figs. 36-37. [Not *Balanophyllia floridana* Pourtalès, 1868]

Diagnosis: Corallum ceratoid, straight, and attached by a thick pedicel (PD:GCD=0.5-0.6). Often several coralla settle near calicular edge of a larger corallum, producing a bushy quasicolony, sometimes extending to a third generation of fixed coralla (Fig. 192). Largest known corallum (Alb-2157) 12.4 x 8.9 mm in CD. Septa hexamerally arranged in 4 cycles, rarely with pairs of S5 in end half-systems of large coralla. S1-2 highly exsert, forming calicular lancets in well-preserved coralla, but S1 slightly wider, thicker, and more exsert than S2. Well-formed paliform lobes (P3) present. Fossa moderate to shallow in depth, containing a slender, elongate, swirled columella, the elements often solidly fused together.

Discussion: Nothing is added to our knowledge of this species from the single record listed below, but the reidentification of *B. floridana*, as reported by HUBBARD & WELLS (1986), extends the distribution of *B. cyathoides* to Trinidad and broadens the depth range to a shallower depth of 20-45 m. Although similar, *B. cyathoides* differs from *B. floridana* in having larger S1 than S2, better developed paliform lobes, a more slender columella, a wider pedicel, and a tendency towards quasicoloniality (Table 4).

New Record: P-595, 1, USNM 99358.

Types: See CAIRNS (1979).

Distribution: Insular Straits of Florida; Yucatan Channel; Lesser Antilles (Cairns 1979: map 52); 45-494 m.

Balanophyllia palifera Pourtalès, 1878

(Figs. 193-194)

Balanophyllia palifera Pourtalès, v*1878: 207 (in part: BL-68). –Cairns, 1977a: 140-141, pl. 1, fig. 4, pl. 2, figs. 4-5, 7 (synonymy and description); 1979: 174-175, pl. 34, figs. 3-7, Map 53 (synonymy, description, lectotype designated). –Viada & Cairns, 1987: 133. –Cairns et al., 1994: 5 (listed).

Diagnosis: Corallum ceratoid to subcylindrical, straight, and attached by a thick pedicel (PD:GCD = 0.4-0.5). Corallum relatively small, the largest known specimen (Alb-2152) 10.5 x 9.0 mm in CD and 33 mm in height. A well-developed epitheca, which is often encrusted with calcareous epizoa, usually covers lower ½ to ⅔ of synapticulotheca. Septa hexamerally arranged in 4 cycles, the S1-2 roughly same size, contributing to 12 calicular lancets. Axial edges of each pair of S4 within a half-system usually do not fuse to one another, the S4 adjacent to the S1 being wider of pair. A crown of 12 well-formed P3 is present, the peripheral edge of each palus separated from the axial edges of S3 by a deep, narrow notch. Fossa of moderate depth, containing an elongate, swirled, labyrinthiform columella.

Discussion: *Balanophyllia palifera* is compared to the other western Atlantic species in Table 4. The only substantive record of this species since 1979 was that of Viada & Cairns (1987) from the northwestern Gulf of Mexico. Most records of *B. palifera* are from 300-500 m, only 2 records from less than 200 m: 53 m (Alb-2157) and 175 m (Viada & Cairns 1987). The 4 new records listed below are also from depths exceeding 200 m, but extend the known range of *B. palifera* to Jamaica and the Bahamas.

New Records: Alb-2354, 1, USNM 62624; G-701, 1, USNM 62622; Gos-112/27, 2, USNM 99359; JSL-I-1355, 1, IRCZM; JSL-II-1519, 2, USNM 94731.

Types: See Cairns (1979).

TABLE 4. – Comparison of the nine species of *Balanophyllia* known to occur in the Western Atlantic.

	B. floridana Pourtalès, 1868	*B. cyathoides* Pourtalès, 1871	*B. palifera* Pourtalès, 1878	*B. dineta* Cairns, 1977	*B. wellsi* Cairns, 1977	*B. caribbeana* Cairns, 1977	*B. pittieri* Vaughan, 1919	*B. bayeri* Cairns, 1979	*B. hadros* Cairns, 1979
Corallum: shape; size (GCD max.)	Ceratoid; 23.0 mm	Ceratoid; 12.4 mm	Ceratoid to subcylindrical; 10.4 mm	Ceratoid, usu. curved; 16.9 mm	Ceratoid, straight, slightly flared calice; 20.0 mm	Ceratoid, usu. curved; 17.5 mm	Ceratoid, curved, elongate; 28.6 mm	Ceratoid, straight to slightly bent; 11.4 mm	Trochoid, straight, robust; 31.0 mm
Base: attachment; PD:GCD	Usually attached; 0.15-0.50	Attached; 0.45-0.60	Attached; 0.40-0.50	Attached to small objects; 0.20-0.50	Attached, encrusting base: 0.5	Free or attached by small pedicel; 0.09-0.35	Free or attached by small pedicel; 0.07-0.30	Attached, elongate pedicel; 0.3	Firmly attached; 0.4-0.5
Epitheca	Absent	Absent	Thick	Occasional bands	Absent	Occasional bands	Absent	Absent	Absent
S1-2 exsertness; S5	S1=S2 (highly exsert); S5 common	S1>S2 (highly exsert); S5 rare	S1=S2 (exsert); S5 absent	S1=S2 (not exsert); S5 common	S1=S2 (slightly exsert); S5 rare	S1>S2 (slightly exsert); S5 often present	S1>S2 (highly exsert); S5 common	S1=S2 (not exsert); S5 rare	S1=S2 (not exsert); S5 common
Depth of fossa	Moderate to shallow	Moderate to shallow	Moderate	Shallow	Moderately deep	Deep	Shallow to moderate	Moderately deep	Moderate to shallow
Paliform lobes	Poorly-defined P3-4	Well-defined P3 (not notched)	Very well-defined P3 (notched)	Well defined (not notched)	Poorly-defined P4	Absent	Absent	Well-defined P3 (notched)	P4
Columella: size; shape; discreteness	Large; elongate, swirled; discrete	Slender; elongate, swirled; discrete	Moderate; elongate, swirled (labyrinthiform); discrete	Large; elliptical in cross-section, convex; swirled; discrete	Large; elongate, narrow; discrete	Rudimentary; loose fusion; not discrete	Large elongate, not discrete	Small elongate, narrow, swirled; discrete	Large elongate, swirled; discrete
Other characters		Quasicolonial			C1-2 slightly ridged; peripheral edges of S4 fuse to S1-2 at calicular edge	Asexual parricidal budding common; theca thin and porous	C1-2 usually slightly ridged		
Distribution; Depth	N. Carolina to Mississippi; SE Caribbean; 13-220 m	Straits of Florida; Lesser Antilles; 45-494 m	Gulf of Mexico; Antilles; 53-708 m (usu. 300-500 m)	SE Caribbean and NE S. America; 27-274 m	Bahamas; Jamaica; 412-505 m	SE Caribbean (Colombia to St. Vincent); 33-86 m	SW Caribbean (Honduras to Colombia); 40-96 m. Pliocene of Costa Rica	Isla Cozumel, Mexico; 274-311 m	Serrana Bank; Nicaragua; 274-293 m

Distribution: Bahamas; Greater and Lesser Antilles; Yucatan Channel; Gulf of Mexico off southwestern Louisiana; 53-708 m (CAIRNS 1979: map 53).

Balanophyllia dineta Cairns, 1977

(Figs. 23, 195-196)

Balanophyllia dineta Cairns, *1977a: 144-147, pl. 4, figs. 5-7 (synonymy and description); 1979: 207 (listed). –Prahl & Erhardt, 1989: 550.

Diagnosis: Corallum ceratoid, often slightly curved, and usually attached to a small object such as a gastropod or bivalve shell through a pedicel of variable diameter (PD:GCD = 0.20-0.50). Largest known corallum (the holotype) 16.9 x 14.0 mm in CD and 18.5 mm in height. Thin epithecal bands sometime cover lower theca. Septa hexamerally arranged in 5 cycles, although a complete fifth cycle is rare (Fig. 196). Coralla with 72 septa, having one pair of S5 in every half-system adjacent to an S1, are common. S1-2 not exsert. Paliform lobes (P3) present. Fossa shallow, containing a large, discrete columella that is elliptical in cross section and convex above, compose of numerous slender swirled elements.

Discussion: *Balanophyllia dineta* is distinguished from the previously described species of *Balanophyllia* by its distinctive columella. It also has a shallow fossa, nonexsert septa, and appears to be restricted to the rather shallow water of the southeastern Caribbean and Guianas (Table 4). The new records reported below extend its known distribution from Guyana to Amapa, Brazil.

New Records: P-671, 8, USNM 46675; P-708, 1, USNM 46676; P-838, 9, USNM 46677; Alb-2120, 2, USNM 7068; O-4459, 2, USNM 62613; Chain 35-35, 8, USNM 62619; Chain 35-36, 20, USNM 62617; Chain 35-38, 52, USNM 62620; Chain 35-39, 14, USNM 62618; Chain 35-43, 4, USNM 62621; Saldanha Pesca N2, 2, 4°27'N, 49°59'W, 116 m, SME.

Types: See CAIRNS (1977a).

Distribution: Southeastern Caribbean from Península de Guajira, Colombia to Guadeloupe, Lesser Antilles; northeastern South America to Amapa, Brazil (4°27'N, 49°59'W); 27-274 m (Fig. 23).

Balanophyllia caribbeana Cairns, 1977

(Figs. 8, 197)

Balanophyllia caribbeana Cairns, *1977a: 141, pl. 2, fig. 6, pl. 3, figs. 1-2; 1979: 207 (listed). –Prahl & Erhardt, 1989: 550 (listed).

Diagnosis: Corallum ceratoid, occurring in both free and attached states. Unattached, recumbent coralla usually curved, having a small pedicel (PD:GCD to 0.09); attached coralla, often the result of asexual budding from a parent fragment, usually straight, having a larger pedicel (PD:GCD up to 0.35). Largest known corallum (O-5696) 17.5 x 13.0 mm in CD and 40.3 mm in length. Theca thin and porous, which facilitates asexual fragmentation; epithecal bands occasionally present. Septa hexamerally arranged in 5 cycles, the fifth cycle rarely complete. S1 larger than S2, both cycles of septa exsert. Axial edges of highest cycle septa (*i.e.*, S4 or S5) laciniate. Paliform lobes absent. Fossa quite deep, containing a rudimentary columella consisting of a loose concentration of slender elements that originate from lower axial edges of S1-2 and highest cycle septa.

Discussion: *Balanophyllia caribbeana* is compared to *B. pittieri* in the account of that species and in Table 4. At the depth range of 30-100 m, these 2 species complement each other in geographic range within the southern Caribbean, overlapping only between the Gulf of Morrosquillo and Península de Guajira, Colombia (Figs. 8, 9).

New Record: O-5696, 2, USNM 62612.

Types: See CAIRNS (1977a).

Distribution: Southeastern Caribbean from Isla Fuerte, Colombia to St. Vincent, Lesser Antilles (Fig. 8); 33-86 m.

Balanophyllia pittieri Vaughan, 1919

(Fig. 9)

Balanophyllia pittieri Vaughan, v*1919: 479, pl. 139, figs. 1-2. –Cairns, 1999b: Table 1 (listed).
Balanophyllia grandis Cairns, *1977a: 142, pl. 3, figs. 3-5 (new synonym); 1979: 207 (listed). –Fenner, v.1993a: 14 (listed).

Diagnosis: Corallum elongate, ceratoid, and usually slightly curved, often recumbent or attached by a slender pedicel: PD:GCD 0.07-0.30. Largest known corallum (O-5683) 28.6 x 20.7 mm in CD and 48.3 mm in length. C1-2 slightly ridged; epitheca not present. Septa hexamerally arranged in 5 cycles, the fifth cycle rarely complete. S1-2 equal in size and slightly exsert. Axial edges of higher cycle septa moderately dentate. Paliform lobes absent. Columella shallow to moderate in depth, containing a robust, elongate, non-discrete columella, the columellar elements spreading to axial edges of S1-2 and highest cycle septa.

Discussion: *Balanophyllia grandis* is most similar to *B. caribbeana* but can be distinguished by its shallower fossa, ridged C1-2, and better developed columella (Table 4). The 4 records listed below serve only to extend the known distribution of the species to the westernmost coast of Caribbean Honduras and northwestern Colombia.

When I (CAIRNS 1977a) described *B. grandis*, only the type series of *B. pittieri* was known, which, despite their gross similarity, made it inconclusive to synonymise these species. Since then, however, numerous Late Pliocene Costa Rican specimens have been collected by the Panama Paleontology Project (CAIRNS 1995b, 1999b), which strongly indicates that these species are the same.

Types: Two syntypes of *Balanophyllia pittieri* from Pittier collection 618 are deposited at the USNM (M325014). The specimens VAUGHAN reported from USGS 6249 were not designated as types. Type Locality: Limón, Costa Rica, Moín Formation (Late Pliocene).

The type series of *B. grandis* is split between the USNM and RSMAS (see CAIRNS 1977a). Type Locality: 15°56.5'N, 86°14'W (off Honduras), 46 m.

New Records: P-392, 1, USNM 62610; P-619, 1, USNM 62608; P-623, 1, USNM 62611; O-5683, 1, USNM 62603; O-5737, 1, USNM 63609.

Distribution: Southwestern Caribbean from Honduras to Península de Guajira, Colombia; Cayman Islands (Fig. 9); 40-96 m. Late Pliocene of Costa Rica (Cairns 1999b).

Genus Leptopsammia Milne Edwards & Haime, 1848

Diagnosis: Corallum solitary, ceratoid to subcylindrical, firmly attached. Synapticulotheca often covered with epitheca. Septa arranged normally (not in a Pourtalès plan). Paliform lobes absent; columella spongy.

Type Species: *Leptopsammia stokesiana* Milne Edwards & Haime, 1848, by monotypy.

Leptopsammia trinitatis Hubbard & Wells, 1987

(Fig. 9)

Leptopsammia trinitatis Hubbard & Wells, v*1987: 142-143, figs. 38-40.

Diagnosis: Corallum cylindrical to subcylindrical, straight, attached by a thick pedicel. Holotype 5.8 x 4.7 mm in CD and 16.3 mm in height; however, largest known corallum (G-899) 6.3 mm in GCD and 43 mm in height. A thick, corrugated epitheca covers all or part of porous synapticulotheca, the epitheca invariably encrusted with bryozoa and/or serpulid tubes. Corallum white. Septa hexamerally arranged in 4 cycles, the fourth cycle never complete, larger coralla having a septal complement of 40 (6:6:12:16). S4 not developed in either of 2 lateral systems, but usually in all 4 end systems, resulting in 8 pairs of S4, or 40 septa. S1 widest and thickest septa, having entire axial edges; all other septa have finely dentate axial edges. S2 ⅓ to ½ width of S1, becoming slightly wider lower in fossa. S3 less wide than S2: those flanked by a pair of S4 widen deep in fossa and weakly fuse to lower axial edges of adjacent S2; those not flanked by S4 become rudimentary lower in fossa. S4 narrowest septa, becoming rudimentary low in fossa and weakly fused to adjacent S3. All septa nonexsert. Fossa quite deep, containing a small, non-discrete, spongy columella.

Discussion: *Leptopsammia trinitatis* is the only species of 11 in the genus known from the western Atlantic. It is distinctive in its tendency to have 40 septa, with no S4 in the lateral systems. HUBBARD & WELLS (1986) report that is has orange-yellow polyps.

New Records: G-899, 7, USNM 99360; Palancar Reef, Cozumel, Mexico (cave roof), 15 m, 4, USNM 75185.

Types: The holotype and paratype are deposited at the USNM (68478 and 68479, respectively). Type Locality: near Winn's bay, south side of Gaspar Grande, Trinidad, 20 m.

Several other non-type specimens (ICZN: article 72(b)vi) examined by HUBBARD and WELLS are also deposited at the USNM: USNM 68480 and 86757, 2 coralla from the passage between Trinidad and Venezuela; USNM 86759, 1 corallum from Winn's Bay; USNM 86760, 1 corallum from Huevos (RH30); and USNM 86758, 7 coralla from 'Trinidad' (RH26). The deposition of coralla listed by HUBBARD and WELLS (1986) from Monos and Chacachacare is unknown.

Distribution: Islands between Trinidad and Península de Paria, Venezuela; Yucatan Channel, Mexico (Cozumel and Arrowsmith Bank) (Fig. 9); 15-40 m.

Genus **Eguchipsammia** Cairns, 1994

Diagnosis: Corallum commonly unattached (recumbent), the result of asexual budding from a parent corallum, but attached coralla also known; intratentacular budding also occurs. Third generation budding rare. Synapticulotheca usually partially covered with epitheca. Septa arranged in a Pourtalès plan. Paliform lobes may be present; columella spongy (discrete or nondiscrete).

Type Species: *Dendrophyllia cornucopia* Pourtalès, 1871, by original designation.

Eguchipsammia cornucopia (Pourtalès, 1871)

(Fig. 198)

Dendrophyllia cornucopia Pourtalès, v*1871: 45, pl. 5, figs. 7-8. –Cairns, 1979: 179-181, pl. 36, figs. 1-4, Map 54 (synonymy and description). –Zibrowius, v.1980: 175-176, pl. 88, figs. A-L. –Not Hubbard & Wells, v1986: 139, figs. 33-35 (=*Rhizopsammia goesi*). –Viada & Cairns, 1987: 132. –Cairns & Wells, 1987: 43, pl. 11, figs. 14-17 (fossil occurrence). –Cairns et al., 1991: 48 (listed). –Cairns, 1999b: Table 1 (listed).
Balanophyllia (sic) *cornucopia*. –Cairns et al., 1994: 5 (listed).
Eguchipsammia cornucopia. –Cairns, 1994: 85 (listed).

Diagnosis: Corallum subcylindrical, elongate, and usually irregularly bent or curved. Most coralla appear to originate by asexual budding from edge zone of a parent corallum, some coralla having as many as 50 buds or bud scars on their theca. Detached, asexually budded coralla result in a broken and thus unattached corallum; however, attached coralla are also known, presumably the result of sexual (planular) reproduction. These coralla often attach to the theca of conspecific coralla (see Discussion). Large, robust coralla are most common (e.g., the syntypes), having corallites as long as 13 cm and a calicular diameter up to 17.4 x 15.0 mm; however, a smaller size class of coralla (indicated by an asterisk in the New Records section, as well as BL-253 and P-861 [SEE CAIRNS 1979]) is known, the coralla of which are identical to the typical form but grow only to a calicular diameter of 8-9 mm and rarely contain more than 48 septa. Epitheca present on lower region of corallum. Septa hexamerally arranged in 5 cycles, but fifth cycle never known to be complete, large coralla having about 72 septa. Septa not exsert; S1 and S2 equal in size; remaining septa arranged in a POURTALÈS plan, a small paliform lobe occurring before the S3. Fossa shallow, containing a well-developed, discrete, swirled columella that is elliptical in cross section (Fig. 198). Vesicular endothecal dissepiments common in elongate coralla.

Discussion: A parent corallum usually bears numerous asexually budded coralla on its theca, but may also bear a lesser number of presumably sexually originated coralla, as mentioned above. The latter class of coralla can be distinguished by having a thicker pedicel (6-8 mm in diameter vs 2-3 mm) and an encrusting base, with costae that radiate outward from the corallum, instead of being continuous with those of the parent corallum.

Also, there is sometimes a colour difference between the attached corallum and the older corallum, sometimes due to the death of the older corallum. Finally, an attached corallum will usually bear additional asexually budded coralla, whereas ordinarily there are no third generation buds in this species.

The records reported below extend the known geographic range of *E. cornucopia* to the Yucatan Channel and off the entire northern coast of Venezuela, as well as extending the minimum known depth of occurrence from 132 m to 91 m.

New Records: P-595, 1, USNM 80500; G-694, 4, UMML; O-4398, 4, USNM 62261; *O-4459, 9, USNM 99362; O-5648, 6, USNM 99363; B-A DS32, 2, USNM 62316; *BLM, SOFLA-36, 14, USNM 72009, 72010, 76443; Hudson 3A, 1, NMC; Hudson 4B, 1, NMC; EJ81-29, 3, FSBC I; *26°16'N, 84°04'W, 137-148 m, 2, USNM 83443-444; off Western Dry Rocks, FL, 263 m, 28, USNM 62318-319.

Types: See CAIRNS (1979).

Distribution: Western Atlantic: Little Bahama Bank; Straits of Florida to off Pensacola, Florida (VIADA & CAIRNS 1987); Yucatan Channel; southeastern Caribbean from Gulf of Venezuela to Barbados; 91-604 m, although no live records known deeper than 300 m (CAIRNS 1979: map 54); Late Miocene to early Pliocene of Dominican Republic (CAIRNS & WELLS 1987). Eastern Atlantic: Celtic Sea; Gulf of Gascony; 330-960 m (ZIBROWIUS 1980).

Eguchipsammia strigosa, new species

(Figs. 10, 199-202)

Dendrophyllia A, n. sp. Cairns, 1976: 204-206, pl. 31, figs. 7-10; 1979: 180.
Dendrophyllia cornucopia. –Hubbard & Wells, v1986: 139-140 (in part: some of the specimens from Balata Bay, Huevos (USNM 86747) and those from Chacachacare (USNM 68476, figs. 33-35). [Not *Dendrophyllia cornucopia* Pourtalès, 1871]

Description: Corallum elongate and subcylindrical, often irregularly bent or curved. As with *E. cornucopia*, most coralla originate by asexual budding from the edge zone of a parent corallum, up to 30 randomly arranged buds or scars of detached buds on theca. Buds usually do not remain attached to parent corallum for long, detaching before they attain a length of 1 cm, but the robust coralla from northwestern Trinidad maintain the connection longer as well as forming reptoid stolons that bud contiguous corallites, altogether forming a bushy colony (see Discussion). Largest corallum (P-709) 15 cm in length (P-709) and 10.6 x 9.1 mm in CD; holotype 9.2 x 8.0 mm in CD. Costae poorly defined; epitheca often covers lower synapticulotheca; corallum white.

Septa hexamerally arranged in 4 cycles, only the largest coralla having several pairs of S5. S1 slightly exsert and wide, defining a deep and narrow fossa. Axial edges of S1 vertical and straight; thecal faces bear very small granules, the face appearing smooth. S2 not exsert, ⅔ to ¾ width of S1. S3 rudimentary, only about ¼ width of an S2, having finely dentate axial edges. At calicular edge S4 equally narrow as S3, but lower in fossa S4 broaden, each pair forming a cribriform junction before its adjacent S3. S4 porous, their axial edges laciniate. Fossa quite deep, containing a small, non-discrete, spongy columella that extends to axial edges of S1-2, 4. Tabular endothecal dissepiments occur about every 5 mm.

Discussion: *Eguchipsammia strigosa* is similar to but differs from *E. cornucopia* by having a deeper and narrower fossa; S1 that are wider than S2; a smaller, non-discrete columella; less defined costae; a thinner theca and less dense corallum; porous S4 with laciniate axial edges that fuse in a cribriform junction; smooth septal faces; and a smaller corallum resulting in a smaller CD and fewer septa (S5 are rare). Although both species occur in the southeastern Caribbean, *E. strigosa* is found at shallower depths (25-77 m vs 91-300 m).

Eguchipsammia strigosa is perhaps more easily confused with *Rhizopsammia goesi*, both species co-occurring in the southeastern Caribbean at the same depth range. Nonetheless, *E. strigosa* appears to differ in having a non-discrete columella; numerous buds that originate from the theca; a more elongate corallum but a smaller calicular diameter, resulting in few, if any, S5; and endothecal dissepiments. Specimens from Trinidad, reported as *D. cornucopia* by HUBBARD & WELLS (1986), are unusual in that budded coralla remain attached to the parent corallum for a longer time and the bases of some coralla appear to form stolons that bud closely adjacent coralla from a common basal coenosteum, both of these phenomena resulting in a bushy colony (Fig. 201). The stoloniferous asexual reproduction increases its resemblance to *Rhizopsammia* and obscures the distinction between these 2 genera, but *E. strigosa* is still reliably differentiated from *R. goesi* by other characters. This quasicolonial prolific and accelerated growth of the Trinidad *E. strigosa* is yet another example of the effects of the unusual environment of northwestern Trinidad as noted in the corals reported by HUBBARD & WELLS (1986). They reported *D. cornucopia* from 4 localities off Trinidad, but specimens from only 2 sites are known to be deposited at the USNM (see Synonymy).

Etymology: The species name *stigosa* (Latin *stigosus*, lean, thin) alludes to the relatively thin, elongate corallites of this species.

Records/Types: Holotype: P-709, USNM 46902. ParaTypes: P-705, 3, USNM 62627; P-709, 135: 113 (USNM 46903), 22 (UMML 8.291); P-710, 3: 2 (USNM 62628), 1 (UMML); P-734, 3, USNM 46904; P-737, 1, USNM 46905; P-759, 1, USNM 99364; O-5033, 2, USNM 62262; Gos-1860, 11, USNM 62260; Balata Bay, Huevos I., Trinidad, 20-25 m, 6 quasicolonies, USNM 86747 (*D. cornucopia* of Hubbard & Wells, 1986); Chacachacare, Trinidad, 30 m, 1 quasicolony, USNM 68476 (*D. cornucopia* of HUBBARD & WELLS 1986); 'Trinidad', RH22, depth unknown, 1 quasicolony, USNM 86748. Type Locality: 11°08.8'N, 62°46.1'W (north of Península de Paria, Venezuela), 46 m.

Distribution: Southeastern Caribbean from Península de Paraguaná, Venezuela to northwestern Trinidad; off Cape Lookout, Outer Banks, North Carolina (Fig. 10); 25-77 m.

Eguchipsammia gaditana (Duncan, 1873)

Balanophyllia gaditana Duncan, v*1873: 333.
Balanophyllia praecipua Gardiner & Waugh, v*1939: 240, pl. 1, fig. 2.
Dendrophyllia gaditana. –Cairns, 1979: 181-182, pl. 36, figs. 5-10, Map 55 (synonymy and description). –Zibrowius, v.1980: 176-178, pl. 89, figs. A-N (description). –Cairns et al., 1991: 48 (listed).
Eguchipsammia gaditana. –Cairns, 1994: 85-86, pl. 37, figs. d-f, h (synonymy and description). –Cairns & Zibrowius, 1997: 190 (synonymy).

Diagnosis: Corallum subcylindrical, elongate, and usually irregularly bent or curved. Buds originate extratentacularly at right angle to parent corallum and occasionally intratentacularly. Coralla delicate in form, rarely exceeding 5 cm in length and 5 mm in GCD. Costae poorly defined, but C1-2 usually slightly ridged; a thin epitheca often covers lower synapticulotheca of each bud. Septa hexamerally arranged in 4 cycles, although it is not unusual for pairs of S4 to be missing from various half-systems, resulting in a complement of 36-48 septa. P3 paliform lobes present. Fossa shallow, containing a rudimentary, non-discrete columella.

Discussion: *Eguchipsammia gaditana* differs from *E. cornucopia* and *E. strigosa* in its smaller size, ridged C1-2, shallow fossa, and rudimentary columella. The 2 new records listed below add the western Atlantic localities of Caracas, Venezuela and west of Key West, and decrease the minimum known depth range from 146 to 97 m, which is more consistent with other known minimum depth ranges for this species from other regions.

New Records: O-4459, 2, USNM 62345; 24°46'N, 83°55'W, 161-168 m, 1, USNM 83439.

Types: See CAIRNS (1979).

Distribution: Western Atlantic: southeastern coast of US from off Hatteras Island, North Carolina (35°48'N, 74°28'W) to west of Key West, Florida; Arrowsmith Bank, Yucatan Channel; off Caracas, Venezuela; St. Peter and Paul Rocks (CAIRNS 1979: map 55); 97-505 m. Eastern Atlantic: Iberian-Morocco Gulf; Madeira; Great Meteor Bank; Gulf of Guinea; 73-417 m. Elsewhere: widespread in tropical temperate world ocean, except for eastern Pacific; 30-988 m (CAIRNS & ZIBROWIUS 1997).

Genus **Rhizopsammia** Verrill, 1870

Diagnosis: Like *Balanophyllia*, but forming reptoid colonies by extratentacular stoloniferous budding. POURTALÈS plan present; pali absent; columella rudimentary.

Type Species: *Rhizopsammia pulchra* Verrill, 1870, by monotypy.

Rhizopsammia bermudensis Wells, 1972

(Figs. 10, 203-206, 210)

Rhizopsammia bermudensis Wells, v*1972: 8-9, figs. 15-17. –Cairns, 1979: 207 (listed). –Cairns et al., 1986: 187 (drawing), 188, pl. 6, fig. 6 (colour).

Description: The holotypic colony consists of about 29 short, cylindrical corallites, most united basally by a thin continuous coenosteal sheet; however, several corallites originate from broad stolons issuing from base of a parent corallite. In no case do corallites bud from the theca of another corallite. In the holotypic colony the largest corallite is 7.5 x 7.1 mm in CD and 8 mm in height; however, a corallite from the "Penilaion" (USNM 83464) measures 11.1 x 9.7 mm in CD and another (USNM 93188) is 44 mm in height. Costae not well formed; a basal epitheca is usually present, uniting bases of all corallites in a holotheca. Corallum white; polyps salmon pink or bright orange.

Septa of most corallites hexamerally arranged in 4 complete cycles (48 septa); however, largest corallite has 8 primary and a total of 70 septa (8:8:16:32:6). S1 moderately exsert, having entire, vertical axial edges that attain the columella. S2 only ⅓ to ½ width of an S1, nonexsert, having laciniate axial edges. S3 rudimentary. S4 dimorphic in size, those adjacent to S1 fusing with the other S4 within that half-system before the S3 and extending to columella, sometimes fusing with axial edge of other S4 within system. Axial edges of S4 laciniate to porous. Fossa moderate to deep, containing a rudimentary elongate columella.

Discussion: The corallite integration of *R. bermudensis* is transitional between that of *Rhizopsammia* and *Cladopsammia*, *i.e.*, reptoid budding from stolons followed by coenosteal infilling resulting in a common sheet-like base. The species differs from *R. goesi* in having smaller, cylindrical corallites; and laciniate axial edges of the S2-4.

New Records: Wreck of the "Penilaion", off St. David's-Head, Bermuda, 8-12 m, 9 corallites, USNM 83464, 83465, 93186; boilers SE of Nonsuch Bay (cave ceiling), Bermuda, 8 m, 2 corallites, USNM 93188 (living coral figured in colour by CAIRNS *et al.* 1986: pl. 6, fig. 6).

Types: The holotypic colony (live when collected) is deposited at the YPM (8500). Type Locality: cavity in reef rock North East Breakers (Haversack East), Bermuda (6.5 km east of North Rock); depth not stated.

Distribution: Known only from Bermuda: Haversack East (type locality); off St. David's-Head; SE of Nonsuch Bay (Fig. 10); 8-12 m.

Rhizopsammia goesi (Lindström, 1877), new combination

(Figs. 207, 209)

Dendrophyllia Goësi Lindström, v*1877: 24, pl. 3, figs. 40-42. –Pourtalès, v.1880a: 97, 111 –Marenzeller, 1907: 3 (listed).
Balanophyllia goesi. –Cairns, 1977a: 138, pl. 2, figs. 1-3 (synonymy and description); 1979: 207 (listed). –Humann, v.1993: 166.
Dendrophyllia cornucopia. –Hubbard & Wells, v.1986: 139-140 (in part: some of the specimens from Balata Bay, Huevos: USNM 62602 and 86749).
Balanophyllia n. sp. Humann, 1993: 166-167, colour figs. (USNM ?91659, 92087).
Cladopsammia n. sp. Humann, 1993: 166-167, colour fig. (USNM 91651, 91655).
?*Balanophyllia* sp. Pires, v.1997: 182 (USNM 90329, listed).

Diagnosis: Corallites straight and ceratoid to subcylindrical, increasing in diameter little to any with increase in height, resulting in a robust pedicel having a PD:GCD of 0.7-1.0. Corallites propagate asexually through wide (up to 7 mm) and thick (up to 3 mm) stolons, which bud additional corallites. Largest known corallite (O-4393) 20.4 x 16.0 mm in CD and 47 mm in height. Costae not well defined, the synapticulotheca being rather smooth, covered only with low granules. Toward base of each corallite, and often extending to stolons, theca and coenosteum usually covered with a well-developed, wrinkled epitheca. Corallum white. Septa hexamerally arranged in 5 cycles, the fifth cycle not complete, although it may be in one of more systems within a corallite. S1 exsert (up to 3 mm) and significantly wider than the S2, having long, straight, vertical axial edges that define a deep, narrow fossa. POURTALÈS plan strongly developed, the S5 (or S4) adjacent to the S1-2 being strongly curved near the columella. Paliform lobes absent. Fossa quite deep, containing a discrete, elongate, narrow columella.

Discussion: LINDSTRÖM (1877) expressed some doubt about the colonial nature of the syntypes of *D. goesi* but nonetheless placed the species in *Dendrophyllia*, whereas I (CAIRNS 1977a), also based exclusively on the type material, transferred the species to *Balanophyllia*. Well-preserved specimens from the Gulf of Venezuela, which appear to be identical to *D. goesi*, show that the species propagates by asexual budding via basal stolons (Fig. 207), which is characteristic of the genus *Rhizopsammia*. Indeed, it is often difficult to properly distinguish between a *Balanophyllia* and a *Rhizopsammia* unless an intact corallum (including its base) is present, the former being solitary, the latter budding by stolons. Thus, LINDSTRÖM was originally correct in assuming this species to be colonial.

Re-examination of the specimens reported as *Balanophyllia* sp. (PIRES 1997) from Cumuruxatiba Reefs, Bahia, Brazil (17°00'S, 39°05'W), suggest that they belong to the genus *Rhizopsammia*, perhaps even *R. goesi*. HUMANN's (1993:166-167) specimen of *Balanophyllia* n. sp. from Roatán (USNM 92087) also appears to be a *Rhizopsammia*, but the species is uncertain. On the other hand, his specimen from San Salvador, Bahamas (USNM 91659) appears to be juvenile *R. goesi*, as well as the specimen he reported as *Cladopsammia* n. sp. from Roatán (USNM 91651) and Conception, Bahamas (USNM 91655).

Both HUBBARD & WELLS (1987) and HUMANN (1993) stated that the polyps of this species are bright orange or pale to bright pink.

New Records: P-1384 (presumed labelling error: correct station unknown), 1, USNM 62604; O-3480, 1 corallite, USNM 62626; O-4393, 7 corallites, USNM 62601; O-4394, 1, USNM 62600; Balata Bay, Huevos, Trinidad, 20 m, 8 corallites, USNM 62602; "Trinidad, over 12 m", 2 corallites, USNM 80464.

Types: See CAIRNS (1977a).

Distribution: Gulf of Mexico off Mississippi Delta; eastern Caribbean from Virgin Islands to Península de Guajira, Colombia; Roatán, Honduras (HUMANN 1993); San Salvador and Conception, Bahamas (HUMANN 1993); Navassa; ?Cumuruxatiba Reefs, Bahia, Brazil (PIRES 1997); 4.5-119 m.

Genus **Cladopsammia** Lacaze-Duthiers, 1897

Diagnosis: Small phaceloid colonies formed by extratentacular budding from a common basal coenosteum and from edge zone of larger corallites. POURTALÈS plan well-developed; pali may be present; columella spongy.

Type Species: *Cladopsammia rolandi* Lacaze-Duthiers, 1897, by monotypy.

Cladopsammia manuelensis (Chevalier, 1966), new combination

(Fig. 211)

Rhizopsammia manuelensis Chevalier, v*1966b: 1382, pl. 6, figs. 1-3, pl. 7, fig. 5. –Wells, 1972: 9 (mentioned). –Zibrowius, v.1980: 181-182, pl. 92, figs. A-M (description). –Cairns, 1991 et al., 48 (listed). –Cairns & Keller, 1993: 277 (mentioned). –Cairns et al., 1994: 5 (listed).
Dendrophyllia n. sp. Allen & Wells, v.1962: 390, pl. 4, figs. 2-4 (USNM 80914).
"*Rhizopsammia*" *manuelensis*. –Cairns, 1979: 193-194, pl. 39, figs 2-6, Map 59 (description and synonymy).

Diagnosis: Small, bushy coralla result from closely adjacent extratentacular budding from a common basal coenosteum. Although founder corallites may initially produce several thick stoloniferous basal extensions (characteristic of *Rhizopsammia*), these stolons are soon merged into a continuous, sheet-like coenosteum that is characteristic of the genus *Cladopsammia*. Buds do not originate from the theca of parent corallites. Corallites slender (ceratoid) and elongate, some as tall as 4 cm and up to 18 mm in GCD. A thin epitheca covers basal portion of each corallite and is often continuous (holotheca) around perimeter of colony. Septa hexamerally arranged in 5 cycles, the fifth cycle never complete. S1-2 slightly exsert; prominent P3 paliform lobes are present. Fossa of moderate depth, containing a large, compact, swirled columella.

Discussion: This species seems to bridge the gap between *Rhizopsammia* and *Cladopsammia*, young coralla having reptoid stolons characteristic of the former genus, older coralla having a common basal coenosteum characteristic of *Cladopsammia*. This was one of the reasons I (CAIRNS 1979) previously placed this species only tentatively in the genus *Rhizopsammia*. Now, even though *C. manuelensis* has paliform lobes, and the type species (*C. rolandi*) does not, the degree of corallite integration (as discussed by CAIRNS 1994) favors a placement of this species in *Cladopsammia*.

New Records: P-236, 1 colony, USNM 48501; SB-331, 1 colony, USNM 83466; WB-413, 1 colony, USNM 46721; CSA site 7, 2 colonies, CSA; CSA 1331.1, 29°18'N, 88°21'W, depth unknown, 1 colony, USNM 93200; USGS-AE-9701-67, 1 colony, USNM 99367; BLM TX, 27°54'N, 93°26'W, 100 m, 1, UCSC.

Types: See CAIRNS (1979).

Distribution: Western Atlantic: Straits of Florida; Gulf of Mexico (Destin Dome Pinnacles, Mississippi; off Padre I., Texas); Arrowsmith Bank, Mexico; southernmost Rio Grande do Sul, Brazil (near border with Uruguay); 70-366 m (CAIRNS 1979: map 59). Eastern Atlantic: off Senegal; Cape Verde Islands; Gulf of Guinea; 55-150 m (ZIBROWIUS, 1980); Pleistocene of Niger Delta (ALLEN & WELLS 1962).

Genus **Tubastraea** Lesson, 1829

Diagnosis: Colonies dendroid, bushy, or plocoid, all achieved by extratentacular budding. Costae poorly defined; no epitheca. Septa arranged normally (not in a POURTALÈS plan). Pali absent; columella usually small and spongy.

Type Species: *Tubastraea coccinea* Lesson, 1829, by monotypy (see WELLS 1936).

Tubastraea coccinea Lesson, 1829

(Figs. 11, 212-215)

Tubastraea coccinea Lesson, *1829: 93-94. –Wells, 1936: 132. –Scatterday, 1974: 86 (listed). –Cairns, 1979: 207 (listed). –Zlatarski, 1982: 320-321 (figs. 70-71), 323-324, 341-342, pls. 149-152 (description, geographic records). –Wells, v.1983: 243-244, pl. 18, figs. 1-2 (synonymy and discussion). –Wood, 1983: 66 (fig.). –Estalella, 1986: 20. –Prahl & Erhardt, 1989: 551, fig. 10. –Cairns et al., 1991: 48 (listed). –Cairns, 1991: 26-27, pl. 12, figs. c-e (description). –Humann, 1993: 164-165, 4 colour figs. –Cairns & Zibrowius, 1997: 197 (Indo-Pacific synonymy).

Lobophyllia aurea Quoy & Gaimaird, *1833: 195-196, pl. 15, figs. 7-11.

Coenopsammia tenuilamellosa Milne Edwards & Haime, *1848b: 110, pl. 1, fig. 11.

Tubastraea Vaughan & Wells, 1943: 238-239 ("West Indies").

Tubastrea tenuilamellosa. –Boschma, 1951: 44-46. –Goreau, 1959: 70, 75, 85 (listed). –Roos, 1964: 17, 48. –Keith & Weber, v.1970: 271. –Olivares, v.1971: 75-77, pl. 2, figs. a-b (description). –Smith, v.1971: 95. –Erhardt, 1974: 407 (listed). –Erhardt & Meinel, 1975: 246 (listed).

Tubastraea tenuilamellosa. –Boschma, 1953: 109-117, pl. 9, figs. 1-4; pl. 10, figs. 1, 3-5; pl. 11, figs. 1, 3. –Roos, 1971: 84, pl. 53, text-fig. 45 (description and discussion).

Tubastrea aurea. –Zans, 1959: 29, 35. –Almy & Carrión-Torres, 1963: 161, pl. 21, fig. b (description). –Goreau & Wells, 1967: 449 (listed). –Land, Lang & Barnes, 1977: 170 (isotopic composition). –Colin, 1978: 291, 293 (2 colour figs.). –Prahl & Erhardt, 1985: 181-182, figs. 180 a-b, 109.

Tubastraea aurea. –Pfaff, 1969: 23 (listed). –Porter, 1972: 113 (listed). –Wells & Lang, 1973: 58 (listed). –Castañares & Soto, 1982: Table 1 (listed). –Wood, 1983: 121 (colour fig.), 124 (colour fig.).

Description: Colonies cerioid, plocoid, or phaceloid, the specific form probably the result of the environment (see Discussion). Most coralla spherical to mound-shaped, firmly attached, up to 14 cm in diameter (ZLATARSKI 1982). Coenosteum of larger coralla may be up to 3 cm thick. Corallites cylindrical, up to 11 mm in GCD, ranging from flush with coenosteum to projecting up to 4 cm above coenosteum. Synapticulotheca quite porous (no epitheca); corallum white; costae poorly defined. Intercorallite coenosteum also quite porous.

Septa hexamerally arranged in 4 cycles, the last cycle never complete: S1>S2>S3>4. All septa nonexsert. S1 slender at calicular edge but gradually widen deeper in fossa, such that their smooth axial edge fuses with upper part of columella. S2 similar in shape to S2 but only half as wide, having a finely dentate axial edge that fuses to columella deeper in fossa that those of S1. S3 rudimentary, usually with laciniate axial edges. S4 usually about same size or slightly less wide than S3. Fossa deep, containing a small, discrete, loosely swirled columella. Elongate corallites often contain 1-3 tabular endothecal dissepiments beneath the columella.

Discussion: *Tubastraea coccinea* may represent the only introduced (exotic) scleractinian coral known from the western Atlantic. The earliest record of the genus in the western Atlantic was that of VAUGHAN & WELLS

(1943), who simply listed the locality of 'West Indies' in their generic account, without further documentation. BOSCHMA (1953) ascertained from these authors that this general reference was based on unpublished material collected from Puerto Rico and Curaçao. Although a date was not given, one might assume that the specimens were collected in the late 1930's. The first date-documented specimens were reported by BOSCHMA (1951, 1953) from the Netherlands Antilles between 1948 and 1950, interestingly some of these specimens were attached to a ship's bottom. Later, ROOS (1971) remarked that since the 1950's the abundance of *T. coccinea* seemed to be increasing both in Curaçao and the northern coast of Jamaica, consistent with the hypothesis that the species was enlarging both its range and abundance. If one plots the earliest occurrences of *T. coccinea* throughout the Caribbean (Fig. 11), the following scenario may be proposed. The species was introduced to the Caribbean at Curaçao and/or Puerto Rico in the late 1930's or early 1940's by transport from the Indo-Pacific on a ship's hull, where it had been known as early as 1829. From Curaçao this opportunistic species quickly spread to Aruba and Bonaire by 1950 (BOSCHMA 1953) and then east to the Gulf of Cariaco, Sucre, Venezuela (OLIVARES 1971) by 1971 and westward to Panama by 1972 (PORTER 1972). Soon after its original introduction it became established in Jamaica (1955). From Puerto Rico it may have spread eastward as far as Saba in 1971 (ROOS 1971) and westward to the Silver Bank (O-5442) by 1965, finally reached southeastern Cuba from Jamaica or Puerto Rico by 1982 (ZLATARSKI 1982). The species is not yet known from most of Cuba, most of the Bahamas, Florida, the Gulf of Mexico, and the western Caribbean (Fig. 11).

Tubastraea coccinea often occurs on dock pilings, buoys, cave ceilings, and on the undersides of large rocks. Coralla that occur in shallow, high-energy water usually are cerioid (Fig. 214) to plocoid (Fig. 213), having closely spaced, nonexsert corallites; whereas those in deeper, calmer water are often phaceloid, having widely spaced corallites that project as much as 4 cm from the coenosteum (Fig. 215). It is a brightly coloured species, the polyps being deep red or orange, whereas the tentacles are bright orange to yellow (HUMANN 1993). Because of its bright colour and tendency to attach to shallow-water, man-made objects, it is a frequently observed and photographed coral. Its common name is the 'orange cup coral'.

New Records: O-5442, 1 colony, USNM 95494; Red Buoy Reef, Discovery Bay, Jamaica, 1994, 1 m, 3 colonies, USNM 94415; Ocho Rios, Jamaica, 3 m, 1 colony, USNM 61848; East Palisadoes, Jamaica, 23 m, 1962, 1 colony, USNM 83698; Jamaica, 1955, 1 colony, USNM 83699; DBL-1314, Discovery Bay, Jamaica, depth unknown, 1 colony, USNM 83693; Little Bonaire, 24 m, April 1974, 1 colony, USNM 61845; Curaçao, 23 III 1950, 3: 2 colonies (USNM 61847 and 83692) and 1 colony (UMML 8.362); Santa Marta, Curaçao, 1 m, November 1968, 2 colonies, USNM 61843; Steven's Reef, St. John, Virgin Islands, 4.5 m, 1968, 2 colonies, USNM 61849; 10°20'N, 75°46'W, 2 m, March 1970, 2 colonies, USNM 88414.

Types: The holotype of *T. coccinea* is deposited at the MNHN (WELLS 1936). Type Locality: Bora Bora, Society islands, depth unknown.

The syntypes of *T. aurea* (Quoy & Gaimard, 1833) were not traced. Type Localities: Port du Roi George Port and Port Jackson, Australia, depth unknown.

The holotype of *T. tenuilamellosa* (Milne Edwards & Haime, 1848) was not traced. Type Locality: 'Panama'.

Distribution: Western Atlantic: eastern Caribbean from southeastern Cuba (ZLATARSKI 1982) and Jamaica throughout the Antilles and along the insular coast of South America to Panama (PORTER 1972); 0.3-37 m (Fig. 11). ROOS (1971) reported that this species was known from Barbados (*fide* LEWIS 1960); however, a reference to this species could not be found in LEWIS' publications. Eastern Atlantic: Cape Verde, Gulf of Guinea (CHEVALIER 1966b; LABOREL 1974). Elsewhere: cosmopolitan in tropical shallow water, including temperate region of Japan; 1-110 m (CAIRNS & ZIBROWIUS 1997).

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APPENDICES

Appendix 1. – List of the 56 species of tropical/warm temperate western Atlantic azooxanthellate Scleractinia that occur exclusively deeper than 183 m.

Fungiacyathus pusillus (Pourtalès, 1868)
F. symmetricus (Pourtalès, 1871)
F. crispus (Pourtalès, 1871)
F. marenzelleri (Vaughan, 1906)
Leptopenus discus Moseley, 1881
Madrepora oculata Linnaeus, 1758
Anthemiphyllia patera patera Pourtalès, 1878
Caryophyllia polygona Pourtalès, 1878
C. paucipalata Moseley, 1881
C. ambrosia caribbeana Cairns, 1979
C. corrugata Cairns, 1979
C. sarsiae Zibrowius, 1974
Premocyathus dentiformis (Alcock, 1902)
Concentrotheca laevigata (Pourtalès, 1871)
Crispatotrochus sp. cf. *C. cornu* Moseley, 1881
C. squiresi Cairns, 1979
Labyrinthocyathus langae Cairns, 1979
L. facetus Cairns, 1979
Trochocyathus fossulus Cairns, 1979
T. faciatus Cairns, 1979
Tethocyathus cylindraceus (Pourtalès, 1868)
T. recurvatus (Pourtalès, 1878)
T. variabilis Cairns, 1979
Deltocyathus agassizii Pourtalès, 1867
D. sp. cf. *D. italicus* (Michelotti, 1838)
D. eccentricus Cairns, 1979
D. moseleyi Cairns, 1979
D. pourtalesi Cairns, 1979
Stephanocyathus (S.) diadema (Moseley, 1876)
S. (S.) paliferus Cairns, 1977
S. (S.) laevifundus Cairns, 1977
S. (Odontocyathus) coronatus (Pourtalès, 1867)
Desmophyllum dianthus (Esper, 1794)
D. striatum Cairns, 1979
Thalamophyllia gombergi Cairns, 1979
Solenosmilia variabilis Duncan, 1873
Trematotrochus corbicula (Pourtalès, 1878)
Peponocyathus folliculus (Pourtalès, 1868)
Cryptotrochus carolinensis Cairns, 1988
Flabellum moseleyi Pourtalès, 1880
F. atlanticum Cairns, 1979
Placotrochides frustum Cairns, 1979
Javania pseudoalabastra Zibrowius, 1974
Polymyces wellsi Cairns, 1991
Pourtalocyathus hispidus (Pourtalès, 1878)
Balanophyllia wellsi Cairns, 1977
B. hadros Cairns, 1979
B. bayeri Cairns, 1979
Dendrophyllia alternata Pourtalès, 1880
Enallopsammia profunda (Pourtalès, 1867)
E. rostrata (Pourtalès, 1878)
Thecopsammia socialis Pourtalès, 1868
Bathypsammia tintinnabulum (Pourtalès, 1868)
B. fallosocialis Squires, 1959
Trochopsammia infundibulum Pourtalès, 1878
"Cylicia" inflata Pourtalès, 1878

Appendix 2. – List of the 65 species of zooxanthellate Scleractinia known from the western Atlantic. An asterisk denotes that the species may be azooxanthellate as well. This list is based on an analysis of the primary literature, with acknowledgements to: Laborel (1971);Wells (1973); Wells & Lang (1973); Zlatarski (1982); Cairns (1982); Cairns et al. (1991); Fenner (1993b); Budd, Stemann & Johnson (1994); Werner (1997); and Cairns, Hoeksema & Van der Land (1999).

Stephanocoenia intersepta (Lamarck, 1816)
Madracis decactis (Lyman, 1859)
M. mirabilis
    forma *mirabilis* Duchassaing & Michelotti, 1860
    forma *martiniquensis* Fenner, 1993
**M. pharensis*
    forma *luciphila* Wells, 1973
M. formosa Wells, 1973
M. senaria Wells, 1974
Acropora palmata (Lamarck, 1816)
A. cervicornis (Lamarck, 1816)
A. prolifera (Lamarck, 1816)
Agaricia agaricites
    forma *agaricites* (Linnaeus, 1758)
    forma *danai* Milne Edwards & Haime, 1860
    forma *carinata* Wells, 1973
    forma *purpurea* (Leseuer, 1821)
    forma *massiva* Zlatarski, 1982
    forma *bifaciata* Zlatarski, 1982
    forma *unifaciata* Zlatarski, 1982
A. humilis Verrill, 1902
A. fragilis
    forma *fragilis* Dana, 1846
    forma *contracta* Wells, 1973
A. tenuifolia Dana, 1846
A. undata (Ellis & Solander, 1786)
A. lamarcki Milne Edwards & Haime, 1851
A. grahmae Wells, 1973
Helioseris cucullata (Ellis & Solander, 1786)
Leptoseris cailetti (Duchassaing & Michelotti, 1864)
Siderastrea siderea (Ellis & Solander, 1786)
S. radians (Pallas, 1766)
S. stellata Verrill, 1868
Porites porites
    forma *porites* (Pallas, 1766)
    forma *divaricata* Lesueur, 1821
    forma *furcata* Lamarck, 1816
P. astreoides Lesueur, 1816
P. colonensis Zlatarski, 1990
Favia fragum (Esper, 1795)
F. gravida Verrill, 1868
F. leptophylla Verrill, 1868
Diploria clivosa (Ellis & Solander, 1786)
D. strigosa (Dana, 1846)
D. labyrinthiformis (Linnaeus, 1758)
Manicina areolata
    forma *areolata* (Linnaeus, 1758)
    forma *mayori* Wells, 1936
Colpophyllia natans (Houttuyn, 1772)
C. breviserialis Milne Edwards & Haime, 1849
C. amaranthus (Houttuyn, 1772)
C. arbuscula (Lesueur, 1821)
Montastraea annularis (Ellis & Solander, 1786)
M. faveolata (Ellis & Solander, 1786)
M. franksi (Gregory, 1895)
M. cavernosa (Linnaeus, 1767)
Solenastrea hyades (Dana, 1846)
S. bournoni Milne Edwards & Haime, 1850
**Astrangia poculata* (Ellis & Solander, 1786)
**Oculina diffusa* Lamarck, 1816
**O. varicosa* Lesueur, 1821
O. valenciennesi Milne Edwards & Haime, 1850
O. robusta Pourtalès, 1871
Meandrina meandrites
    forma *meandrites* (Linnaeus, 1758)
    forma *danai* (Milne Edwards & Haime, 1848)
    forma *brasiliensis* (Milne Edwards & Haime, 1848)
    forma *memorialis* (Wells, 1974)

Dichocoenia stokesi Milne Edwards & Haime, 1848
D. stellaris Milne Edwards & Haime, 1848
Dendrogyra cylindrus Ehrenberg, 1834
Mussa angulosa (Pallas, 1766)
Scolymia lacera (Pallas, 1766)
S. cubensis Milne Edwards & Haime, 1849
S. wellsi Laborel, 1967
Mussismilia hispida
  forma *hispida* (Verrill, 1902)
  forma *tenuispina* (Verrill, 1902)
M. braziliensis (Verrill, 1868)
M. harttii (Verrill, 1868)
Isophyllia sinuousa (Ellis & Solander, 1786)
Isophyllastrea rigida (Dana, 1846)
Mycetophyllia lamarckiana Milne Edwards & Haime, 1848
M. daniana Milne Edwards & Haime, 1849
M. ferox Wells, 1973
M. aliciae Wells, 1973
M. reesi Wells, 1973
Eusmilia fastigiata
  forma *fastigiata* (Pallas, 1766)
  forma *flabellata* Wells, 1973
  forma *guacanayabensis* Zlatarski, 1982

Figure 3

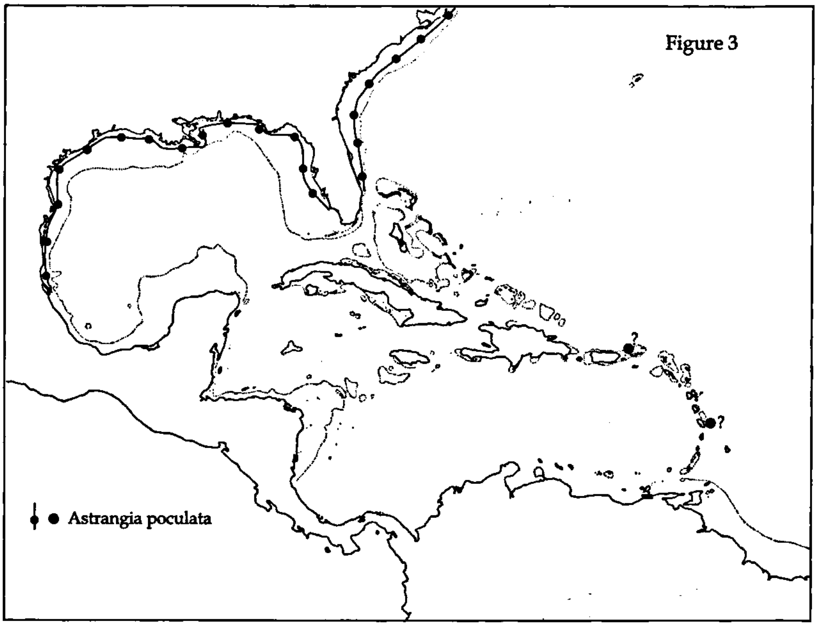
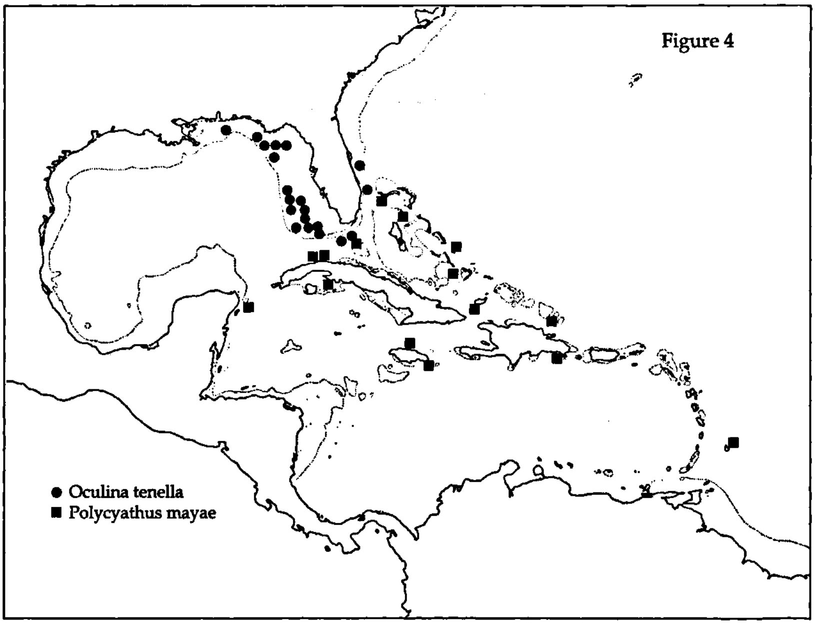


Figure 4



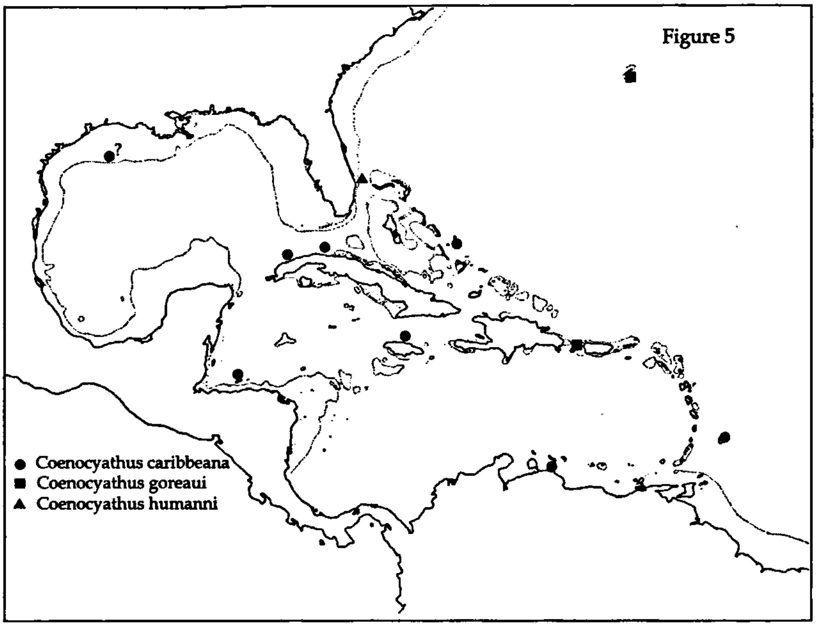


Figure 5
?
● Coenocyathus caribbeana
■ Coenocyathus goreaui
▲ Coenocyathus humanni

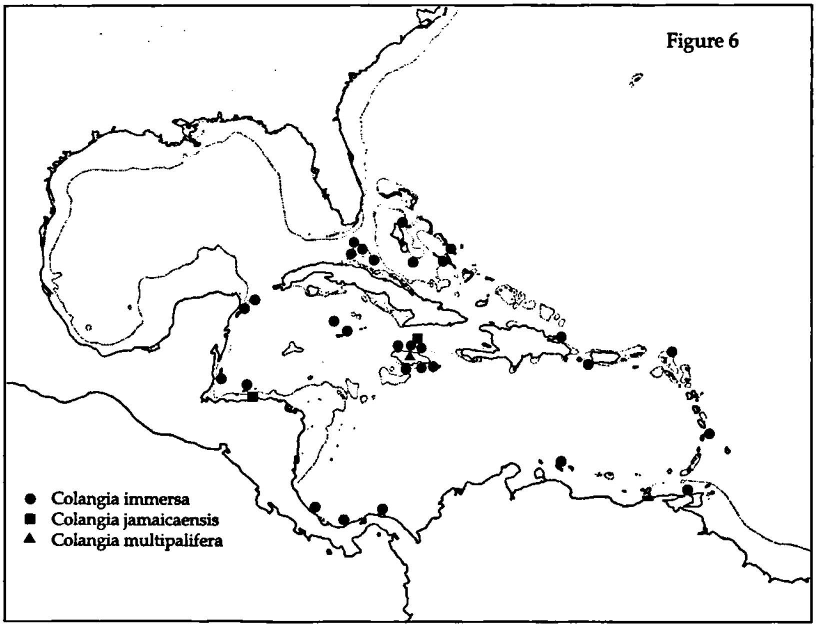


Figure 6
● Colangia immersa
■ Colangia jamaicaensis
▲ Colangia multipalifera

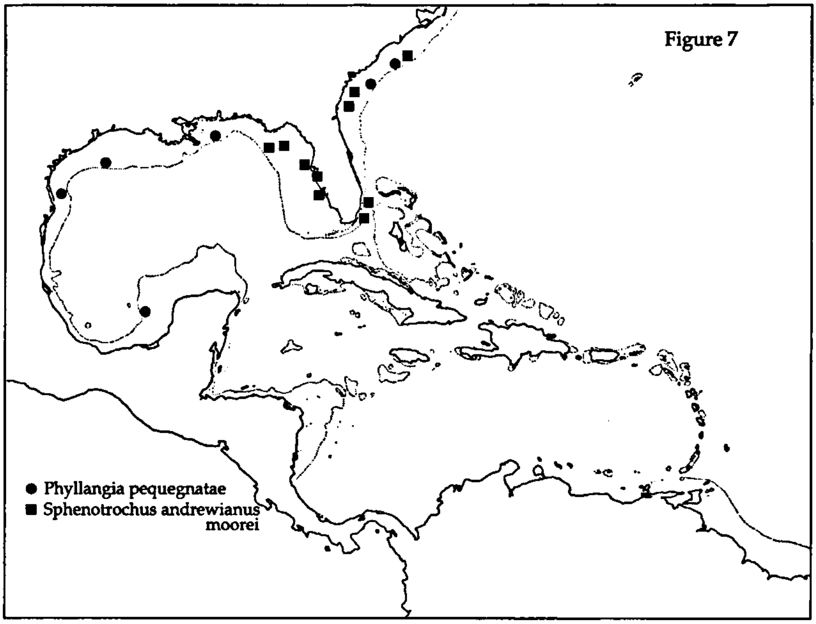


Figure 7
● Phyllangia pequegnatae
■ Sphenotrochus andrewianus moorei

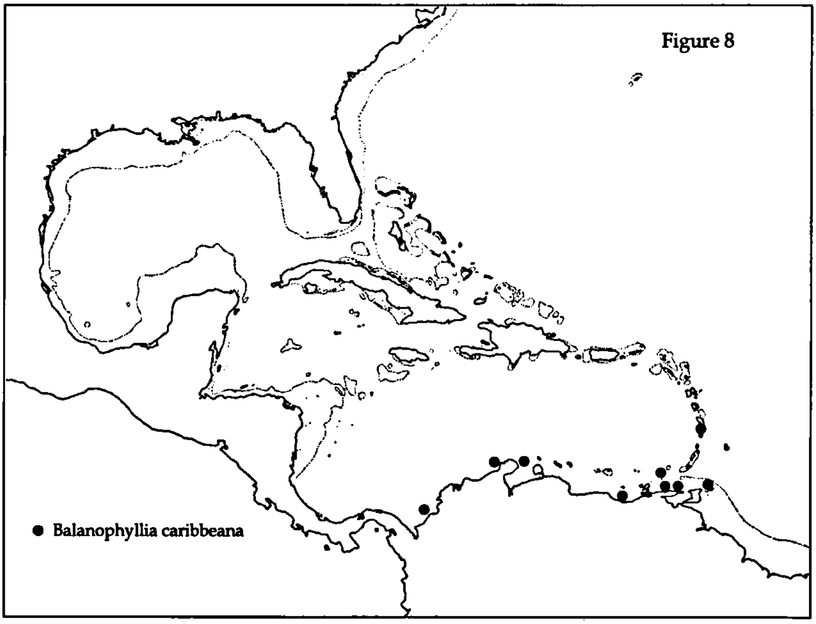


Figure 8
● Balanophyllia caribbeana

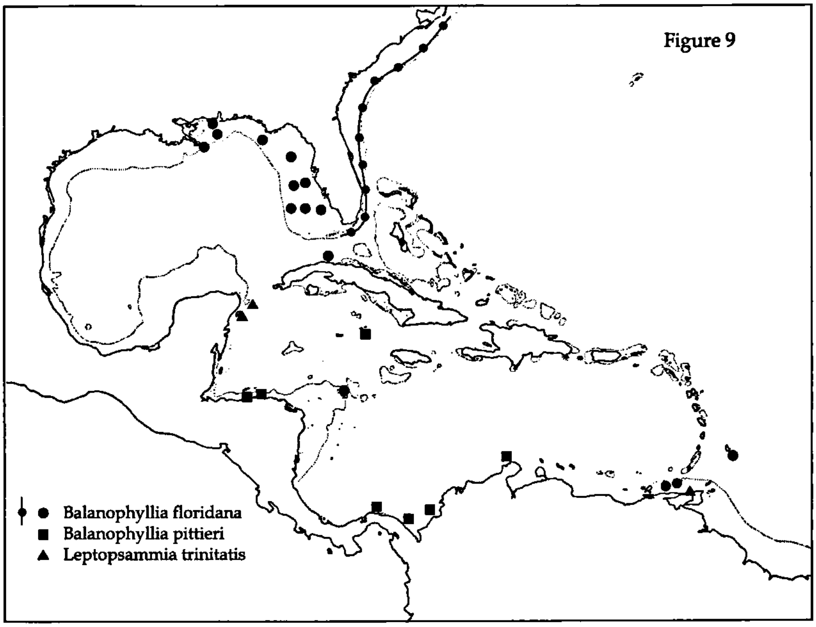


Figure 9

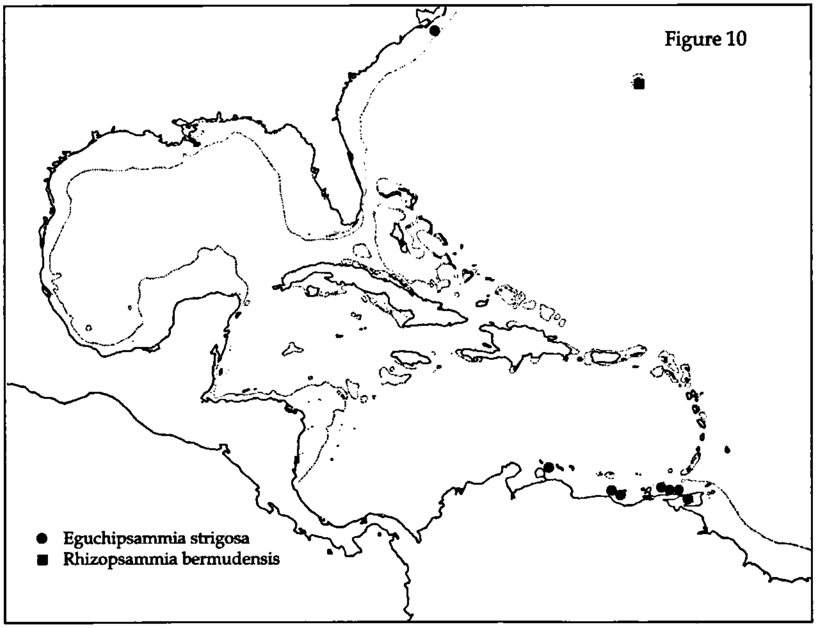
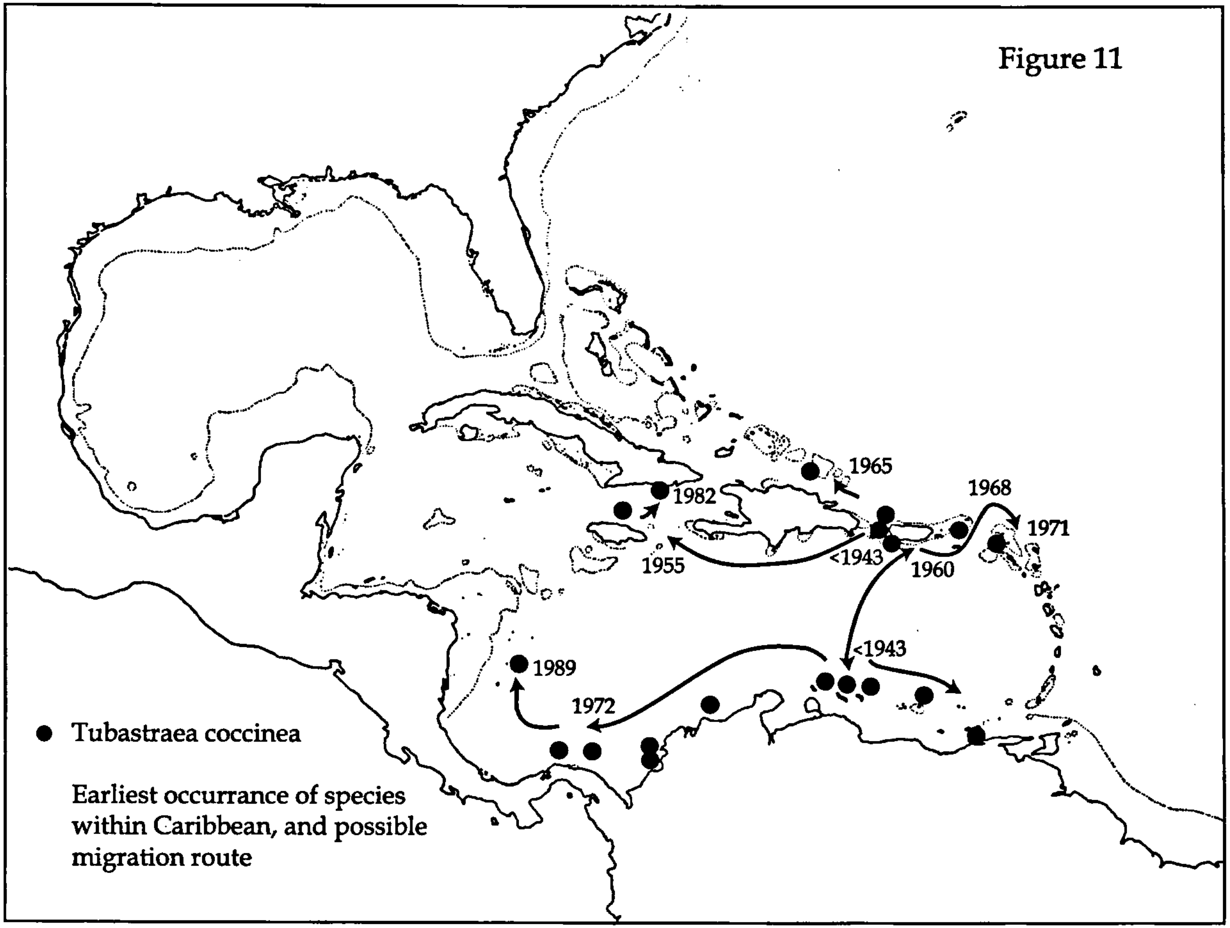


Figure 10

Figure 11


1965
1968
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● Tubastraea coccinea
Earliest occurrance of species within Caribbean, and possible migration route

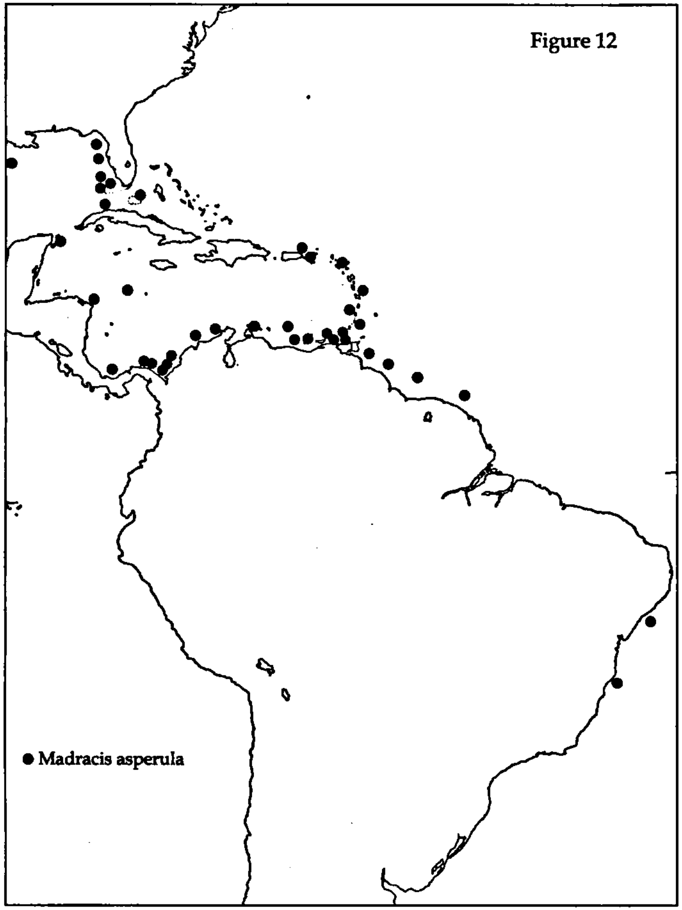


Figure 12

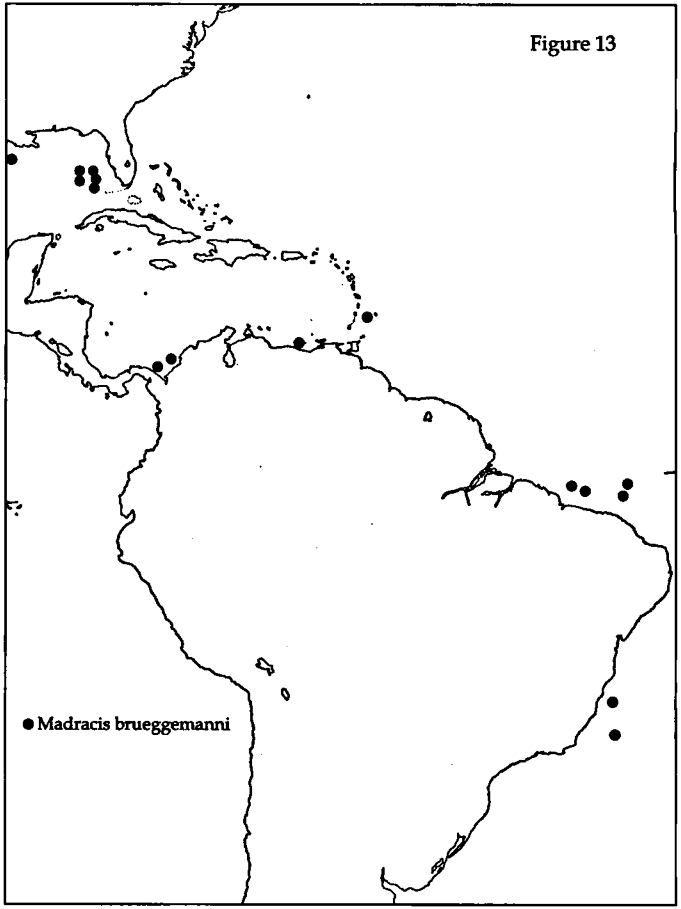


Figure 13

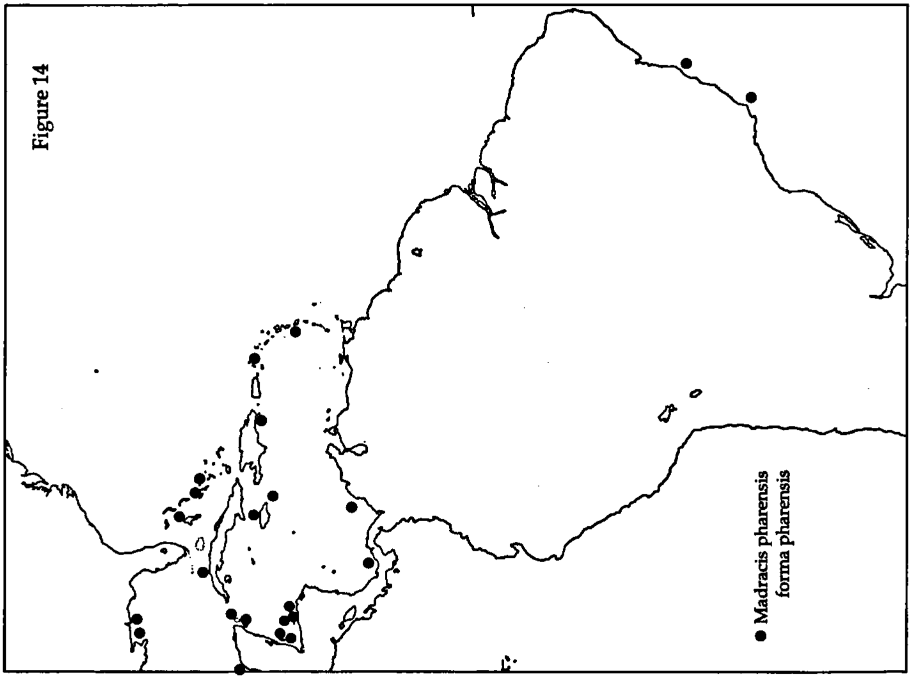


Figure 14

● Madracis pharensis forma pharensis

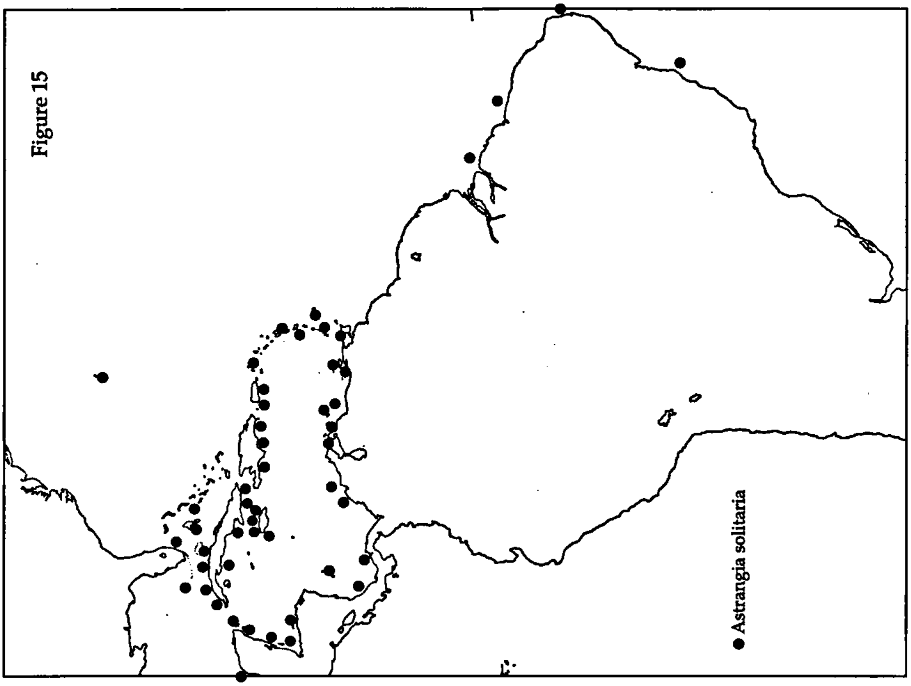


Figure 15

● Astrangia solitaria

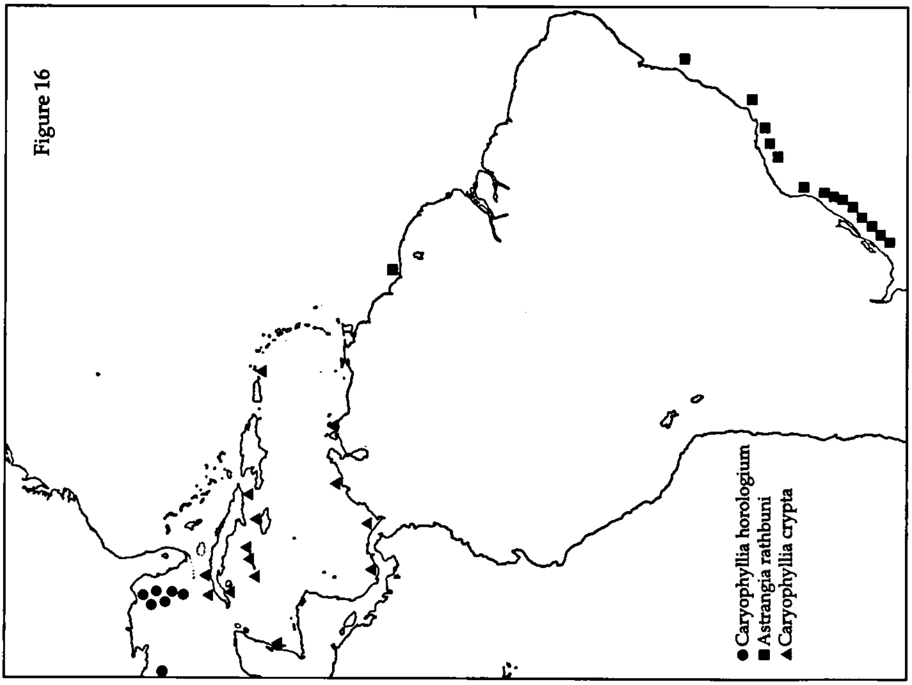
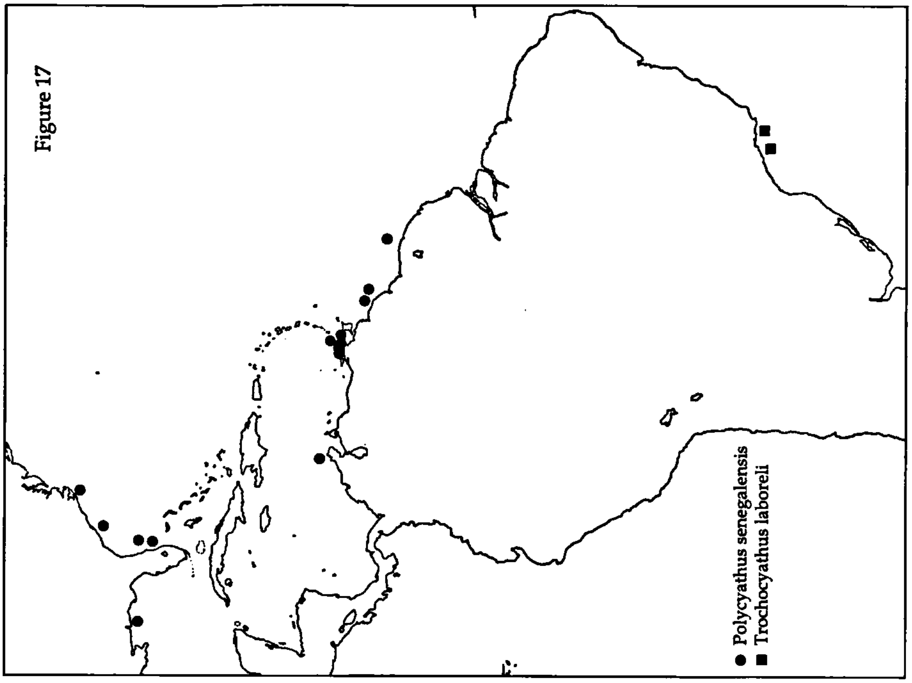


Figure 16



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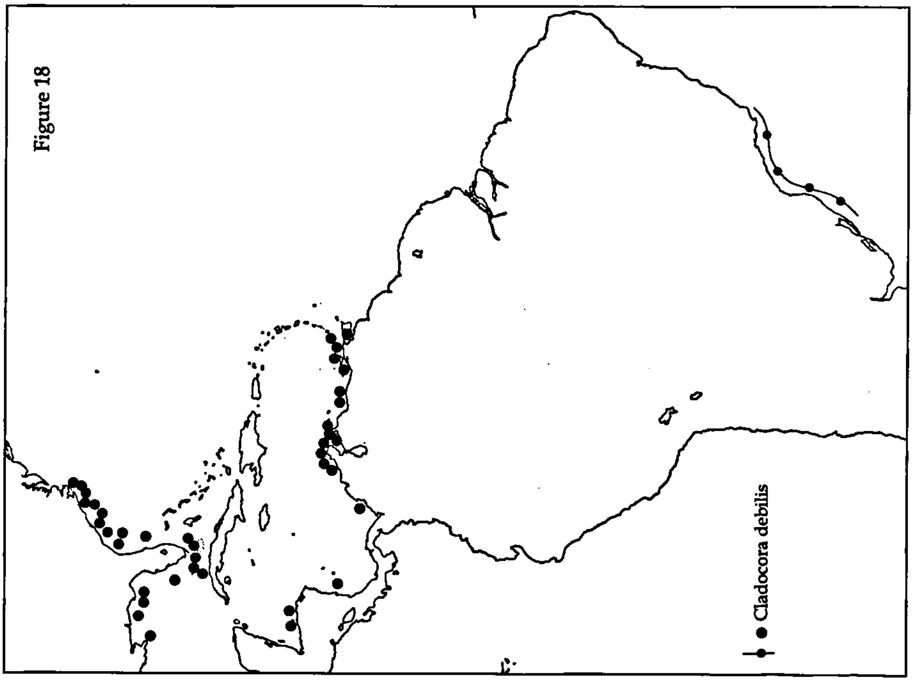


Figure 18

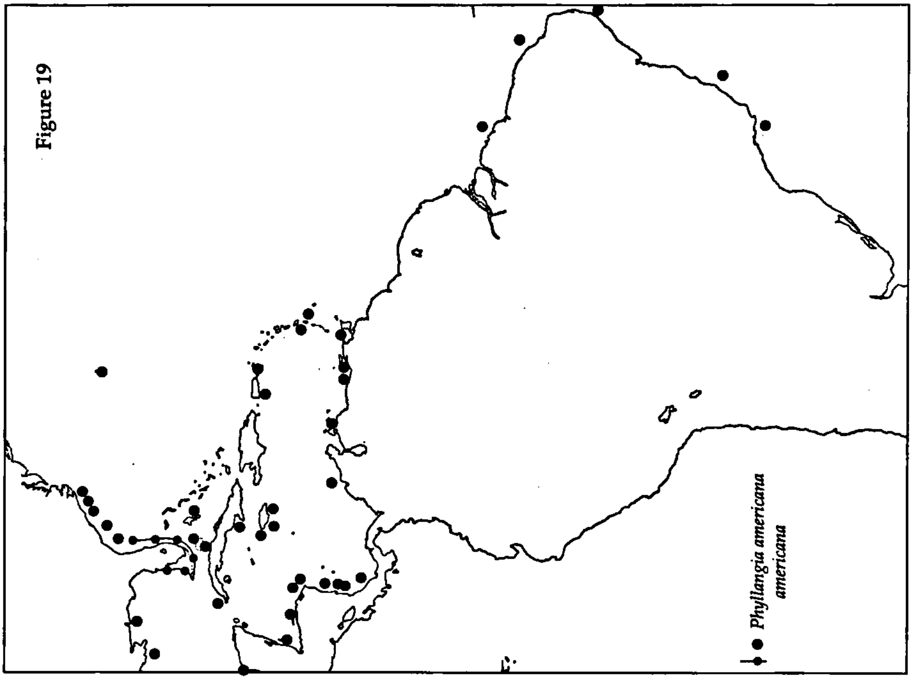


Figure 19

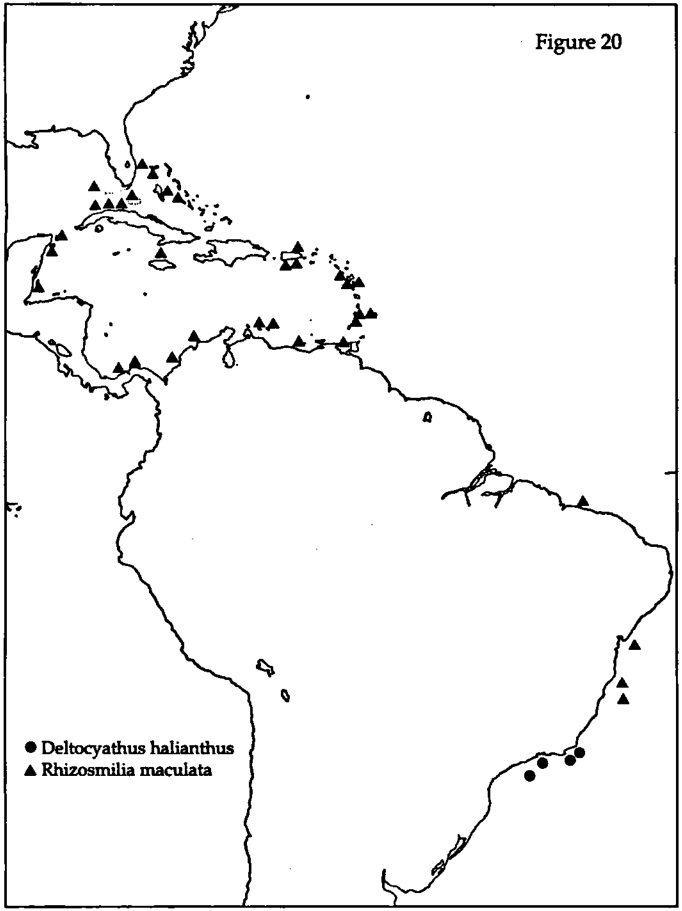


Figure 20

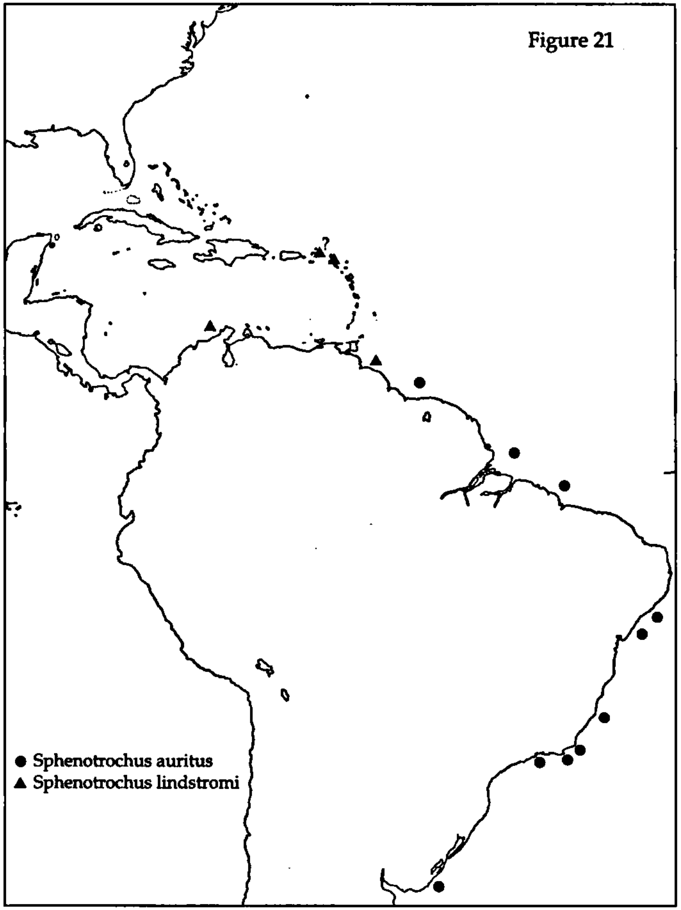


Figure 21

Figure 22

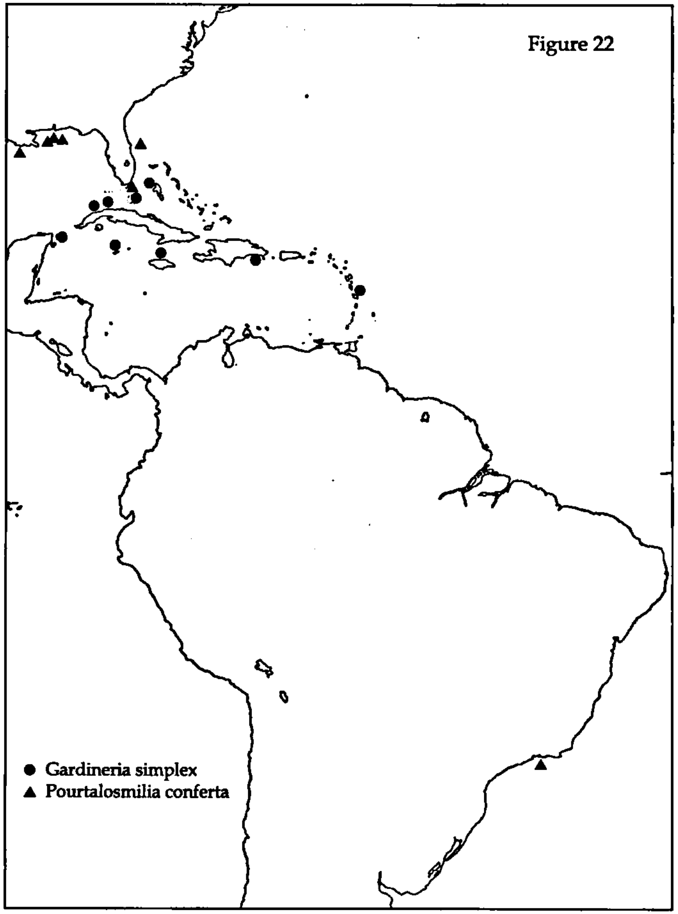
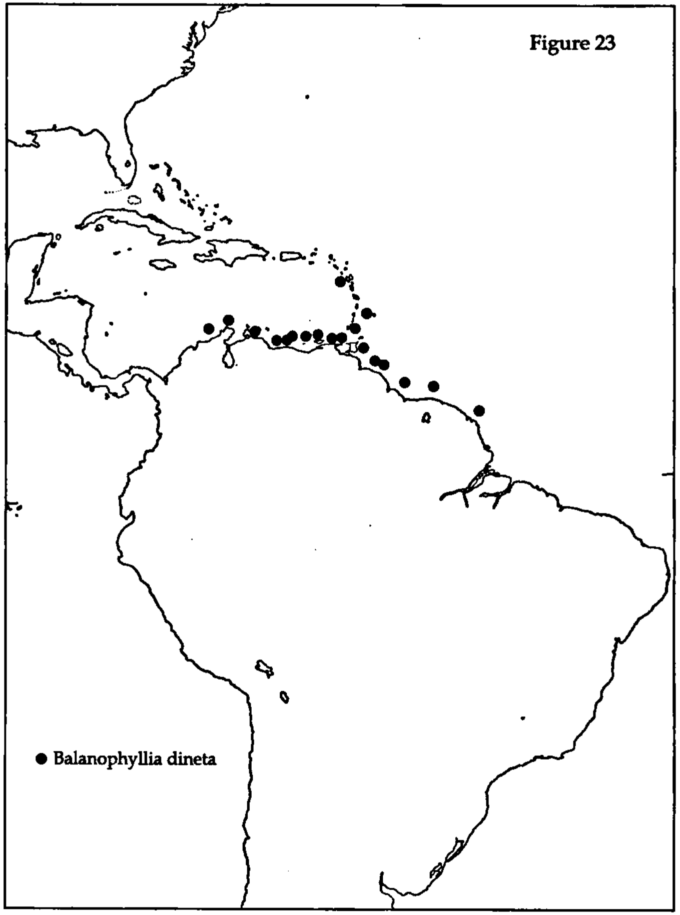
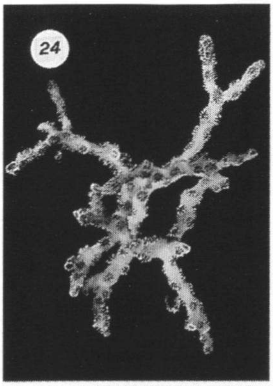
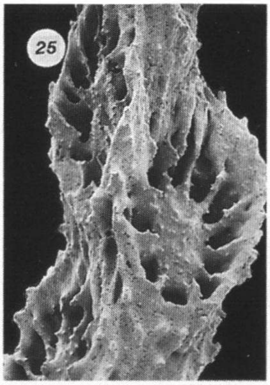
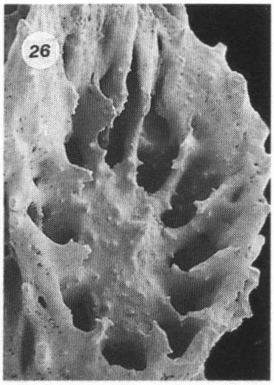


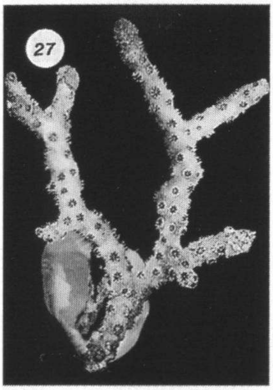
Figure 23

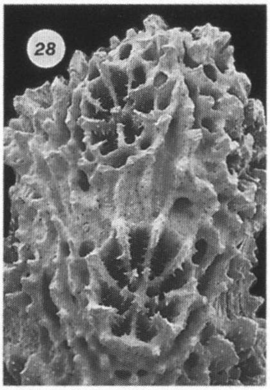


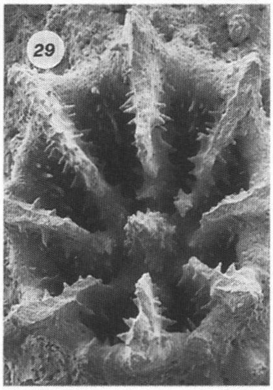


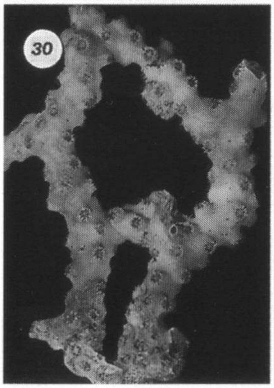


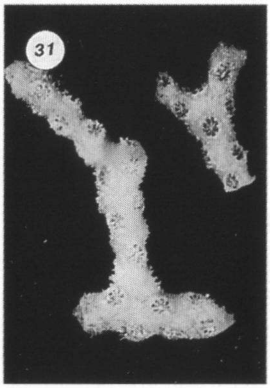




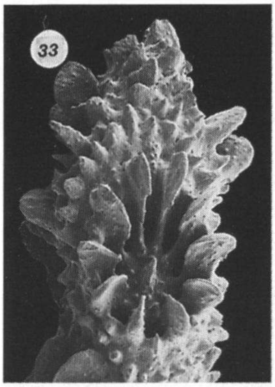


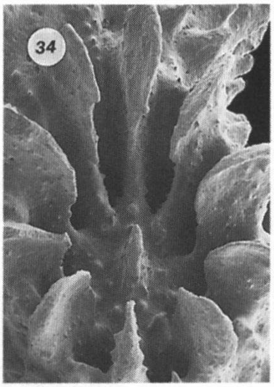


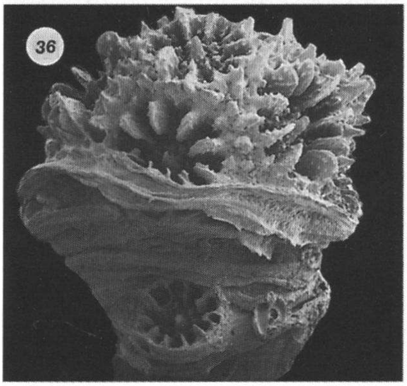


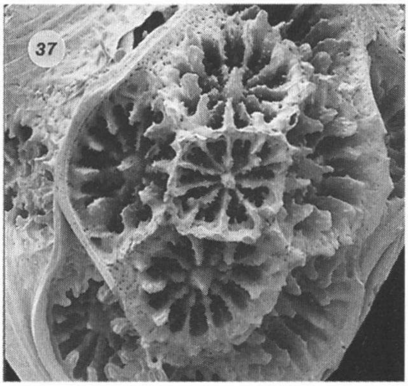


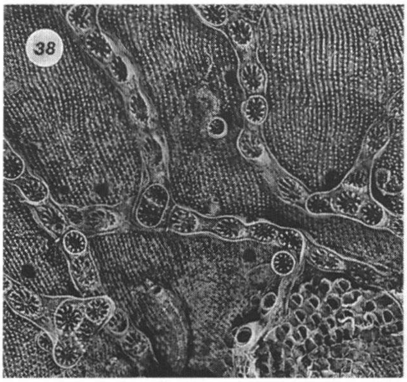
Figures 24-26. *Madracis asperula.* 24, SOFLA-9, USNM 72471, a bushy colony, x 1.0; 25-26, P-775, USNM 99068, corallites on an attenuate, distal branch, x 13, x 23, respectively. Figures 27-32. *Madracis brueggemanni.* 27-29, 32, SOFLA-23, USNM 72576: 27, branch fragment, x 1.2; 28, blunt branch tip, x 16; 29, octameral calice, x 45; 32, coenosteal spines, x 195; 30, syntype of *Madracis scotiae,* BM 1939.7.20.14, x 16; 31, fragments of lectotype of *M. brueggemanni,* BM 79.12.27.78, x 1.6.

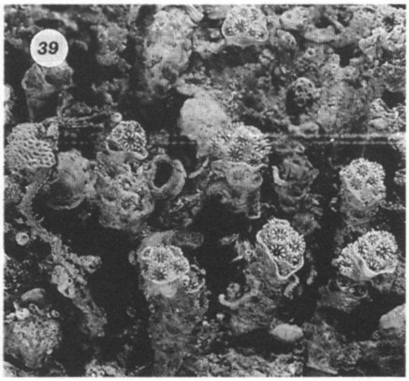




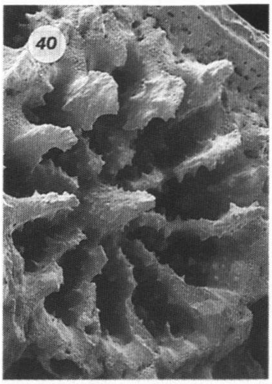


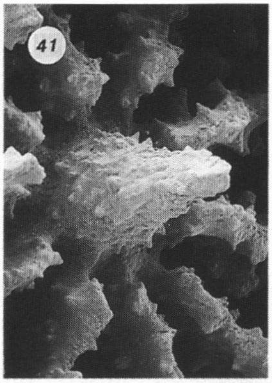


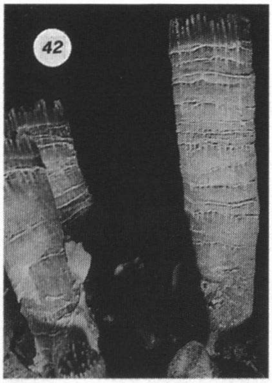


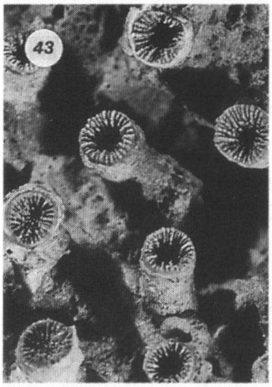


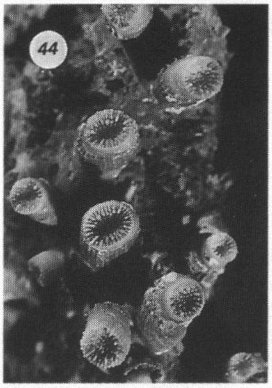
FIGURES 33-35. *Madracis myriaster.* 33-34, JSL-I-1504, USNM 75208, corallites on branch tip, x 13, x 26, respectively; 35, JSL-I-1360, USNM 79722, coenosteal tubercles, x 78.
FIGURES 36-39. *Madracis pharensis pharensis.* 36-37, 39, P-629, USNM 99092: 36-37, side and apical views of a nodular colony, x 14, x 13, respectively; 39, a cluster of nodular colonies, x 1.6; 38, Discovery Bay, USNM 85445, a reptoid colony on underside of live *Agaricia grahmae,* x 2.9.

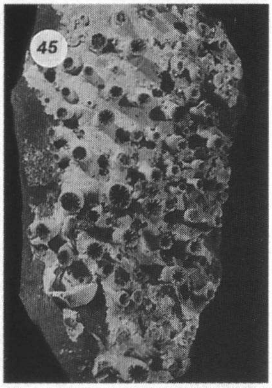


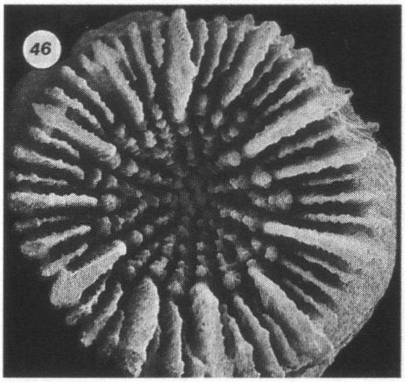


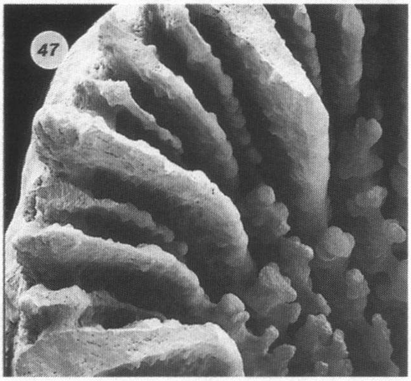






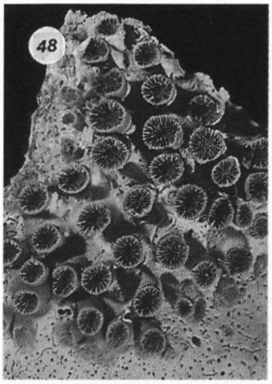


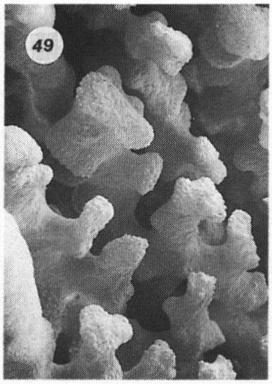


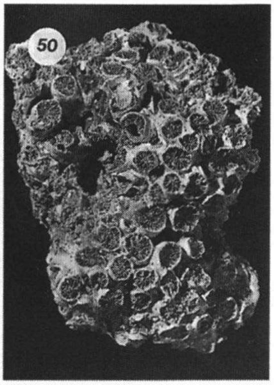


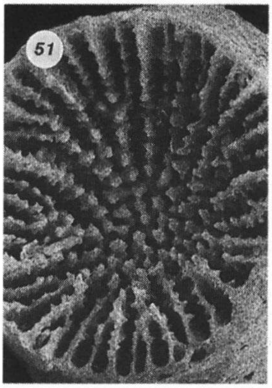
FIGURES 40-41. *Madracis pharensis pharensis*, P-629, USNM 99092, calice and styliform columella, x 33, x 78, respectively.

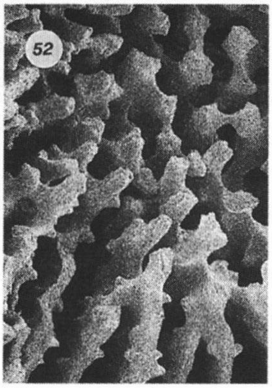
FIGURES 42-47. *Astrangia solitaria*. 42, DBL-1303, USNM 80920, extremely tall corallites, x 2.1; 43, Guadeloupe, Schramm collection (1869), MNHN, x 1.6; 44, St. Thomas (1870), MNHN, x 1.5; 45, paratype of *A. braziliensis*, USNM 10916, x 0.77; 46-47, Carrie Bow Cay, USNM 47791, calice and detail of septal teeth, x 6.6, x 20, respectively.

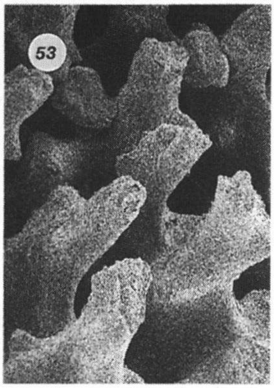


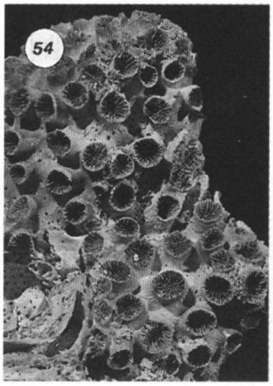


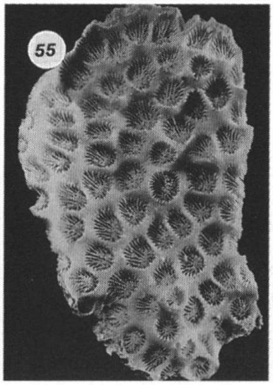


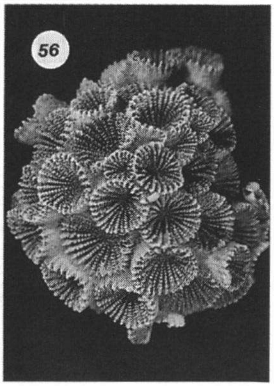








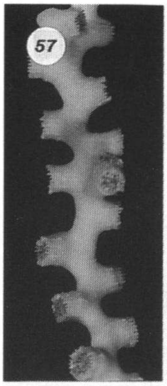


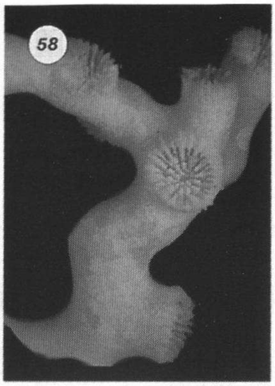


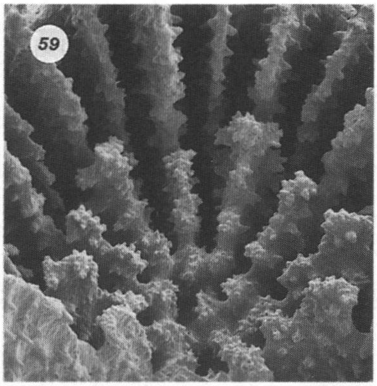
FIGURES 48-49. *Astrangia solitaria.* 48, O-4228, USNM 80217, colony encrusting a bivalve shell, x 1.1; 49, Carrie Bow Cay, USNM 47791, axial teeth on septum, x 39.

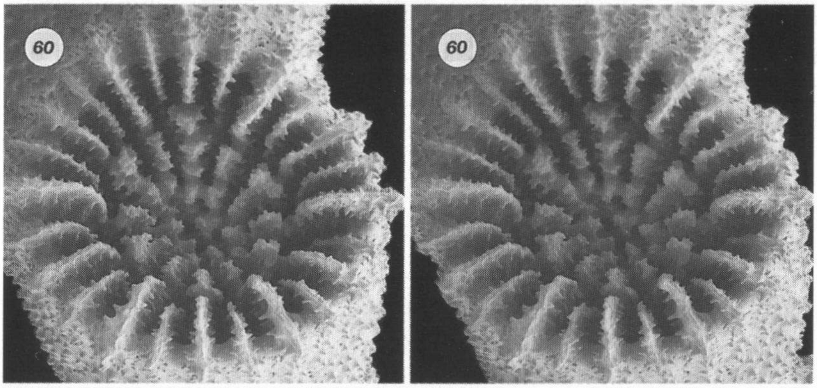
FIGURES 50-54. *Astrangia rathbuni.* 50, Tierra del Fuego, US Exploring Expedition, MCZ 2520, x 0.65 (see Squires, 1963); 51-53, corallite from a paratype of *A. rathbuni*, USNM 10975, x 8.9, x 24, x 59, respectively; 54, off Brazil, a colony attached to barnacles, USNM 80484, x 1.1.

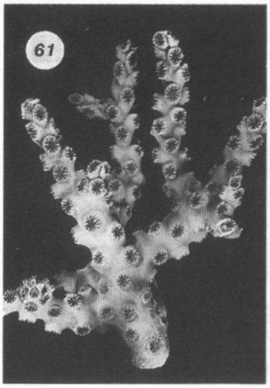
FIGURES 55-56. *Astrangia poculata.* 55, Stonington, CT, USNM 24823, a cerioid corallum, x 1.0; 56, Pelican 177-10, USNM 79714, a plocoid corallum, x 1.4.

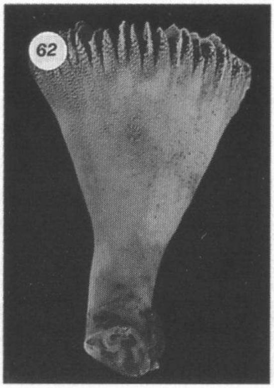


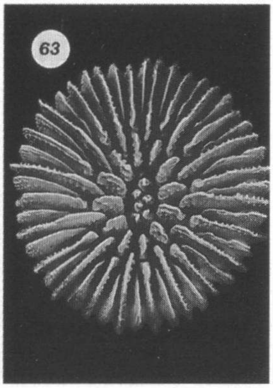








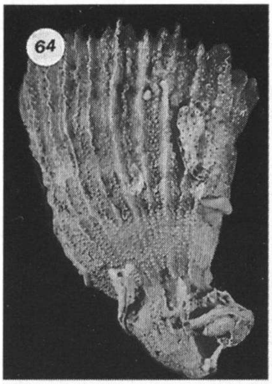


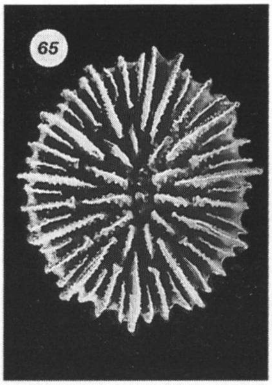


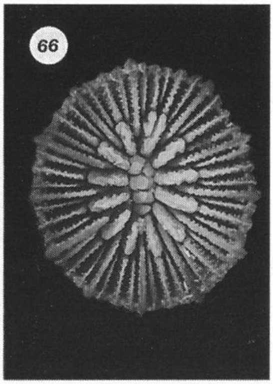
FIGURES 57-60. *Oculina tenella.* 57, SOFLA-17, USNM 72081, typical sympodial budding of corallites, x 1.6; 58, syntype, MCZ 5209, x 4.8; 59-60, SOFLA-17, USNM 72065, enlargement of palar crowns and stereo calicular view, x 36, x 20, respectively.

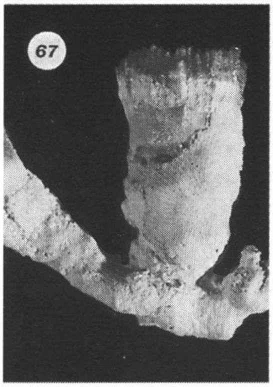
FIGURE 61. *Oculina diffusa,* Humann 2WPB-2, USNM 92075, reputed azooxanthellate colony figured by Humann (1993: 199-101).

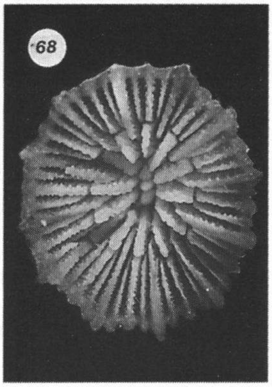
Figures 62-63. *Caryophyllia berteriana* forma *formosa,* P-944, USNM 46003, side and calicular views, x 1.7, x 2.2, respectively.

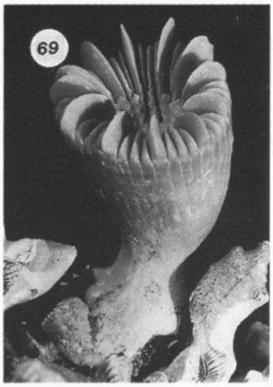


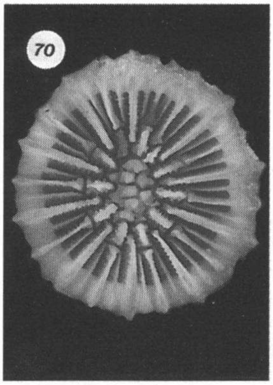


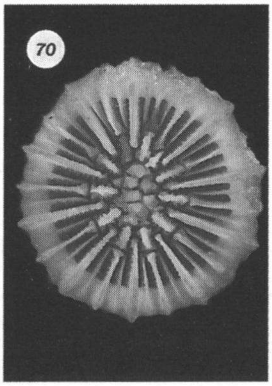


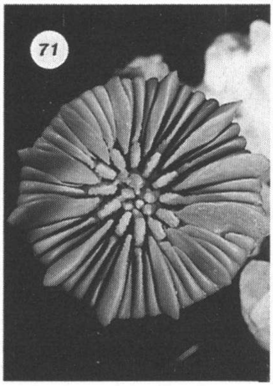










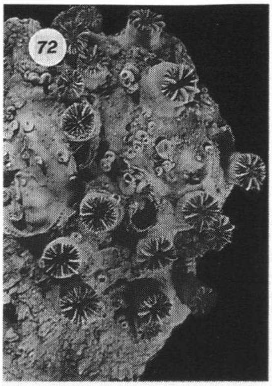


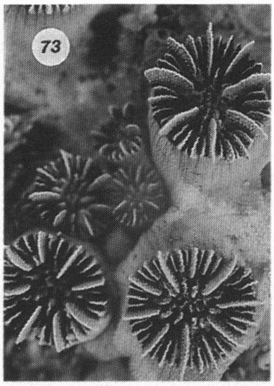
FIGURES 64-65. *Caryophyllia horologium*, SOFLA-32, USNM 80100, side and calicular views of corallum having 11 pali, x 2.2, x 2.6, respectively.

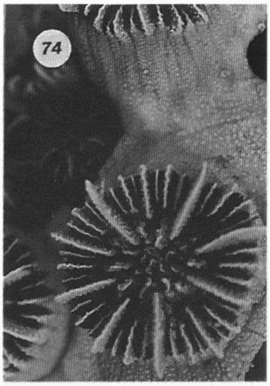
FIGURES 66-68. *Caryophyllia crypta*. 66, paratype from Cardiff Hall, USNM 46864, calice with 13 pali, x 3.9; 67-68, holotype, USNM 46861, side and calicular views, x 2.0, x 5.3, respectively.

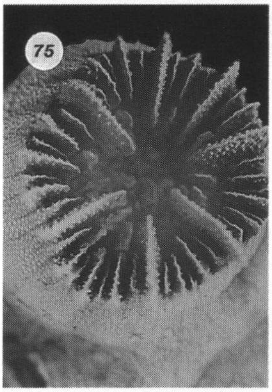
FIGURES 69, 71. *Caryophyllia sarsiae*, Bermuda, 1200 m, USNM 76307, side and calicular views, x 1.3, x 1.9, respectively.

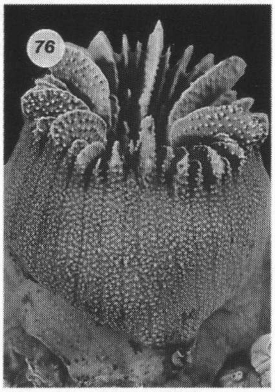
FIGURE 70. *Caryophyllia antillarum*, lectotype, MCZ 2786, stereo calicular view, x 4.1.

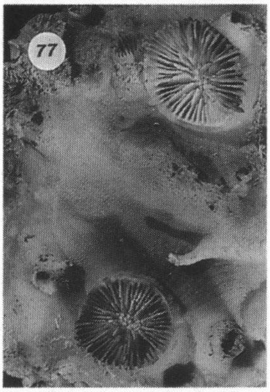


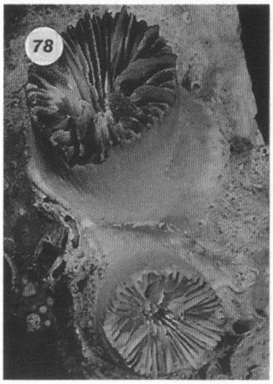


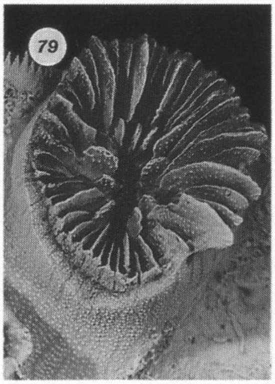


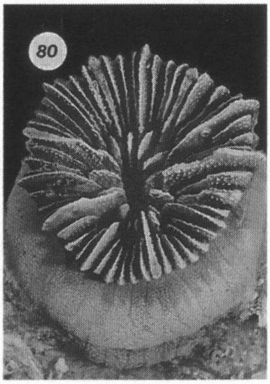






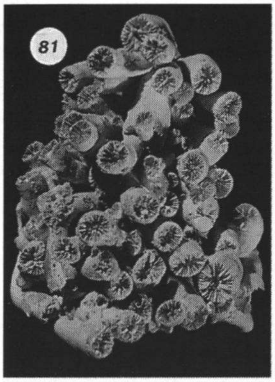


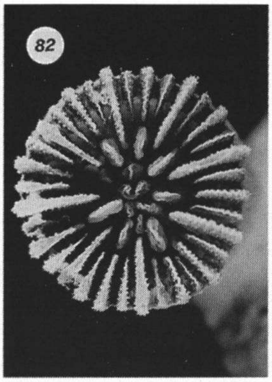


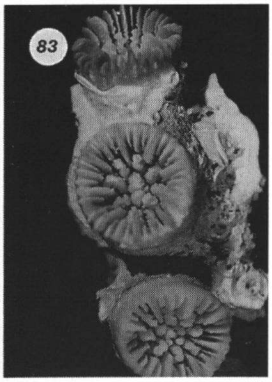


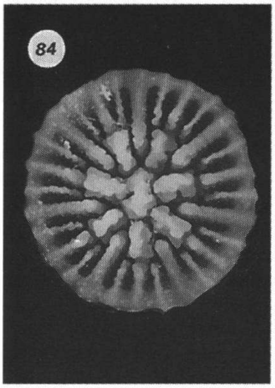
FIGURES 72-76. *Coenocyathus humanni*, holotypic colony, USNM 92080. 72, entire colony encrusting a *Spondylus* shell, x 1.0; 73-75, calicular views of several corallites, x 3.1, x 4.6, x 6.0, respectively; 76, side view of corallite figured in 75, x 6.0.

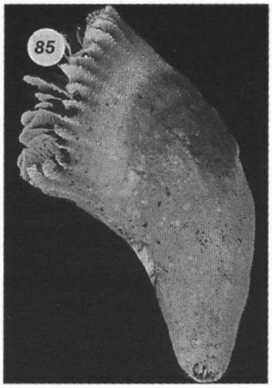
FIGURES 77-80. *Coenocyathus caribbeana*. 77, 79, holotypic colony, USNM 99189, colony and larger corallite, x 1.3, x 2.6, respectively; 78, 80, paratype colonies, USNM 99190: 78, colony of 2 corallites, x 1.4; 80, corallite showing swollen lower theca, x 2.8.

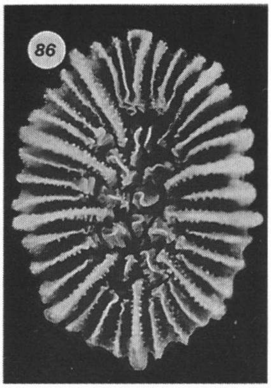


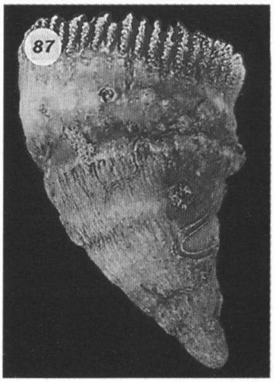


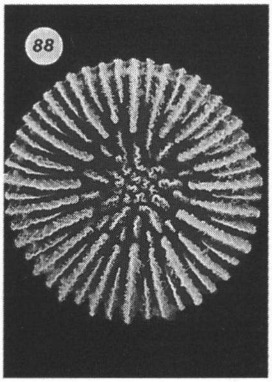


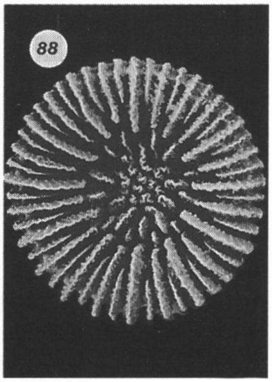








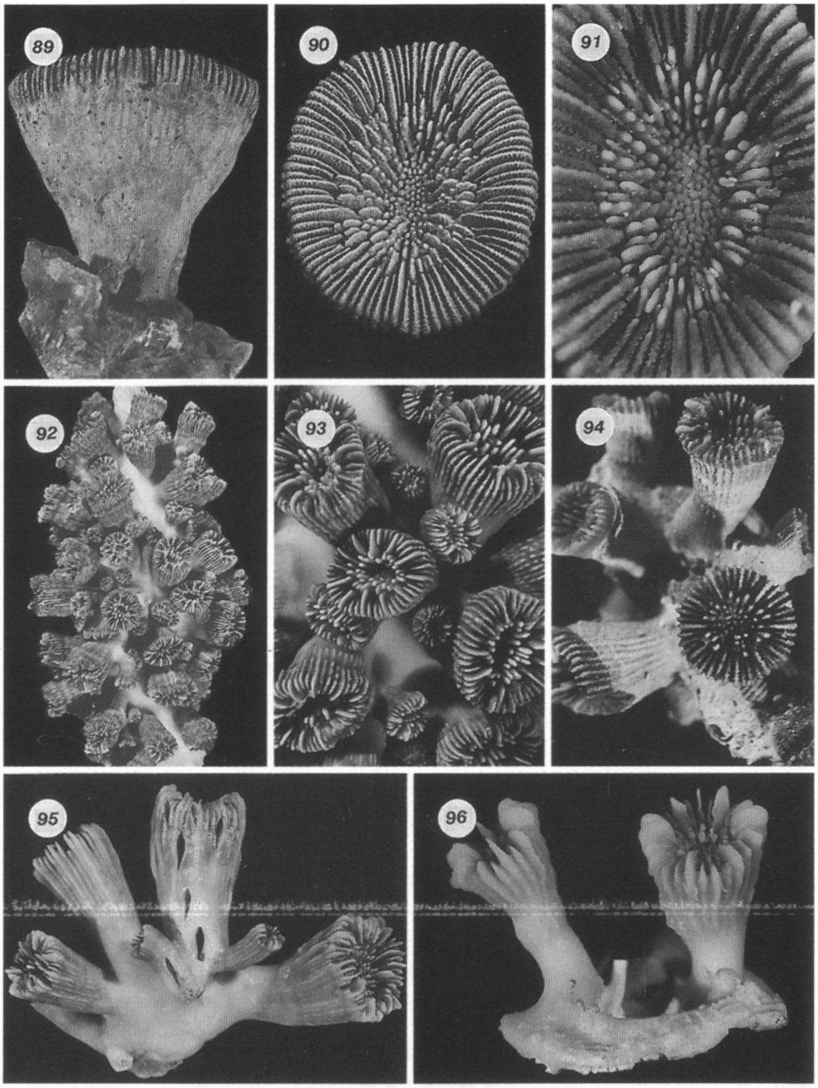




FIGURES 81-84. *Coenocyathus goreaui.* 81, paratype, YPM 8499, x 0.9; 82, Canton Point, Bermuda, USNM 80470, calice, x 5.5; 83-84, Dececheo, P.R., USNM 80367, colony and corallites with only 7 pali, x 3.9, x 9.1, respectively.

FIGURES 85-86. *Premocyathus dentiformis,* P-876, USNM 62523, side and calicular views, x 2.9, x 2.8, respectively.

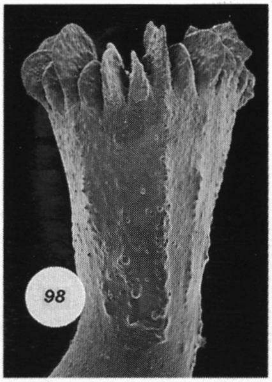
FIGURES 87-88. *Trochocyathus laboreli,* holotype, USNM 99193, side and stereo calicular views, x 2.6, x 2.8, respectively.

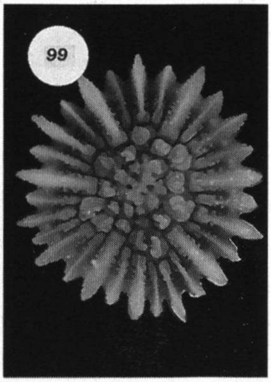


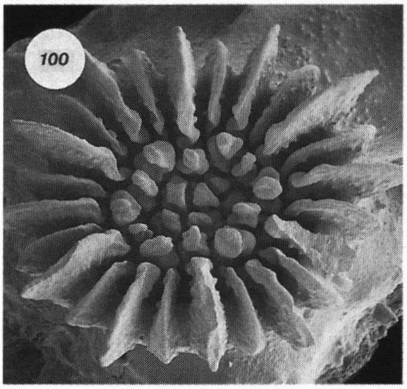
FIGURES 89-91. *Paracyathus pulchellus.* 89-90, O-1493, USNM 61915, side and calicular views of largest corallum, x 2.1, x 2.5, respectively; 91, Key West, USNM 61918, fossa of specimen having multiple paliform lobes on all septa, x 4.0

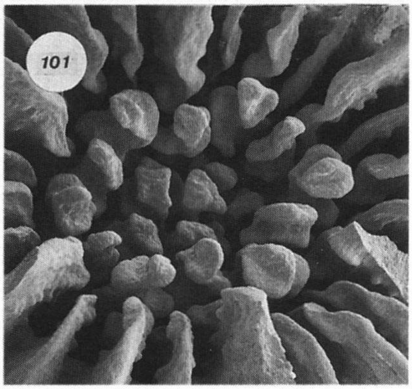
FIGURES 92-95. *Polycyathus senegalensis.* 92-93, P-691, USNM 80241, corallum and corallites of a robust colony, x 0.65, x 2.0, respectively; 94, holotype, MNHN, x 2.5; 95, Chain 35-39, USNM 80417, colony infested with acrothoracican cirripedes, x 2.0.

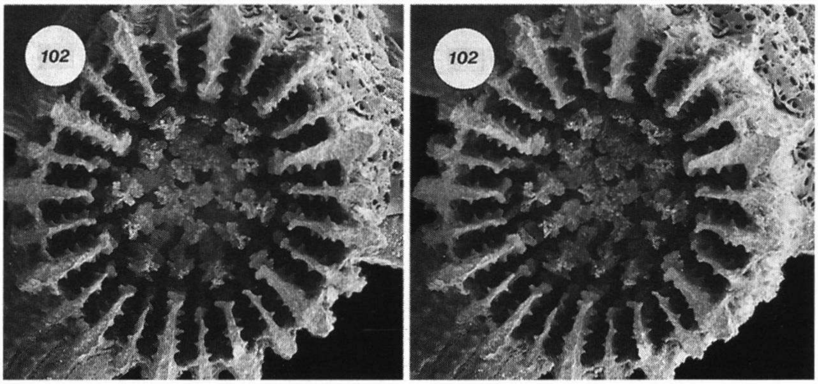
FIGURE 96. *Polycyathus mayae,* holotype, USNM 99214, x 3.6.



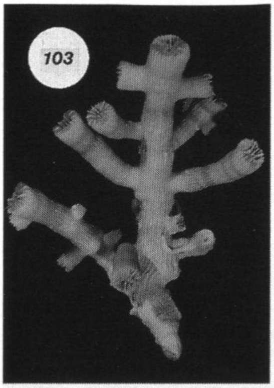


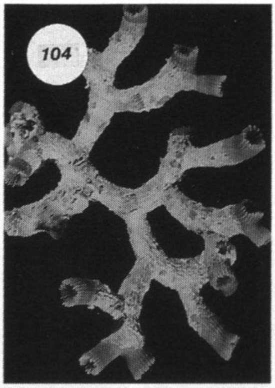


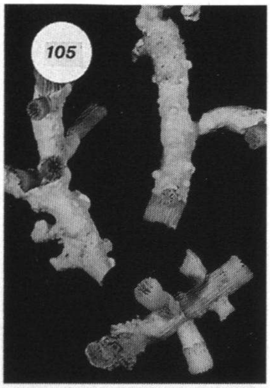


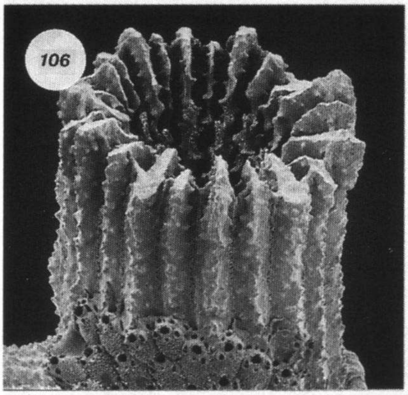


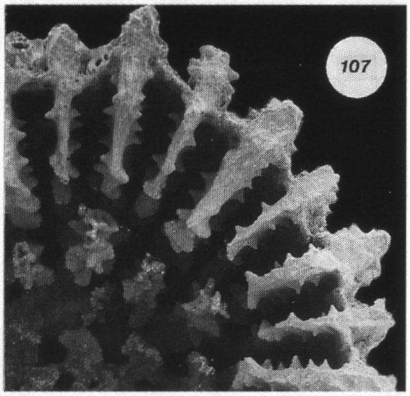
FIGURES 97-101. *Polycyathus mayae.* 97, paratype, Discovery Bay, USNM 99237, colony on underside of a dead coral, x 0.9; 98, 100-101, paratype, P-1411, USNM 99210: 98, side view of a corallite, x 11; 100-101, calicular views of the same corallite showing palar crown and columella, x 16, x 29, respectively; 99, calice of holotypic corallite, x 7.9
FIGURE 102. *Cladocora debilis.* Alb-2405, USNM 10452, stereo calicular view, x 16.

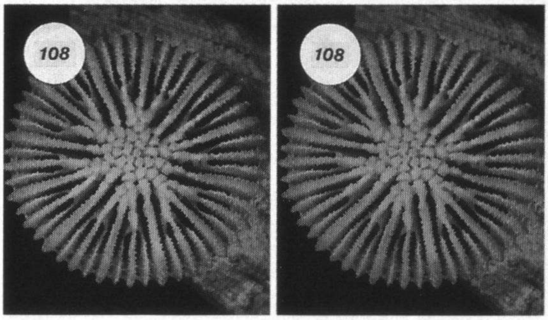


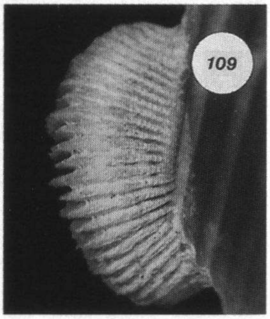






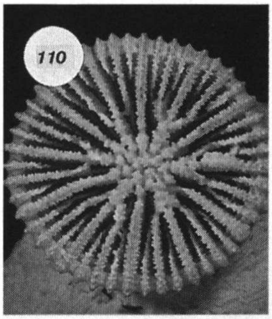


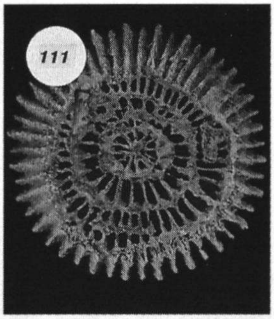


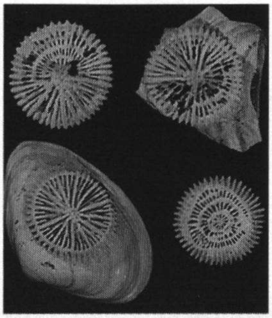


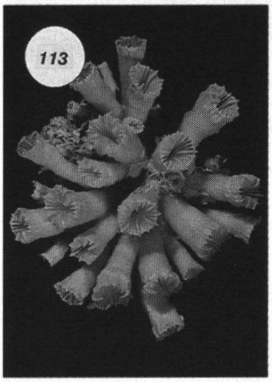
FIGURES 103-107. *Cladocora debilis.* 103, G-602, USNM 62360, typical branching pattern, x 1.2; 104, P-778, UMML 8.590, sympodial growth form, x 1.25; 105, 3 syntype branches, BM 1974.6.15.2, x 1.3; 106-107, Alb-2405, USNM 10452, bryozoan-encrusted corallite and enlargement of part of a calice, x 13, x 26, respectively.

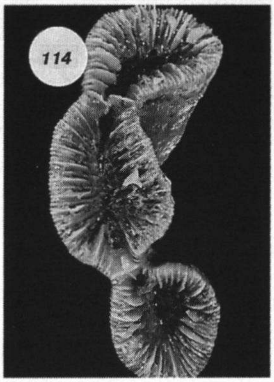
FIGURES 108-109. *Deltocyathus halianthus,* largest syntype, SMNH 134, stereo calicular and edge views, both x 3.4.

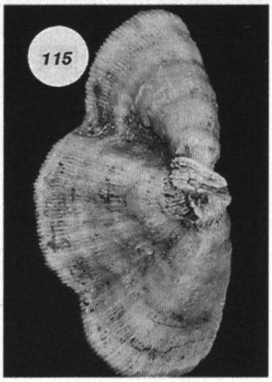


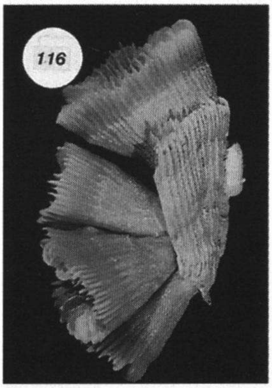


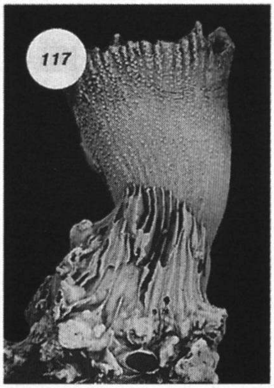


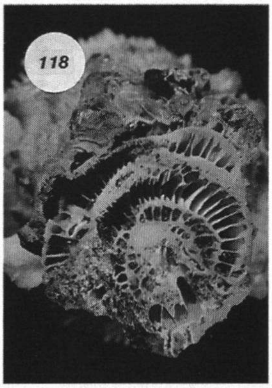










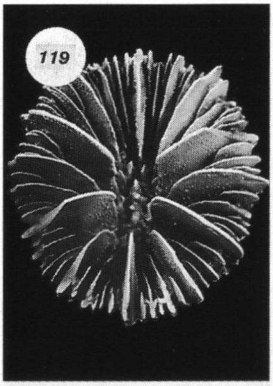


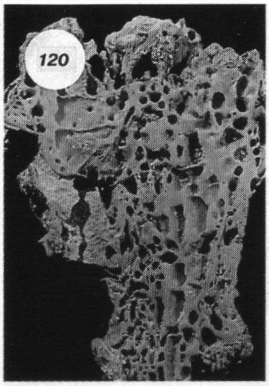
FIGURES 110-112. *Deltocyathus halianthus.* 110, syntype, SMNH 134, calice, x 4.4; 111-112, WB-302, USNM 62302: 111, polycyclic base, x 4.6; 112 (unnumbered), 4 coralla showing attachment and polycyclic theca, x 1.6.

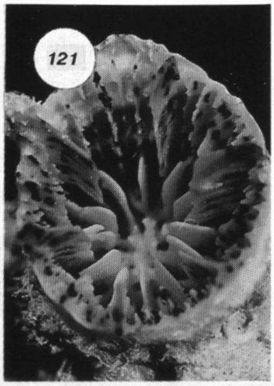
FIGURE 113. *Thalamophyllia riisei,* Chankanaab, USNM 73915, a bushy corallum, x 0.9.

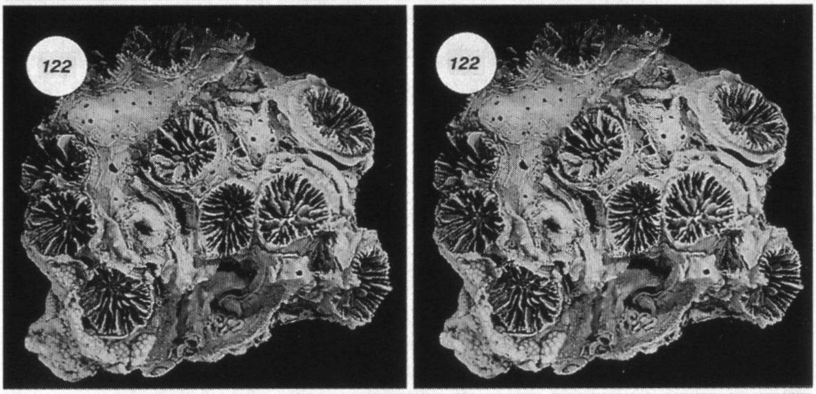
FIGURES 114-116. *Dasmosmilia lymani.* 114-115, BLM-OCS A1, USNM 62636, 3 partial fused coralla, both x 1.0; 116, FH-7516, USNM 82997, a parent fragment with 4 buds, x 1.8.

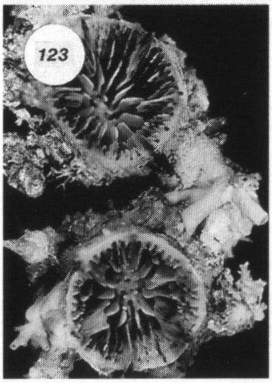
FIGURES 117-118. *Oxysmilia rotundifolia.* 117, O-4832, USNM 61876, exothecal dissepiments, x 2.4; 118, BL-155, USNM 6414, cross-section through base showing concentric rings of dissepiments, x 2.2.

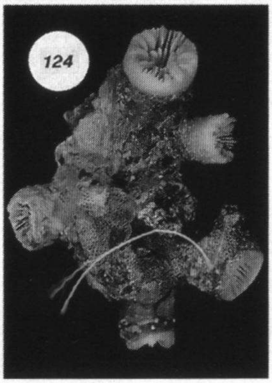


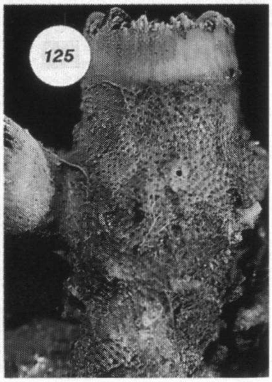








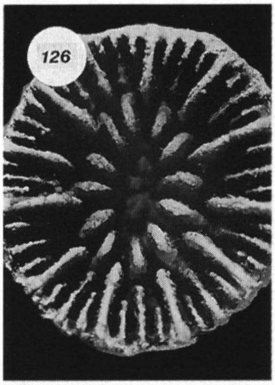


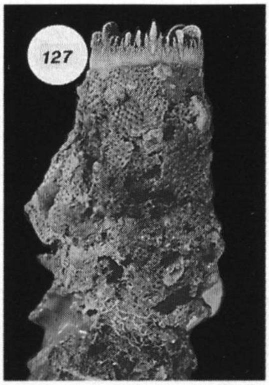


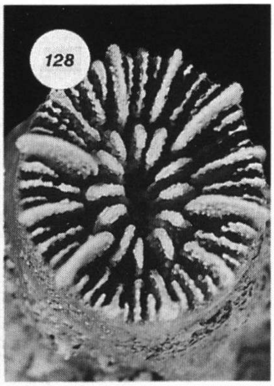
FIGURES 119-120. *Oxysmilia rotundifolia.* 119, O-5016, USNM 61881, calice having prominent P3, x 2.0; 120, G-725, USNM 46057, longitudinal section of corallum showing endothecal dissepiments, x 1.1.

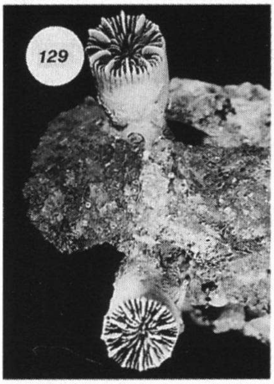
FIGURES 121-123. *Colangia immersa.* 121, 123, Roatán, USNM 92086, corallites having both P2 and P3, x 6.3, x 3.1, respectively; 122, stereo view of holotypic colony, MCZ 2787, x 1.6.

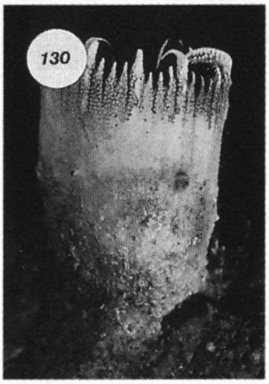
FIGURES 124-125. *Colangia jamaicaensis,* holotypic colony, USNM 80925, x 1.3, x 3.2, respectively.

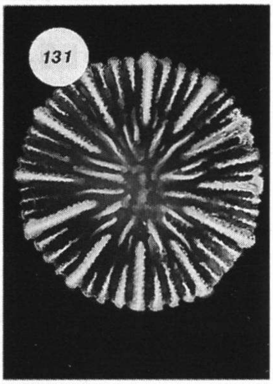


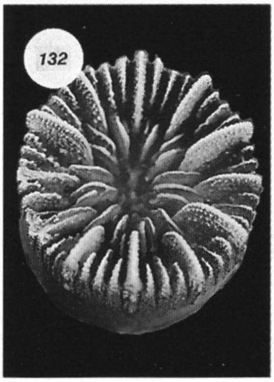


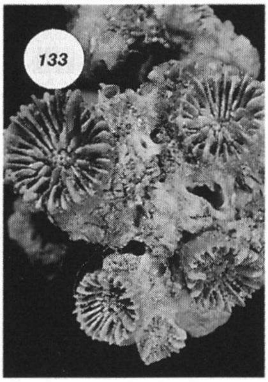


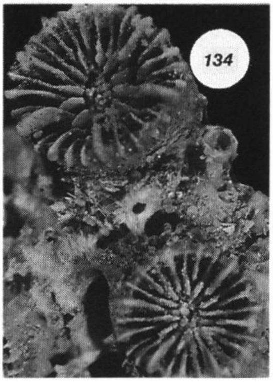








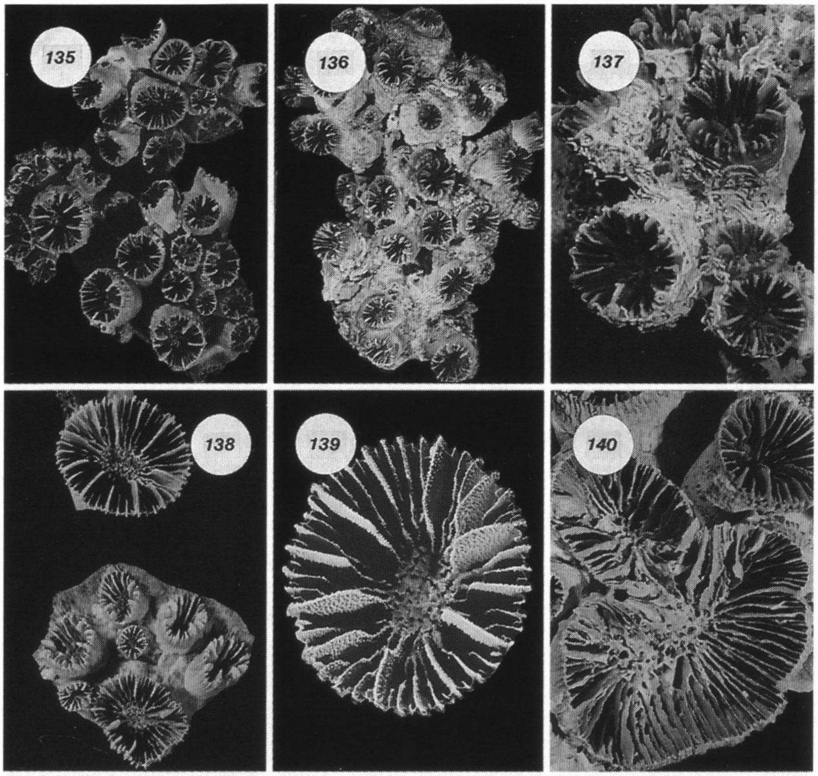


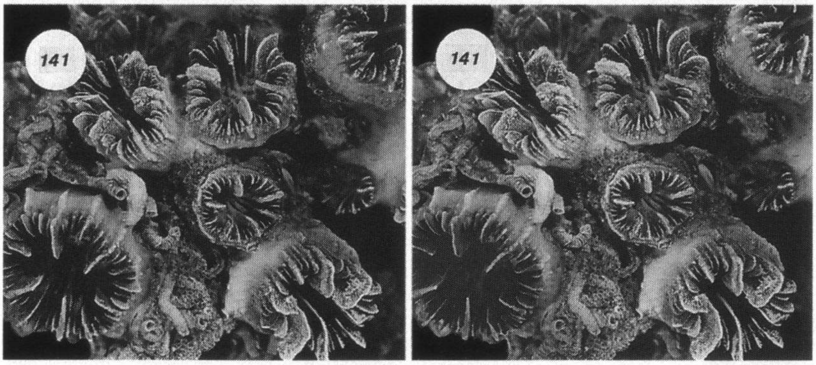


FIGURES 126-128. *Colangia jamaicaensis.* 126, calice of holotype, x 6.1; 127-128, paratype from DBL-2483, USNM 99251, side and calicular views, x 2.2, x 5.8, respectively.

FIGURES 129-132. *Colangia multipalifera,* holotypic colony, USNM 99253: 129, colony, x 1.25; 130-132, side, calicular, and oblique views, x 2.6, x 3.9, x 3.9, respectively.

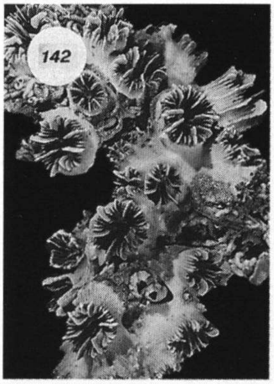
FIGURES 133-134. *Colangia moseleyi,* BM (lectotype of *Cladocora conferta* Moseley, 1881), x 2.4, x 3.5, respectively.

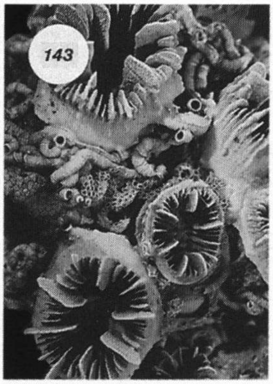


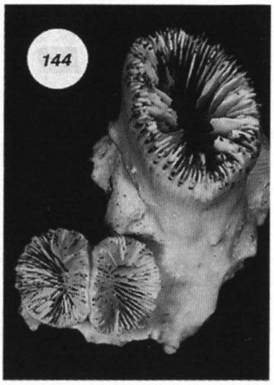


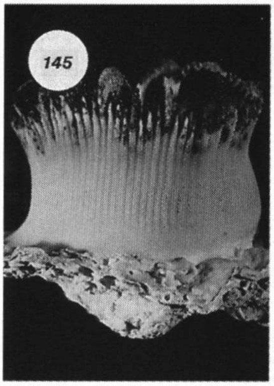
FIGURES 135-140. *Phyllangia americana americana.* 135, syntypes, MNHN, x 1.0; 136, Devonshire Bay, Bermuda, USNM 87782, colony of dwarf corallites, x 0.85; 137, O-4216, USNM 99279, serpulid-encrusted corallum, x 1.8; 138-139, Port Royal, Jamaica, USNM 80881, x 1.5, x 2.7, respectively.

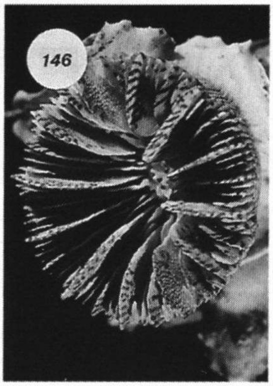
FIGURE 141. *Phyllangia pequegnatae,* holotypic colony, USNM 99286, stereo view of several corallites, x 2.0.

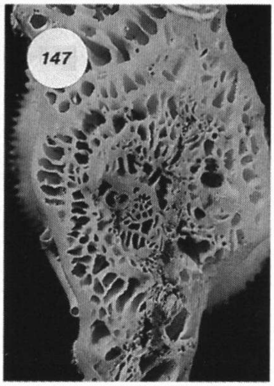


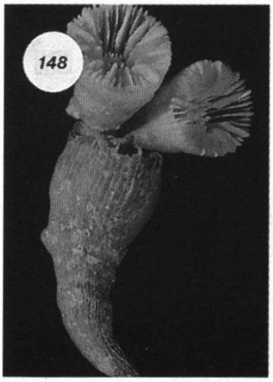


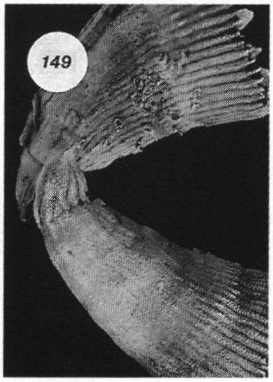


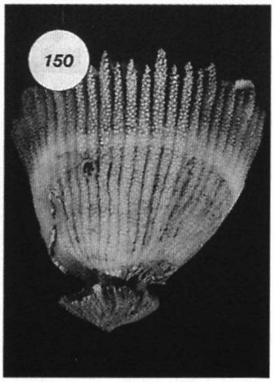








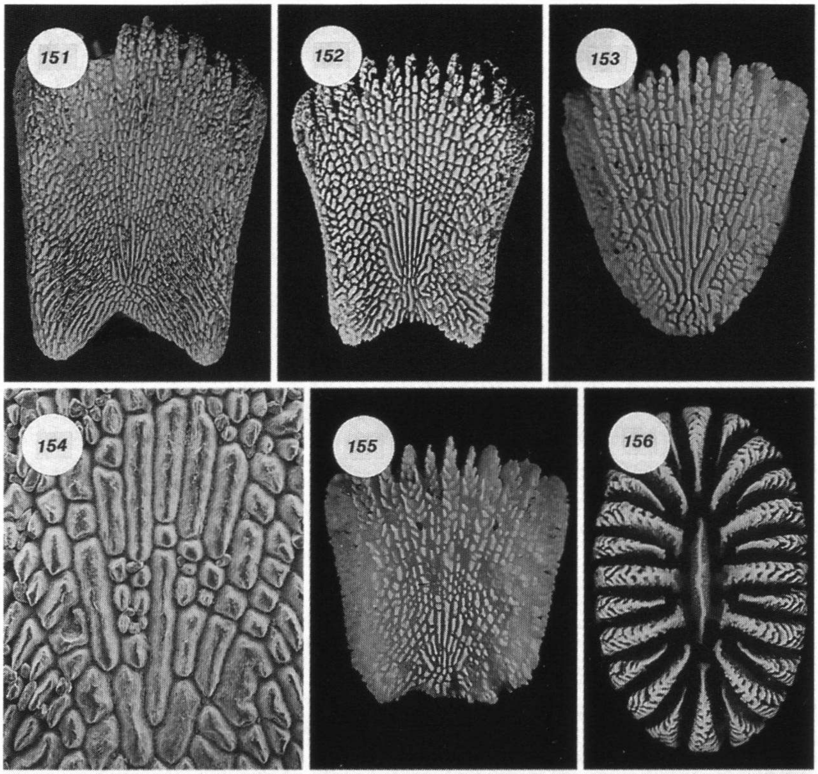


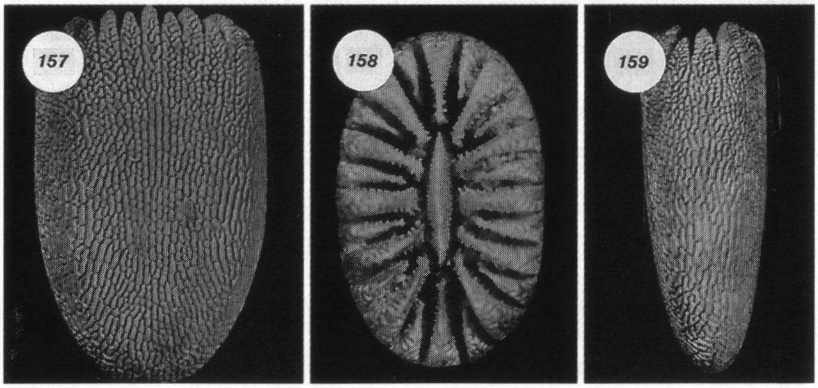


FIGURES 142-143. *Phyllangia pequegnatae*, holotype, USNM 99286, whole colony and several corallites, x 0.8, x 1.9, respectively.

FIGURES 144-147. *Rhizosmilia maculata.* 144, holotype of *Coenocyathus bartschi* Wells, 1947, x 1.0; 145, P-876, USNM 92293, side view, x 1.8; 146, 'attached to cable', MCZ 5101, oblique calicular view, x 2.0; 147, 'Caribbean', USNM 92309, cross-section through base showing dissepimental rings, x 2.2.

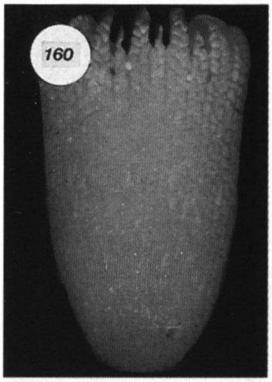
FIGURES 148-150. *Asterosmilia prolifera.* 148, P-199, USNM 46778, corallum with 2 buds, x 1.3; 149, O-4461, USNM 80735, corallum that has remained attached to parent, x 1.7; 150, SOFLA-36, USNM 71961, specimen attached to *Deltocyathus calcar*, x 2.7.

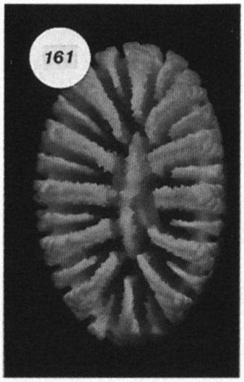


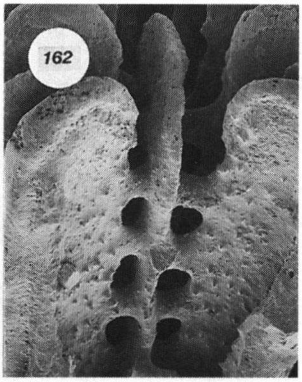


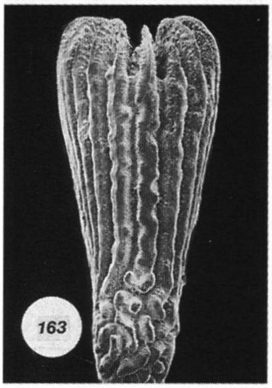
FIGURES 151-156. *Sphenotrochus auritus.* 151, Astro Garoupa-15, MNRJ, typical adult corallum, x 3.8; 152, 156, Emilia-251, USNM 99301, side and calicular views of a medium-sized corallum, x 3.8, x 5.6, respectively; 153, P-686, USNM 87612, small corallum before development of fish-tail spurs, x 6.6; 154, Akaroa-92, USNM 99300, thecal face showing costal granules, x 23; 155, syntype from Cabo Frio, MCZ 2755, x 4.5.

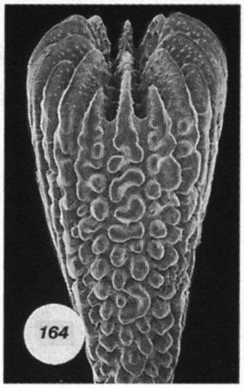
FIGURES 157-159. *Sphenotrochus lindstroemi*, holotype, USNM 87609, side, calice, and edge views, x 4.5, x 6.4, x 4.1, respectively.

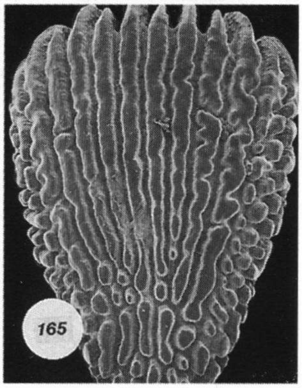


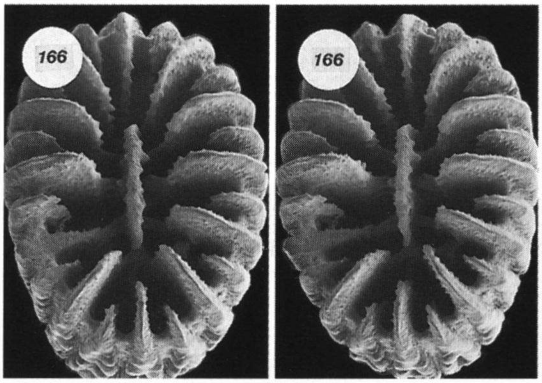


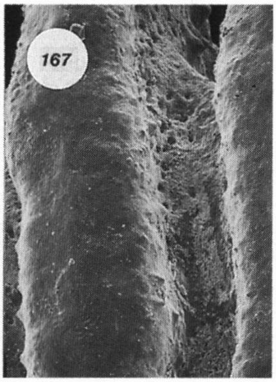












FIGURES 160-161. *Sphenotrochus lindstroemi*, paratype (*S. auritus* var. of Lindström, 1877), SMNH 120, side and calicular views, x 12.2, x 16, respectively.

FIGURES 162-167. *Sphenotrochus andrewianus moorei.* 162, FH-7106, USNM 22022, fractured corallum revealing columellar attachment to axial septal edges, x 29; 163, Broward County, USNM 89365, edge of corallum with fairly continuous edge costae, x 13; 164-167, holotype, USNM 87614, edge, face, and stereo calicular views of corallum, and enlargement of upper costae, x 13, x 13, x 16, x 98, respectively.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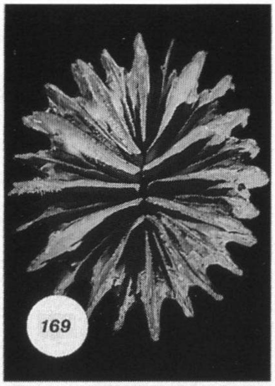
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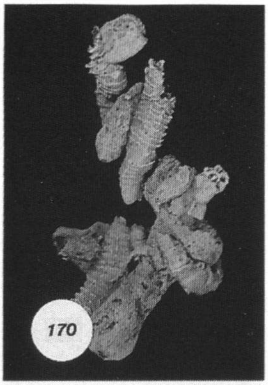
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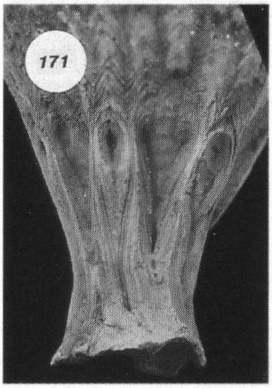
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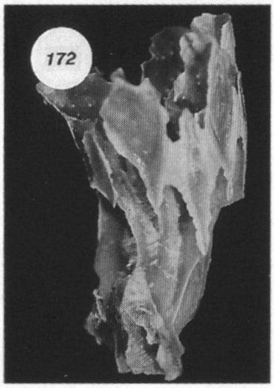
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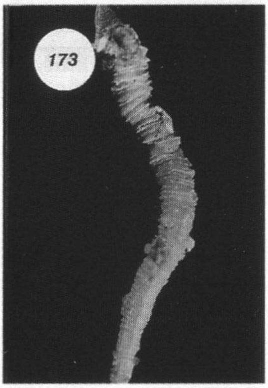
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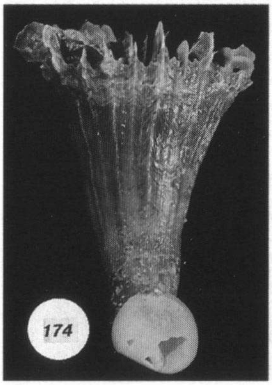
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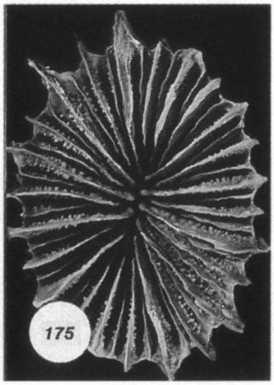
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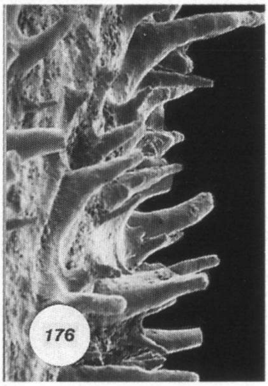
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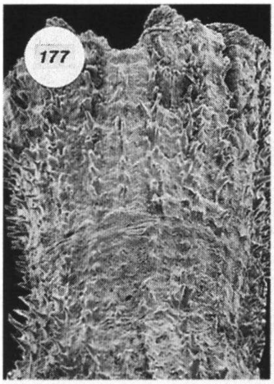
FIGURES 168-169. *Javania cailleti* forma *nobile*, Gos-112/78, USNM 80991, side and calicular views, x 0.55, x 1.0, respectively.

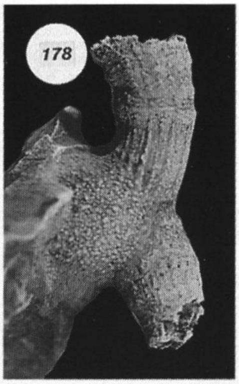
FIGURES 170, 173. *Guynia annulata*, Alpha Helix-16, USNM 79508: 170, a cluster of several 'serpuliform' corallites, x 4.6; 173, an extremely elongate corallum, x 4.1.

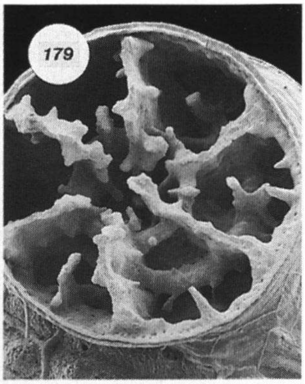
FIGURES 171-172. *Polymyces fragilis*. 171, Isla Contoy, USNM 98468, corallum base showing rootlets, x 4.2; 172, Gos-1863, USNM 61957, partially formed rootlets of a juvenile corallum, x 5.6.

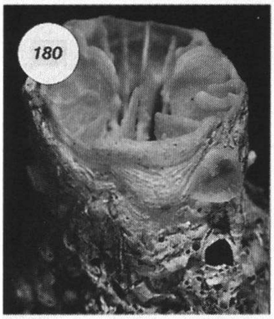
FIGURES 174-175. *Polymyces wellsi*, O-11225, USNM 98949, side and calicular views, x 1.0, x 1.7, respectively.

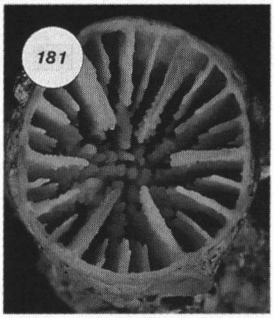
FIGURE 176. *Schizocyathus fissilis*, Explorer-1b, USNM 61729, hispid theca, x 98.

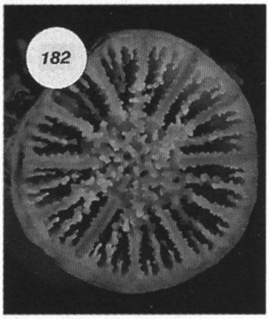


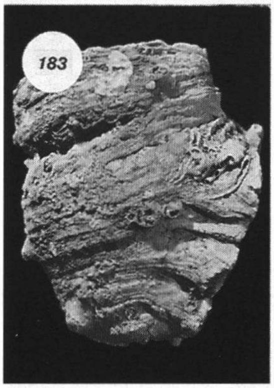


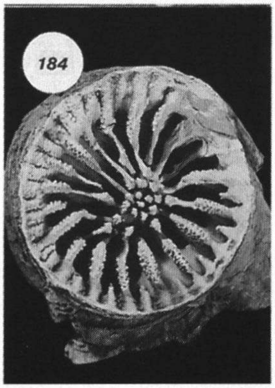












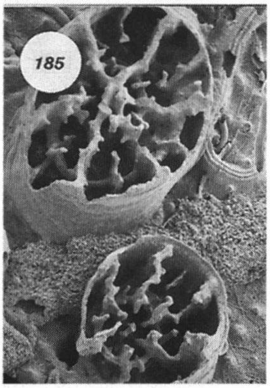


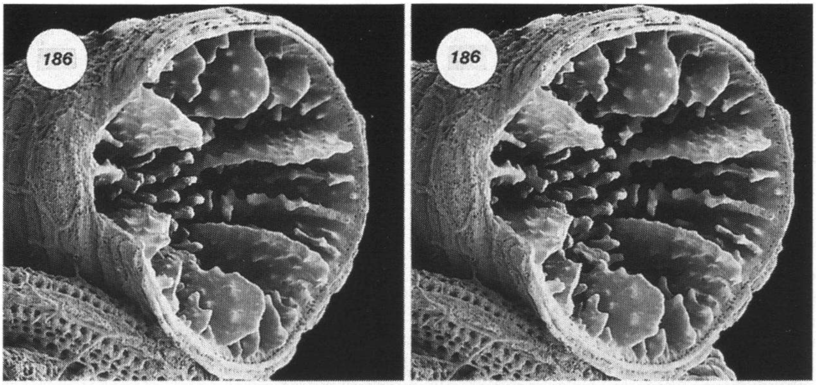
FIGURE 177. *Schizocyathus fissilis*, Explorer-1b, USNM 61729, hispid theca, x 16.

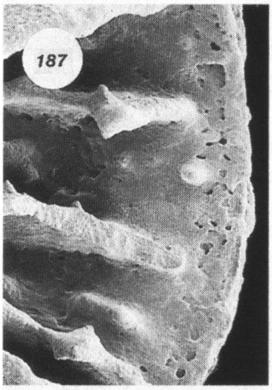
FIGURE 178. *Stenocyathus vermiformis*, JSL-I-2590, USNM 87794, 2 coralla originating from a common basal coenosteum, x 7.8.

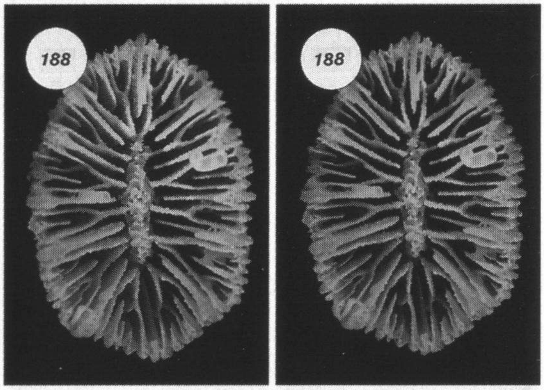
FIGURES 179, 182, 185. *Gardineria minor*. 179, 185, DBL-808, USNM 81013, juvenile coralla showing early development of polycyclic bases, x 26, x 14, respectively; 182, holotype, USNM 53503, x 5.8.

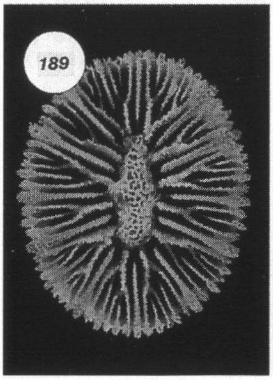
FIGURES 180-181. *Gardineria simplex*, lectotype, MCZ 5560, side and calicular views, x 2.7, x 3.4, respectively.

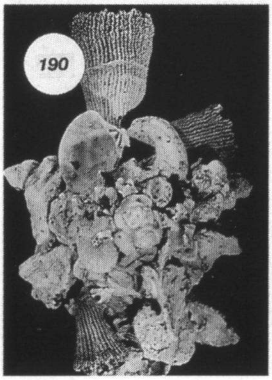
FIGURES 183-184. *Gardineria paradoxa*, Hummelinck-1443, USNM 99353, side view showing lateral attachment and calicular view, x 2.6, x 3.2, respectively.

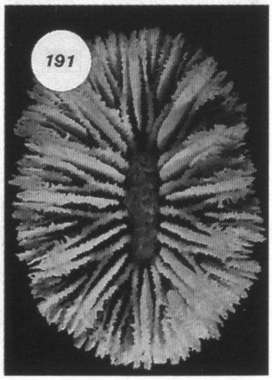






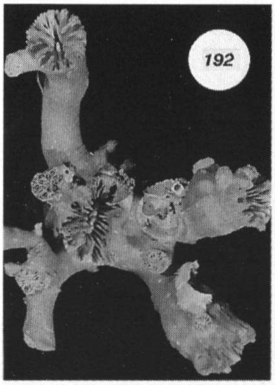






FIGURES 186-187. *Gardineria minor*, Santa Marta, Colombia, USNM 80891, stereo calicular view and enlargement of inner calicular theca, x 13, x 46, respectively.

FIGURES 188-191. *Balanophyllia floridana*. 188, largest syntype, MCZ 5475, stereo calicular view, x 2.7; 189, Grampus-5118, USNM 80489, calicular view, x 2.5; 190, Alb-2318, USNM 10088, several live coralla affixed to shell of gastropod *Xenophora conchyliophora*, x 1.4; 191, SB-1789, USNM 48980, calicular view of a spiny corallum, x 2.6.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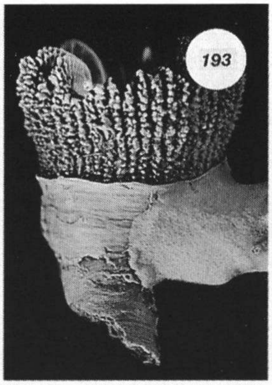
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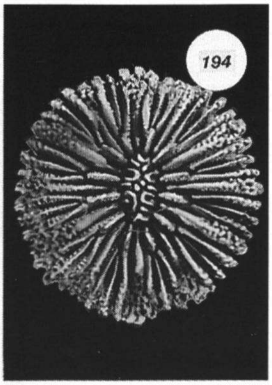
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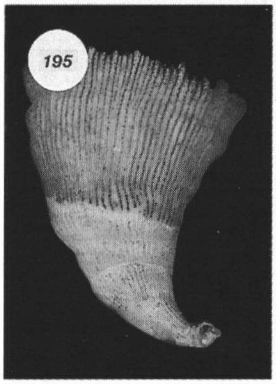
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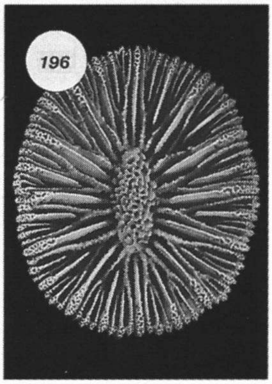
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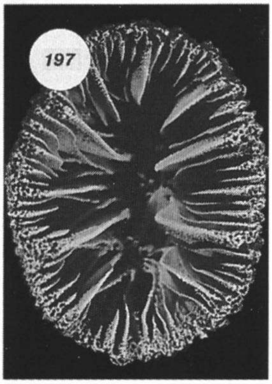
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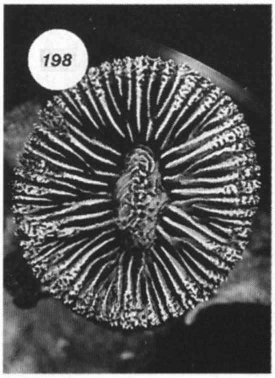
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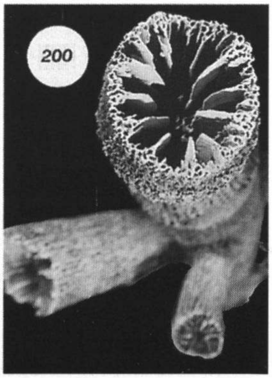
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FIGURE 192. *Balanophyllia cyathoides*, Alb-2157, USNM 16102, a quasicolony, x 1.0.

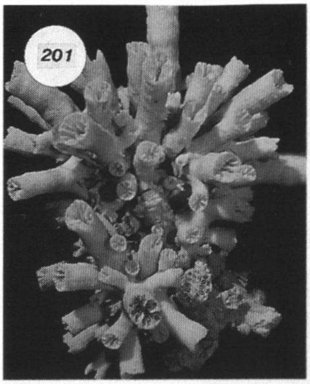
FIGURES 193-194. *Balanophyllia palifera*, Alb-2338, USNM 10223, side and calicular views, x 4.2, respectively.

FIGURES 195-196. *Balanophyllia dineta*, P-775, USNM 45870, paratype, side and calicular views, x 1.9, x 2.6, respectively.

FIGURE 197. *Balanophyllia caribbeana*, O-5696, USNM 62612, calicular view of deep fossa, x 2.7.

FIGURE 198. *Eguchipsammia cornucopia*, Sand Key, USNM 62319, calice, x 2.5.

FIGURES 199-200. *Eguchipsammia strigosa*, holotype, USNM 46902, side and calicular views, x 1.3, x 2.6, respectively.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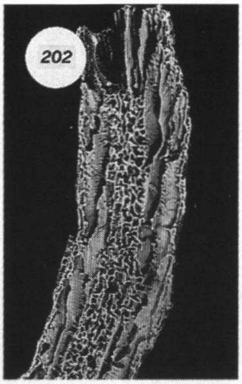
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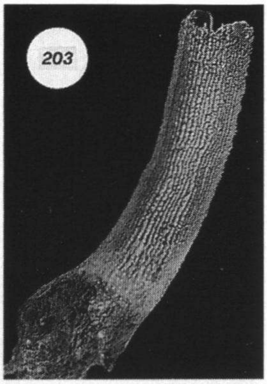
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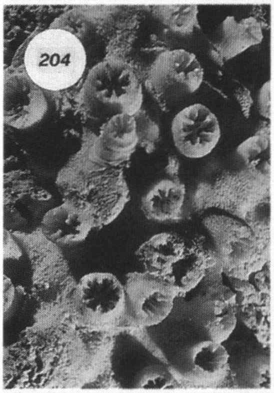
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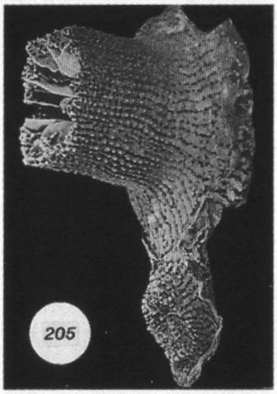
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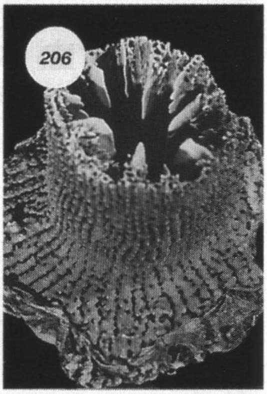
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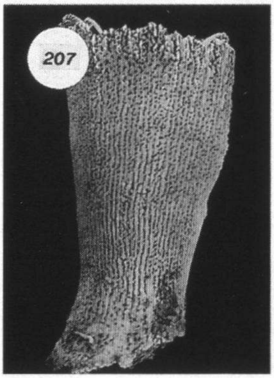
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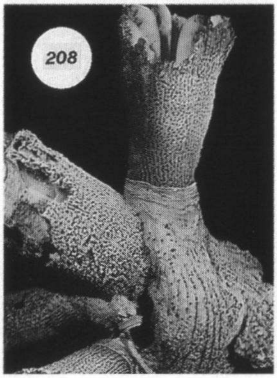
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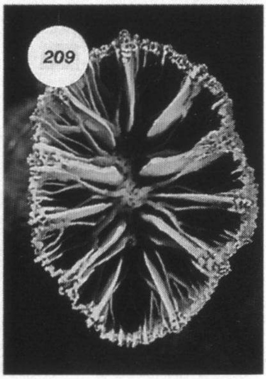
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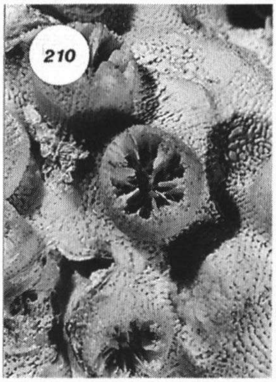
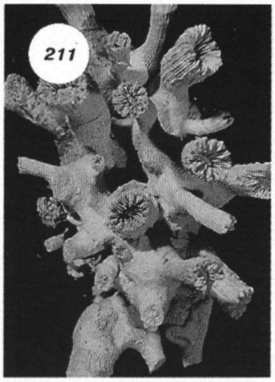
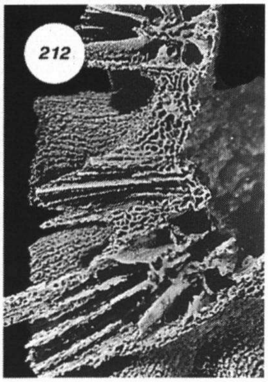
FIGURES 201-202. *Eguchipsammia strigosa.* 201, Huevos, Trinidad, USNM 86747, paratype, a bushy corallum, x 0.61; 202, P-709, USNM 46903, paratype, longitudinal section revealing widely-spaced dissepiments., x 1.8.

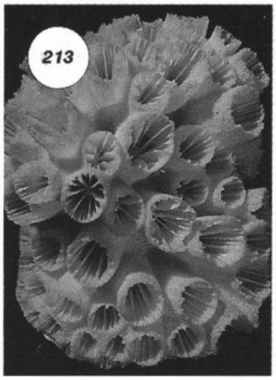
FIGURES 203-206. *Rhizopsammia bermudensis.* 203, Nonesuch, Bermuda, USNM 93188, specimen illustrated by Sterrer (1986: pl.6, fig. 6), x 1.1; 204, corallites of holotypic colony, YPM 8500, x 0.8; 205-206, St. David's-Head, Bermuda, USNM 83465: 205, side view of colony with 2 corallites, x 2.2; 206, oblique view of a different corallite, x 2.6.

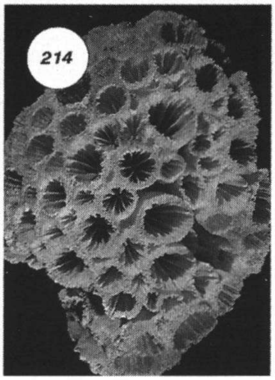
FIGURES 207-209. *Rhizopsammia goesi.* 207, 209, O-4394, USNM 62600, side and calicular views of a robust corallite, x 1.4, x 2.2, respectively; 208, O-4393, USNM 62601, colony showing stoloniferous rootlet, x 1.4.











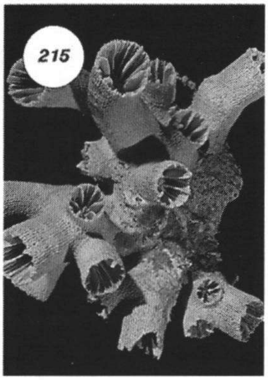


FIGURE 210. *Rhizopsammia bermudensis*, corallites of holotype, YPM 8500, x 2.1.
FIGURE 211. *Cladopsammia manuelensis*, SB-331, USNM 83466, typical colony, x 0.75.
FIGURES 212-215. *Tubastraea coccinea*. 212, Virgin Islands, USNM 61849, longitudinal section through corallites revealing widely-spaced dissepiments, x 1.9; 213, Discovery Bay, USNM 94415, a plocoid corallum, x 0.7; 214, Curaçao, USNM 83692, a cerioid corallum, x 0.65; 215, East Palisadoes, USNM 83698, a phaceloid corallum, x 0.55.