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 rudimen-

tary 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, ⅝ to ¾ width of S1. S3 rudimentary, only about ⅛ 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 re-

sulting 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 colo-

nial 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) pre-

viously 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, Discov-

ery 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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Figure 2 was executed by Departmental staff illustrator MOLLY RYAN, and the scanning electron photomicrographs were taken by SUSANN BRADEN. LINDA COLE assisted with the distribution maps.

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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

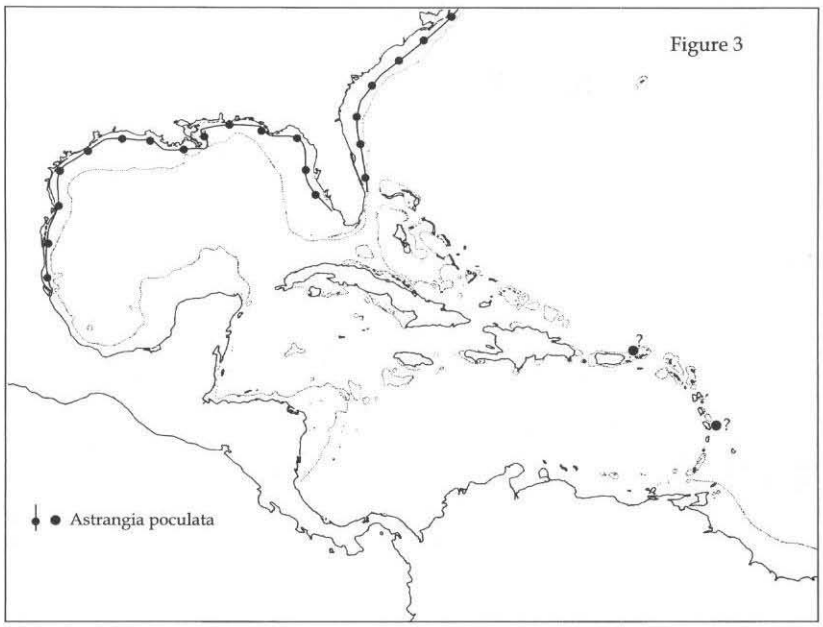
Figure 3
Astrangia poculata
?

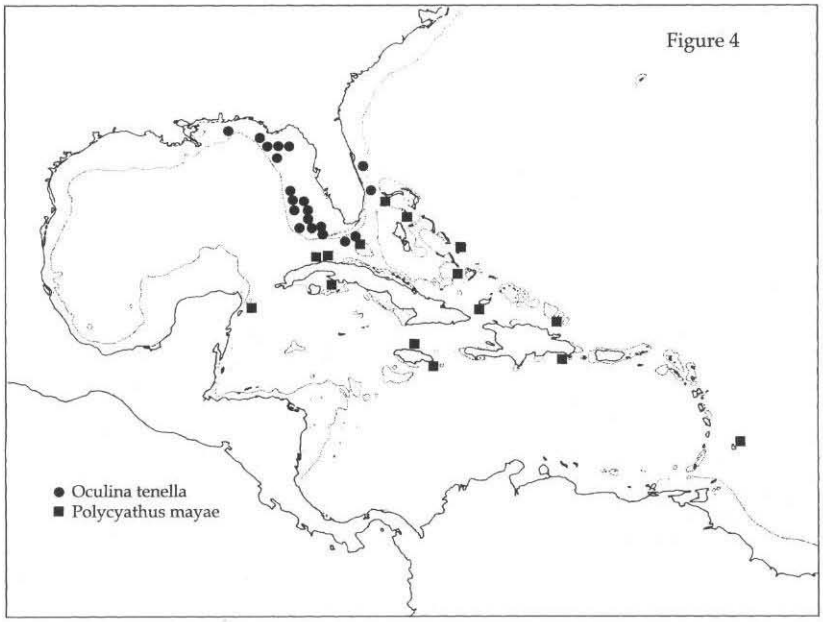
Figure 4
Oculina tenella
Polycyathus mayae

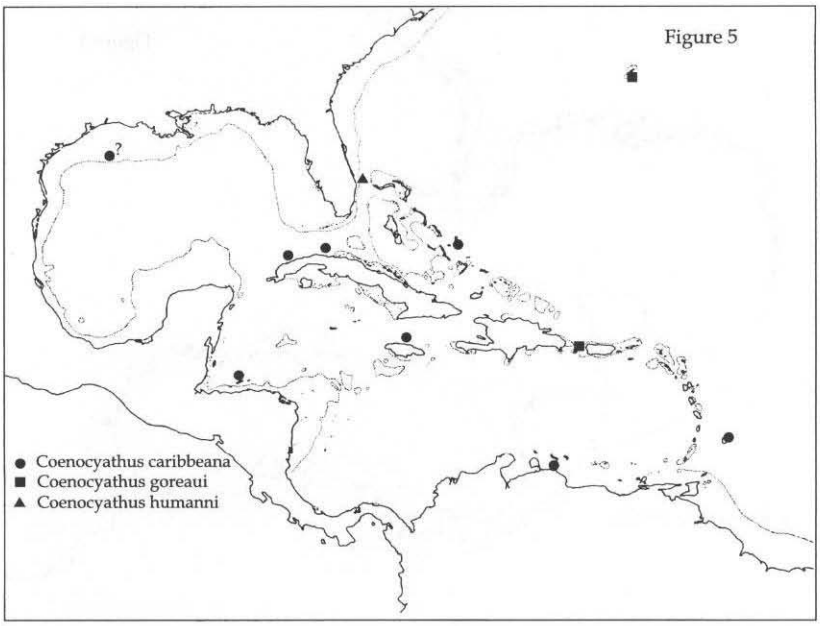
Figure 5
● Coenocyathus caribbeana
■ Coenocyathus goreaui
▲ Coenocyathus humanni

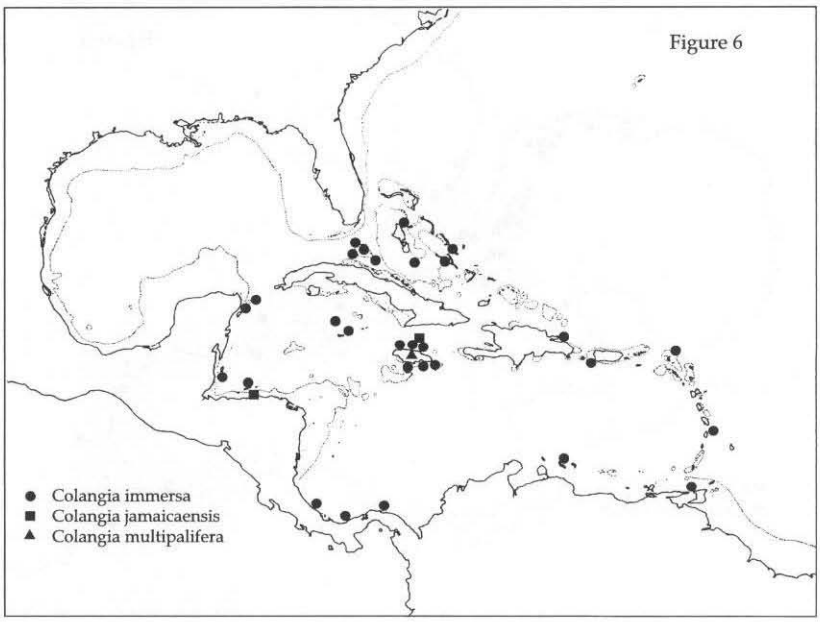
Figure 6
● Colangia immersa
■ Colangia jamaicaensis
▲ Colangia multipalifera

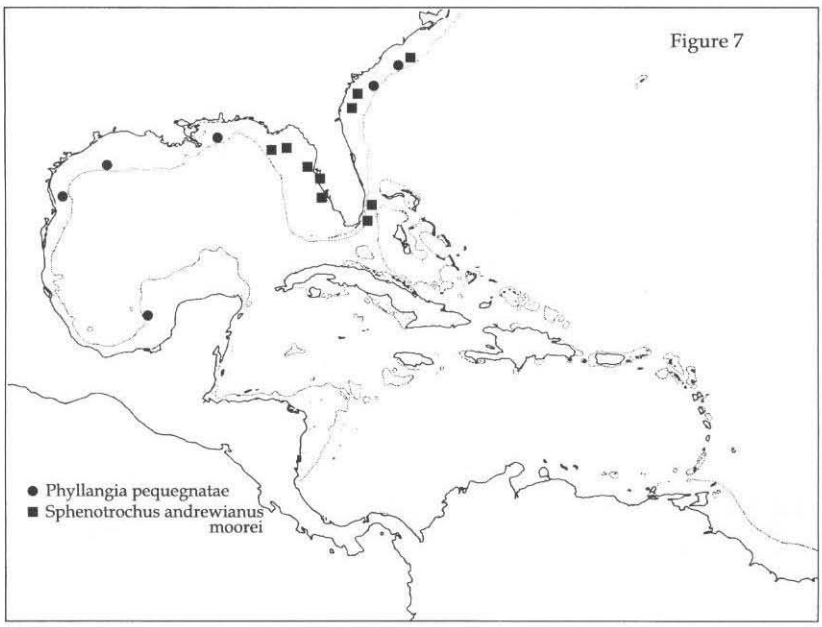
Figure 7
● Phyllangia pequegnatae
■ Sphenotrochus andrewianus moorei

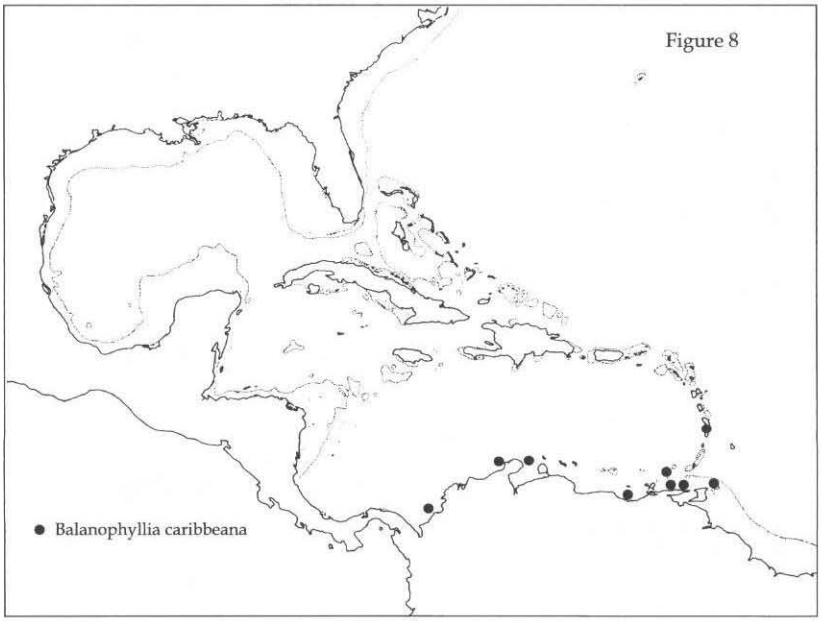
Figure 8
● Balanophyllia caribbeana

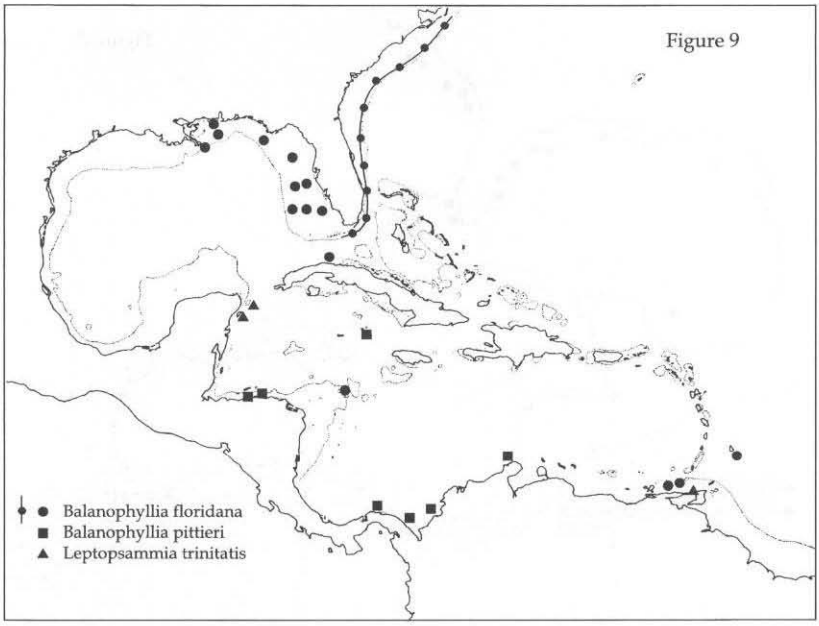
Figure 9
Balanophyllia floridana
Balanophyllia pittieri
Leptopsammia trinitatis

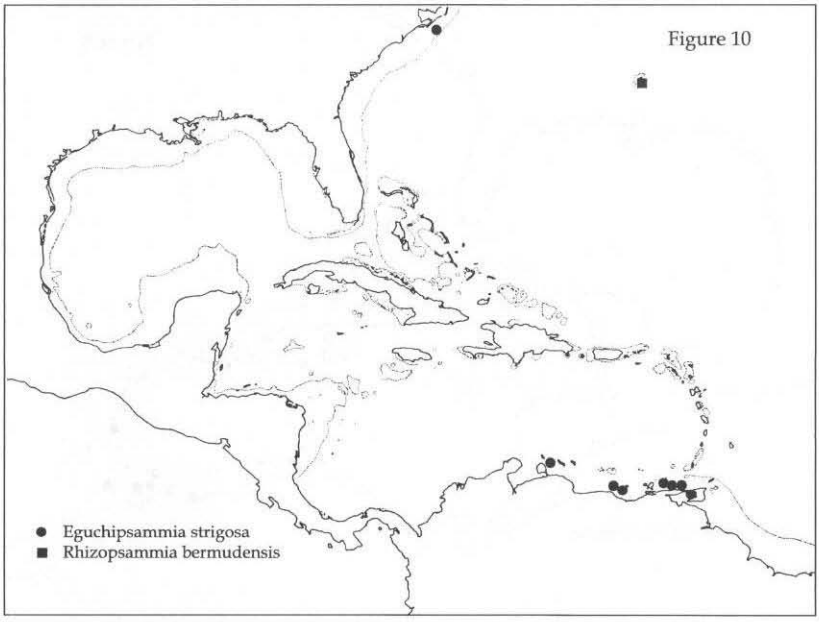
Figure 10
Eguchipsammia strigosa
Rhizopsammia bermudensis

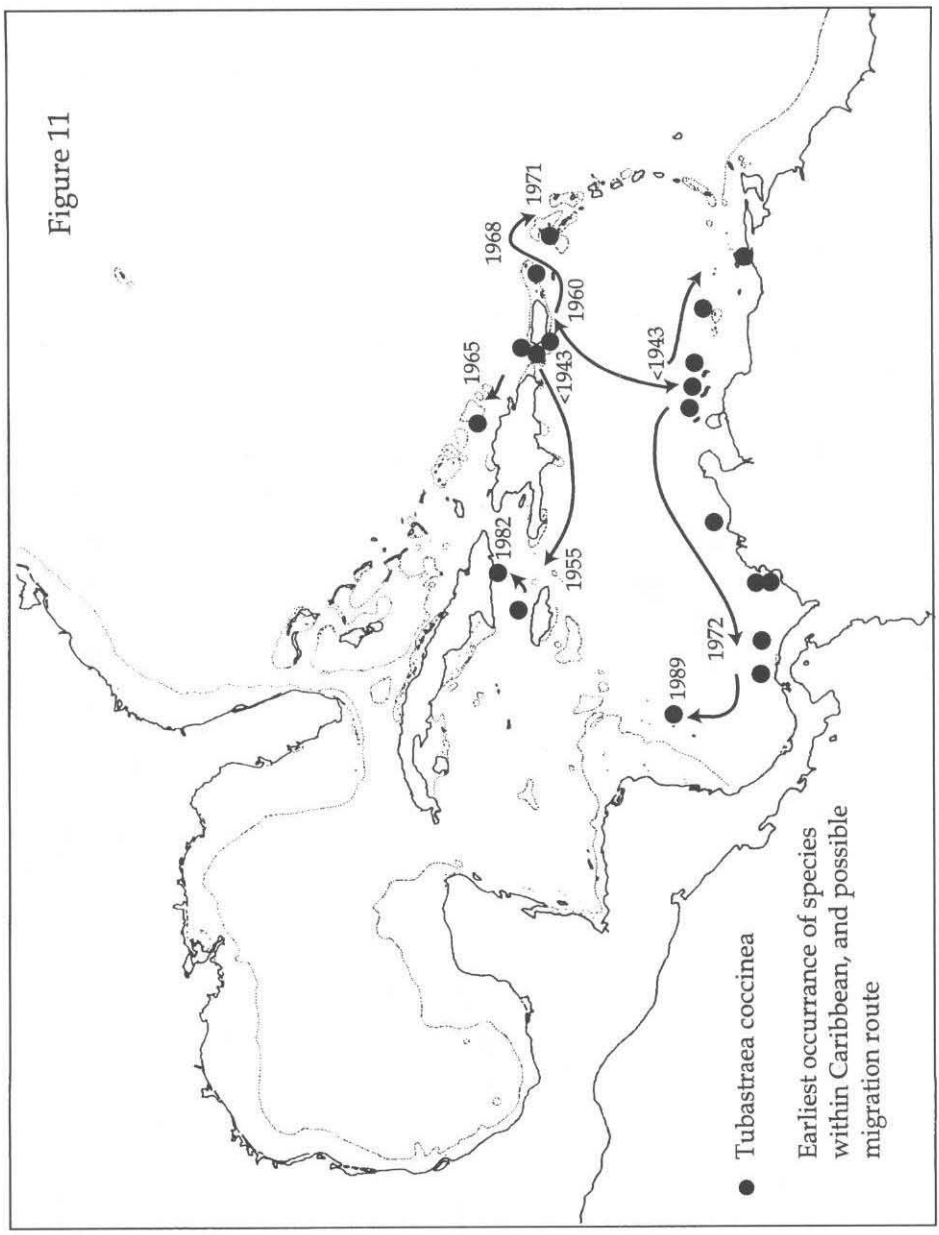
Figure 11
1968
1971
1960
1965
<1943
<1943
1982
1955
1972
1989
Tubastraea coccinea
Earliest occurrance of species within Caribbean, and possible migration route

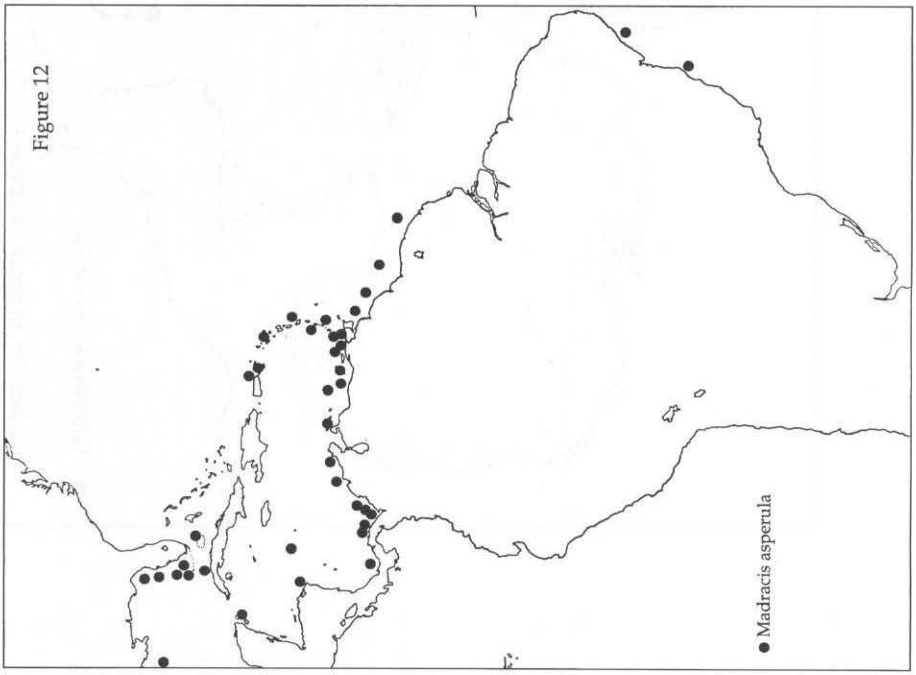

Figure 12

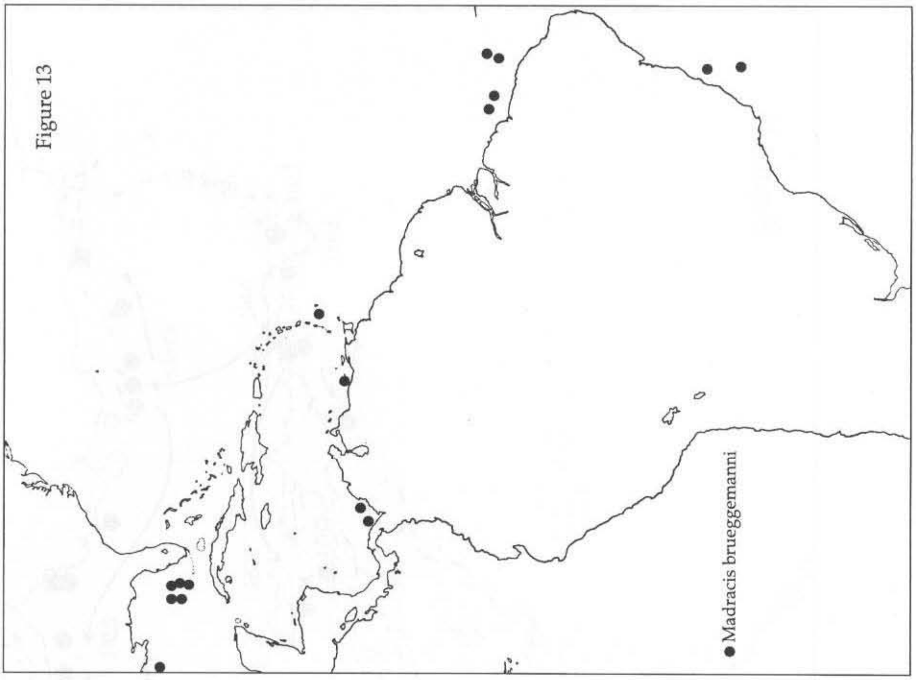

Figure 13

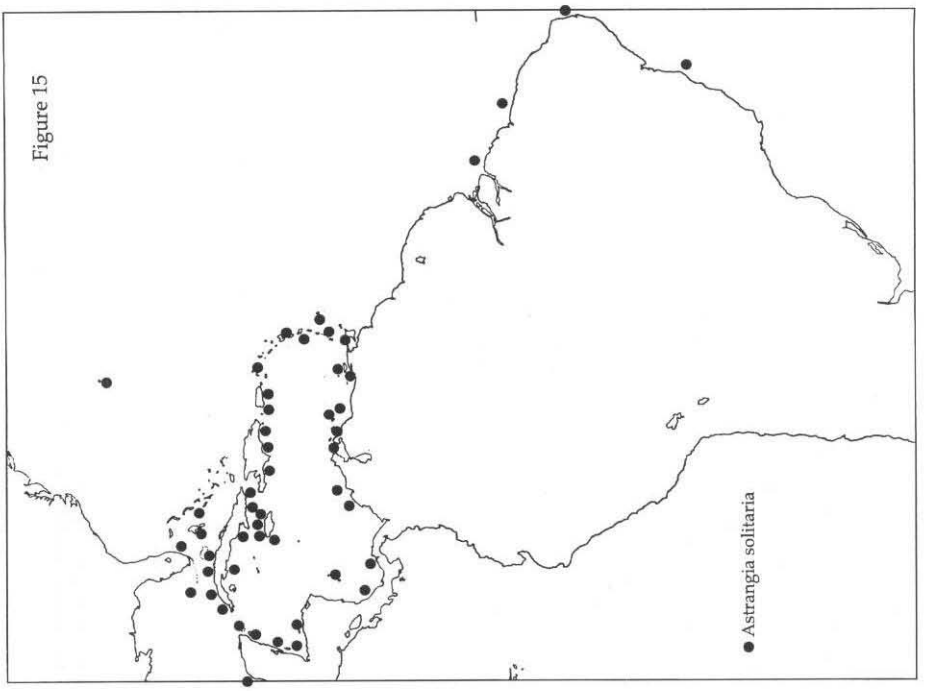
Figure 15
Astrangia solitaria

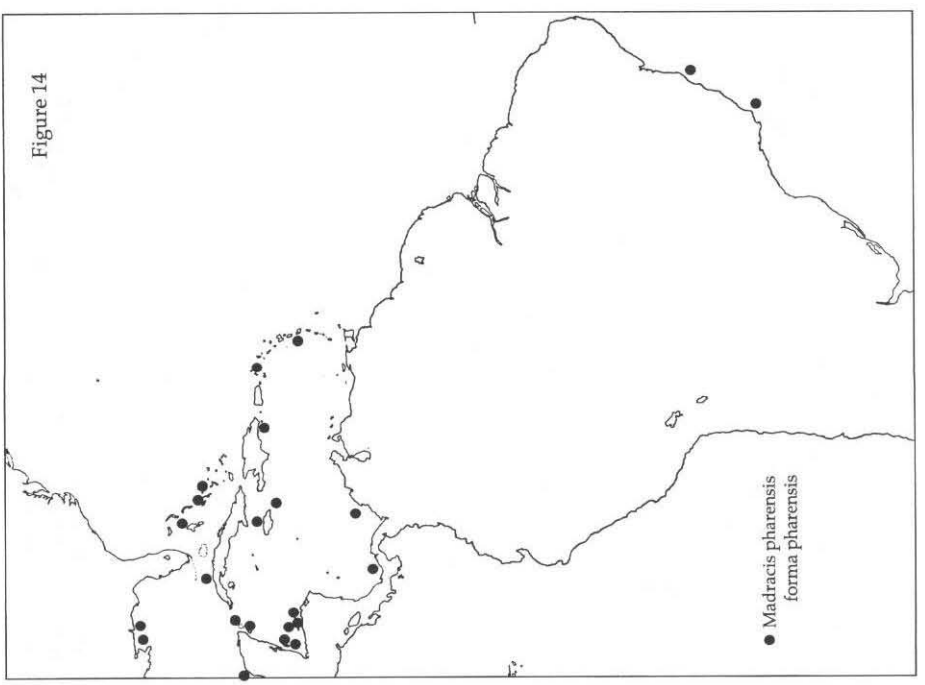
Figure 14
Madracis pharensis
forma pharensis

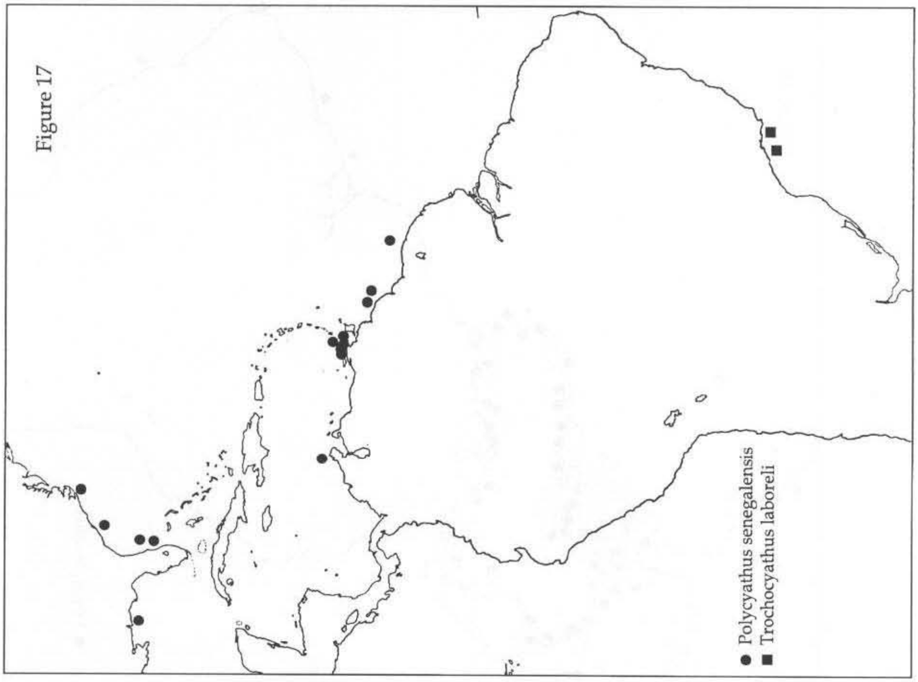

Figure 17

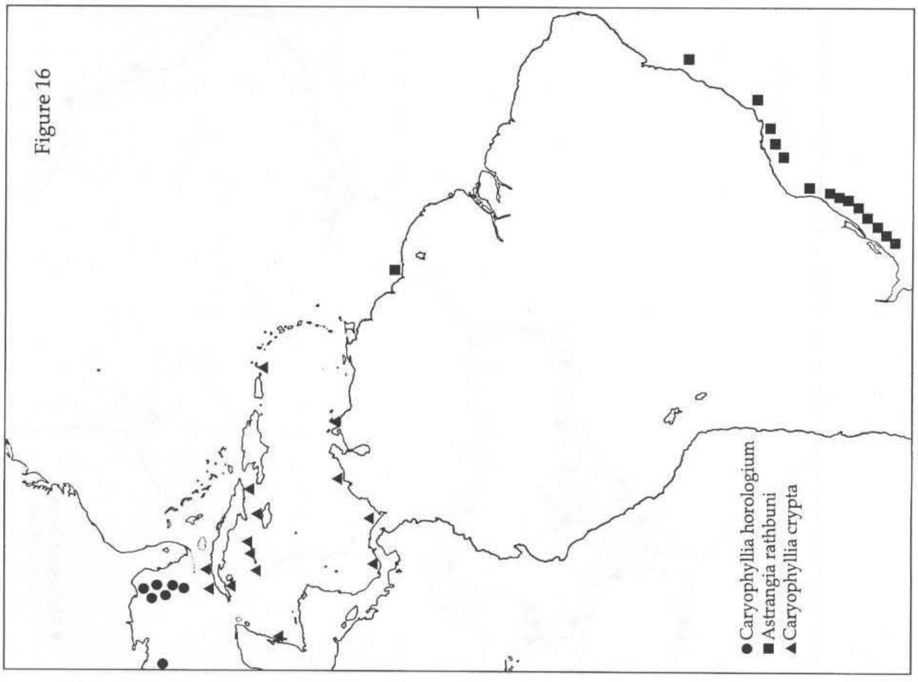

Figure 16

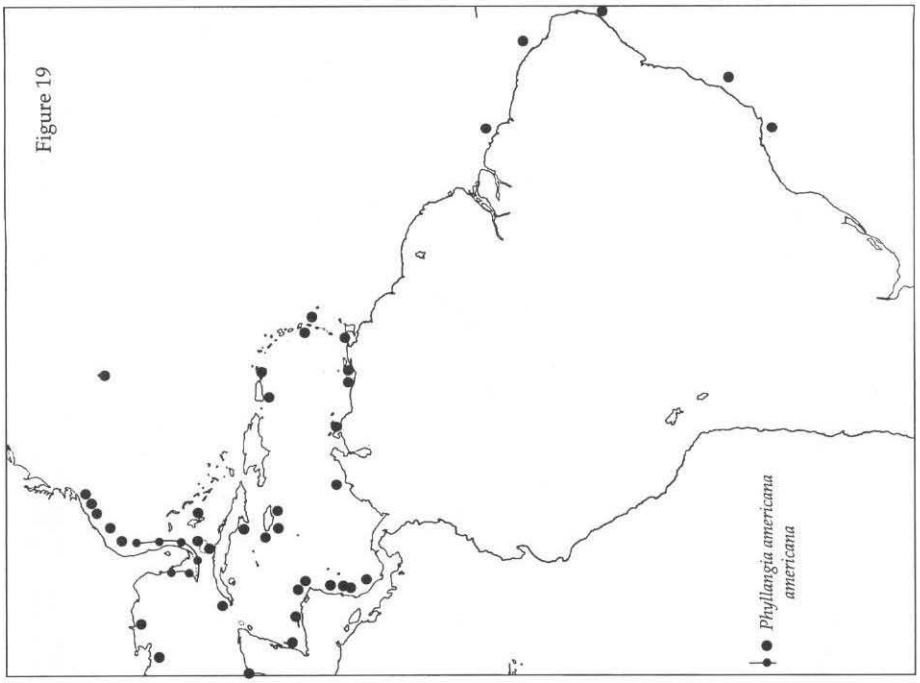
Figure 19
Phyllangia americana americana

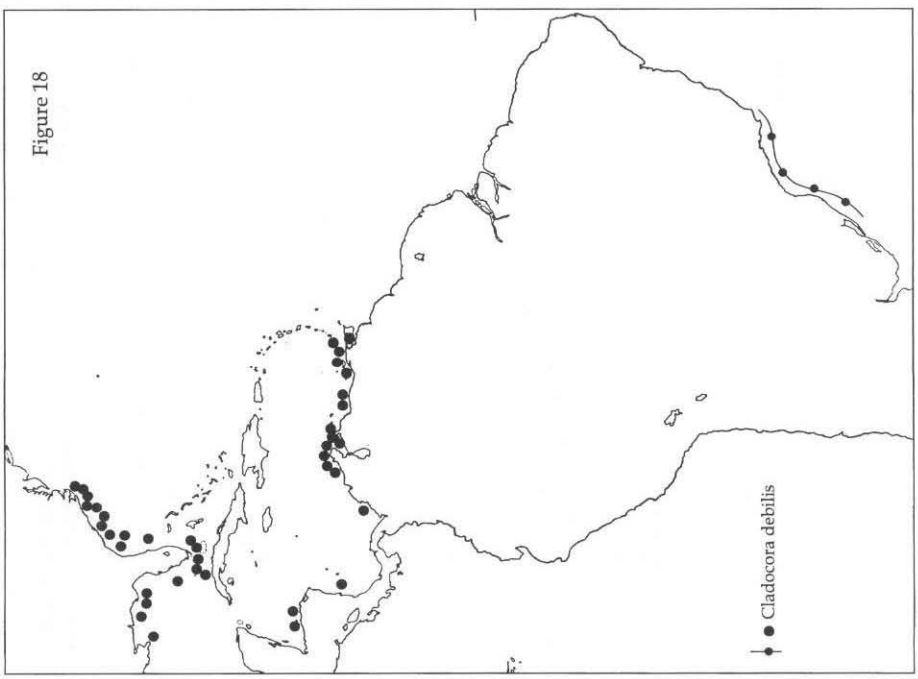
Figure 18
Cladocora debilis

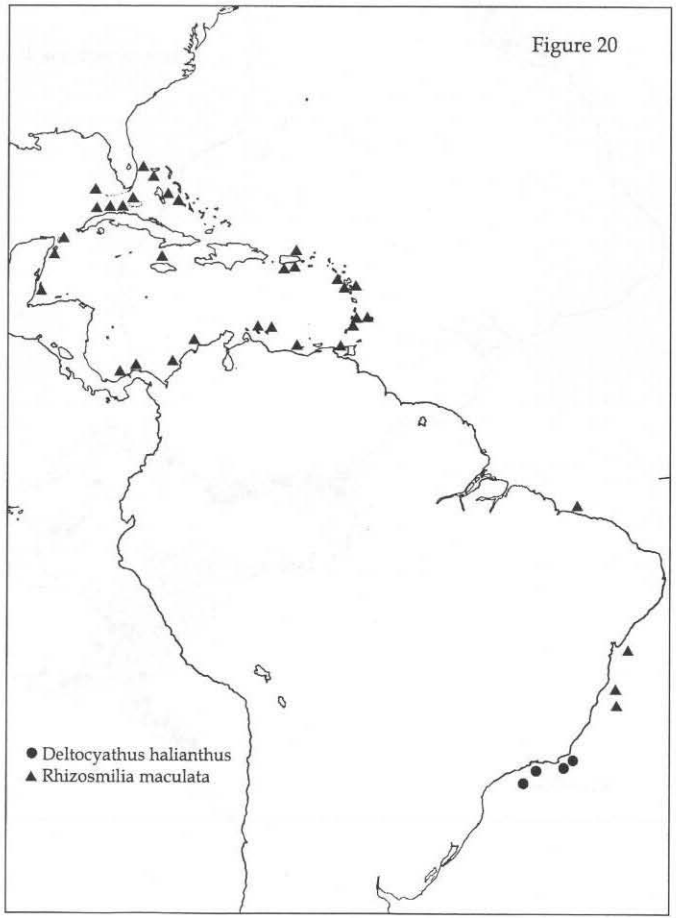
Figure 20
● Deltocyathus halianthus
▲ Rhizosmilia maculata

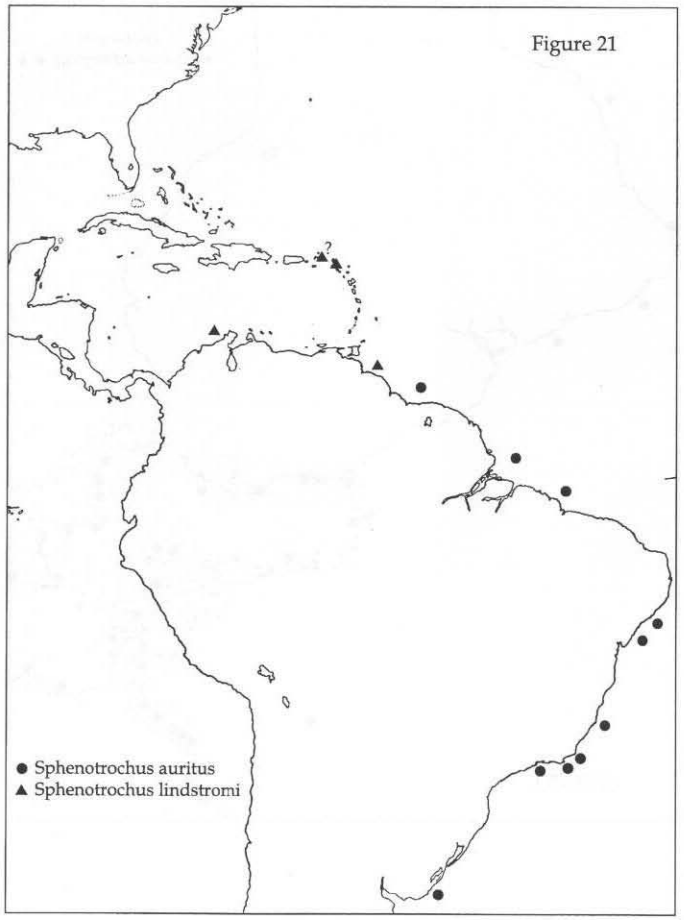
Figure 21
● Sphenotrochus auritus
▲ Sphenotrochus lindstromi

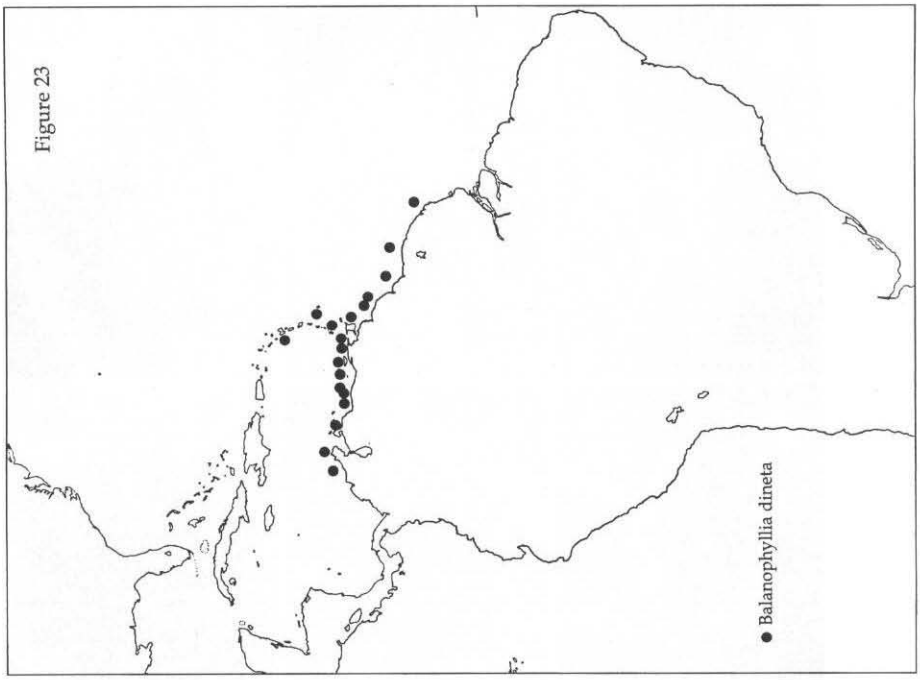
Figure 23
Balanophyllia dineta

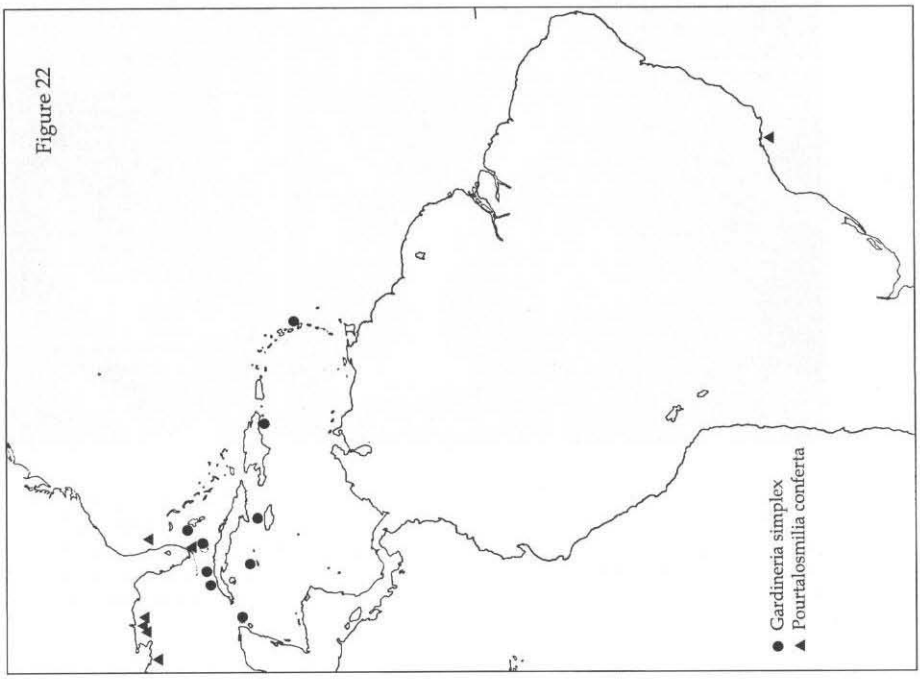
Figure 22
Gardineria simplex
Pourtalosmilia conferta