Remarks. Many of the sea-fans from the Bahamas exactly fit the original description of *Gorgonia flabellum* as given by LINNAEUS (1758, p. 801): "Gorgonia reticulata, ramis interne compressis," and also agree with his characterization in the *Hortus Cliffortianus*: "Lithoxylon retiforme, ramis parallele compressis: primordialibus crassioribus." These fans are further distinguished by the tuberculate sculpture of the convex side of the scaphoid spicules. Toward the west, in Florida, and the south, in the Lesser Antilles, *G. flabellum* becomes less and less abundant and, unfortunately, less easily recognized. The flattening of the branches may be less pronounced and colonies approach the external appearance of *G. ventalina*, the commoner species in those areas. The spicules remain recognizable, however, and it is upon their characteristics that *G. flabellum* is best distinguished from *G. ventalina*.

83a **Gorgonia flabellum** Linnaeus, 1758 forma **occatoria** Milne Edwards & Haime, 1857

(Fig. 84)

Rhipidigorgia occatoria VALENCIENNES 1855, p. 13. (Guadeloupe.) [Nomen nudum.]

Rhipidigorgia occatoria MILNE EDWARDS & HAIME 1857, *1*, p. 175. (Côtes de la Guadeloupe.)

Diagnosis. *Gorgonia flabellum* with numerous short branchlets growing from one or both sides of the fan. The scaphoids (Fig. 84 a), spindles (Fig. 84 b), and anthocodial rods (Fig. 84 c) are identical with those of the typical form.

Material. Collected by Dr. Hummelinck: ST. JOHN, Turner Bay, rock debris, 1 m., sta. 1407, 18.VI.1955, dry colony with commensal gastropods; *Coralliophila* attached to base and several yellow *Neosimnia* clinging to branches (USNM 51346).

From the U.S. National Museum: several specimens from NEW PROVIDENCE, Nassau (50755), Long Key (50756), and the Sea Garden at the east of Hog Island (50757); and one from HISPANIOLA, Haiti (50224).

Distribution. Probably coincides with that of the typical form.

Remarks. It appears quite certain that specimens of this growth form were in hand when VALENCIENNES (1855) and MILNE EDWARDS & HAIME (1857) established *Rhipidigorgia occatoria*. The latter authors state (p. 175): "Un grand nombre de petites branches accessoires naissant sur l'une et l'autre surface de l'éventail formé par le polypiéroïde." Furthermore, the color was said to be whitish, as several of the specimens before me are.

84 **Gorgonia ventalina** Linnaeus, 1758

(Figs. 85–86; Pl. X fig. 1, XXVII)

Gorgonia Ventalina Linnaeus 1758, p. 801. (Habitat in O. Americano & Asiatico.)
not *Gorgonia ventilabrum* Pallas 1766, p. 165.
not *Gorgonia ventalina*, Esper 1791, *2*, p. 20, pl. 1. [= ?*Pacifigorgia elegans* (Duchassaing & Michelotti).]
not *Gorgonia ventalina*, Bielschowsky 1929, p. 152, fig. 25, pl. 3 fig. 14.
Gorgonia flabellum, Verrill 1907, p. 297, fig. 142, pl. 33C figs. 2–3, pl. 36 fig. 1 (1a).

Diagnosis. *Gorgonia* with branches usually compressed in the plane of the fan; ascending branches occasionally somewhat compressed at right angles to the fan, but not the connecting branchlets. Scaphoids with sculpture of convex side reduced to low prickles, sometimes placed on low transverse ridges (Figs. 85 a, f; 86 a, d, e); spindles acute (Figs. 85 b, e; 86 c, f); anthocodial rods 0.065–0.1 mm. long (Figs. 85 c–d; 86 b, g). Color of colonies, yellow or purple, occasionally whitish.

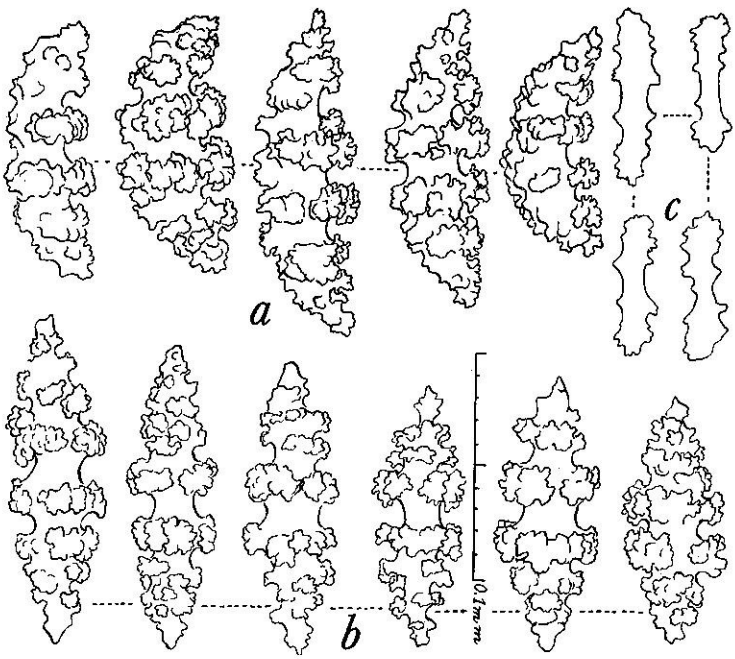


Figure 84. *Gorgonia flabellum* Linnaeus, forma *occatoria* Milne Edwards & Haime: spicules of a specimen from Haiti (USNM 50224): a, scaphoids; *b*, spindles; *c*, anthocodial rods. (All figures drawn to the same scale.)

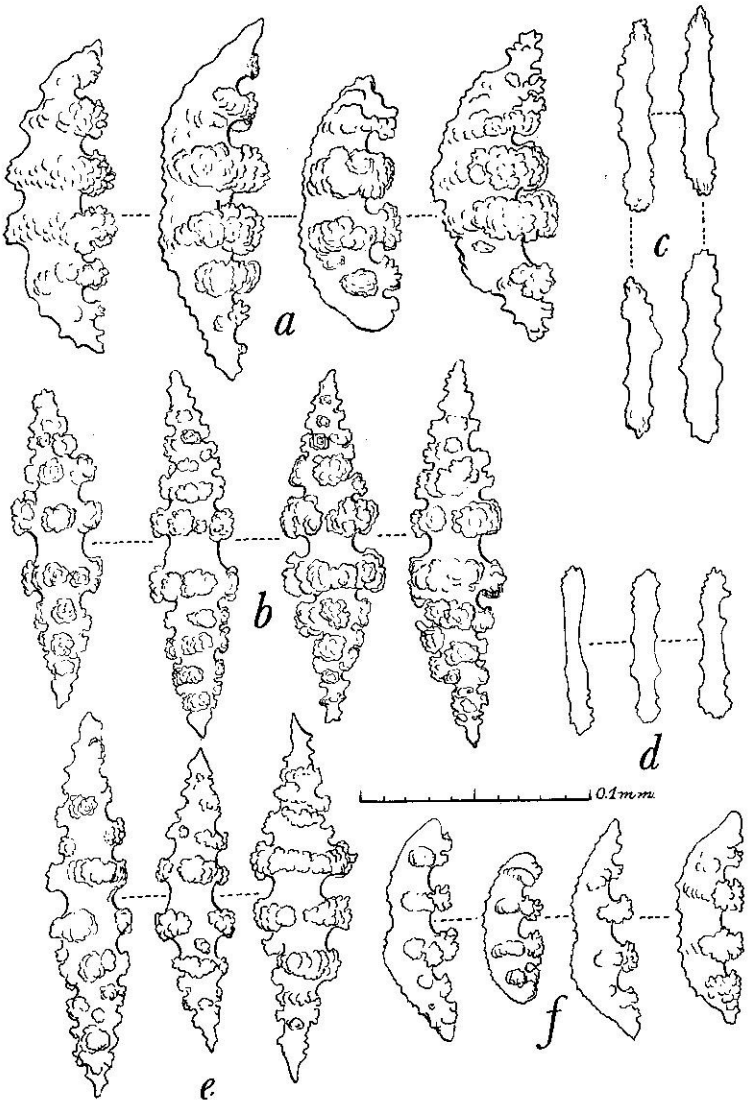


FIGURE 85. *Gorgonia ventalina* Linnaeus, spicules. *a–c*, of a specimen from Rodriguez Key, Florida (USNM 8860): *a*, scaphoids; *b*, spindles; *c*, anthocodial rods. *d–f*, of a specimen from Bonaire (50218): *d*, anthocodial rods; *e*, spindles, *f*, scaphoids. (All figures drawn to the same scale.)

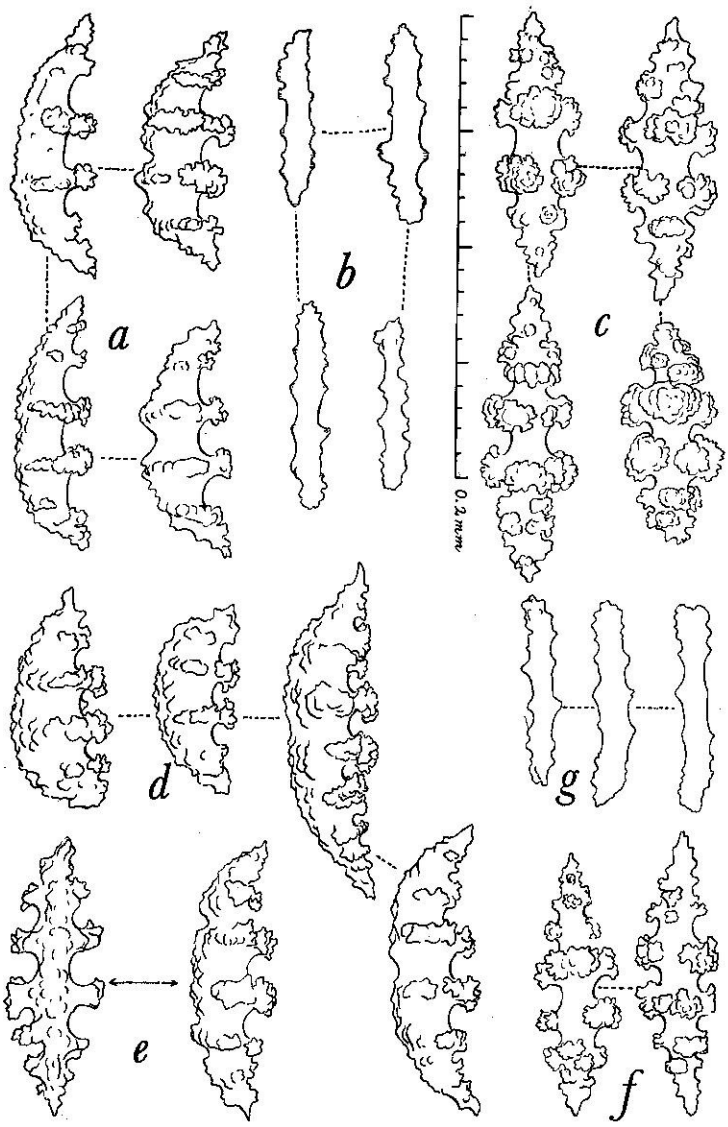


FIGURE 86. *Gorgonia ventalina* Linnaeus, spicules. *a–c*, of a specimen from St. Barts (USNM 50222): *a*, scaphoids; *b*, anthocodial rods; *c*, spindles. *d–g*, of a specimen from St. James (50758): *d*, scaphoids; *e*, two views of same scaphoid; *f*, spindles; *g*, anthocodial rods. (All figures drawn to the same scale.)

Material. USNM specimens from Dr. Hummelinck's collection: BONAIRE, Kralendijk roadstead, from two covered buoys cleaned 20 months before, 0–1.5 m., sta. 1053, 21.XI.1948, 11 small specimens in alcohol (50218). Punt Vierkant, sandy reef, 2 m., sta. 1059B, 9.IX.1948, fragments in alc. (50219). KLEIN CURAÇAO, J. S. Zaneveld, 9.I.1955 (51352). Found by J. H. Stock on CURAÇAO: Blauwbaai, 3 m., 17.X.1958; Fuik Baai, 3 m., 3.XI.1958 (Amsterdam). ST. EUSTATIUS, Gallows Bay, rocky beach, 2 m., sta. 1116B, 15.VII.1949, dry spec. (50221); J. H. Stock, 11.II.1959 (Amsterdam). ST. BARTHÉLEMY, Fourche, rock debris, 1.5 m., sta. 1124, 2.VI.1949, 6 complete dry spec. and fragments in alc. (50222, 51347).

Many other USNM specimens from various localities: BERMUDA (50670, 50671); FLORIDA Keys (8860); DRY TORTUGAS (50392); BAHAMAS, New Providence (50550, 50719), Rum Cay (50725), Watling's Island (50696); CUBA (34680); HISPANIOLA, Haiti (4082); JAMAICA, Port Royal Cays (51406); PUERTO RICO (42144); VIRGIN ISLANDS (49561, 50348); SABA Bank (50346); ST. CHRISTOPHER (50347); ANTIGUA (34045); TOBAGO, Milford Bay (51422); Curaçao and ARUBA (50663, 50664, courtesy of the Leiden Museum); OLD PROVIDENCE (8857).

Distribution. Geographically, *Gorgonia ventalina* ranges from Bermuda south to Curaçao. In Florida, it extends through the Keys southward to the Dry Tortugas but, so far as I know, does not occur on the Gulf coast of Florida; where it reappears on the mainland to the southward cannot be determined from available records. The U.S. National Museum has a very badly damaged specimen said to be from Texas, but there is absolutely no assurance that the species lives off that coast. The collections from the Gulf of Campeche and the Yucatan Peninsula, scant though they are, do not include it. It is known from Old Providence Island off Nicaragua, and may occur on the mainland in that latitude. It occurs at Curaçao, Aruba, Bonaire, and probably all the other islands of the Leeward Group, and perhaps lives also along the mainland.

Ecology. Along the Florida Keys, sea-fans are restricted to the outer reefs and the reef patches in deeper water in the lagoon. At Bermuda, according to VERRILL (1907, p. 298), it reaches its maximum growth off the outer reefs in 10 to 20 feet of water, where its height may be 5 to 6 feet.

Remarks. It is no easier to separate the various references in the literature into their proper species today than it was in Linnaeus' time. The correct assignment of the older references will depend upon a reexamination of specimens, insofar as they are extant, and it will likely prove that many of them deal with both *Gorgonia ventalina* and *G. flabellum*.

85 **Gorgonia mariae** spec. nov.
forma **mariae**

(Figs. 87–88 a–c; Pl. X figs. 3–4)

Gorgonia bipinnata, HARGITT & ROGERS 1901, p. 287, pl. 3 fig. 4. (Off. St. Thomas and Vieques Island.)
not *Pterogorgia bipinnata* VERRILL 1864b, p. 31.

Diagnosis. *Gorgonia* with large meshes. Scaphoid spicules with their convex profile entirely smooth, the long ones pointed, the short one blunt and stubby. Spindles mostly double cones with girdles of very complicated tubercles. Anthocodial rods narrow, with enlarged ends, up to 0.06 mm. in length.

Description. All of the known colonies are of small size, the largest being a complete specimen about 28 cm. in height. The holotype is a complete colony 20 cm. in height and about the same in width. Branching is pinnate, in one plane, and regularly anastomosed. The branchlets are 1.0–2.0 mm. wide, but 1.5 mm. is usual; they arise at intervals of 3–6 mm. (commonly 4–5 mm.), usually in an alternating manner and, as soon as they are sufficiently long (10–15 mm.), anastomose freely with one another. Small colonies tend to show few anastomoses until some strong lateral branches are developed, but as soon as this occurs the branchlets invariably fuse so that well-developed colonies are complete nets. The polyps, which occur in irregular, alternating double rows along the two edges of the branchlets, usually appear as tiny slits, occasionally with a somewhat raised rim, and rarely at the summit of a slight coenenchymal swelling. Protruding calyces are not formed. There are the usual two categories of spicules in the cortex, namely, scaphoids and spindles. The scaphoids are of two types: (1) long and acute, and (2) short and blunt. The former reach a length of 0.16 mm. and are gently curved and sharply pointed; the latter are at most 0.12 mm. long, usually 0.06–0.08 mm., with blunt, incurved ends that give them the appearance of beetle-grubs or, perhaps, mammalian embryos. Both long and short scaphoids are entirely smooth on their convex surface (Figs. 87 a, d; 88 a). The spindles are very acute double cones up to 0.17 mm. in length;

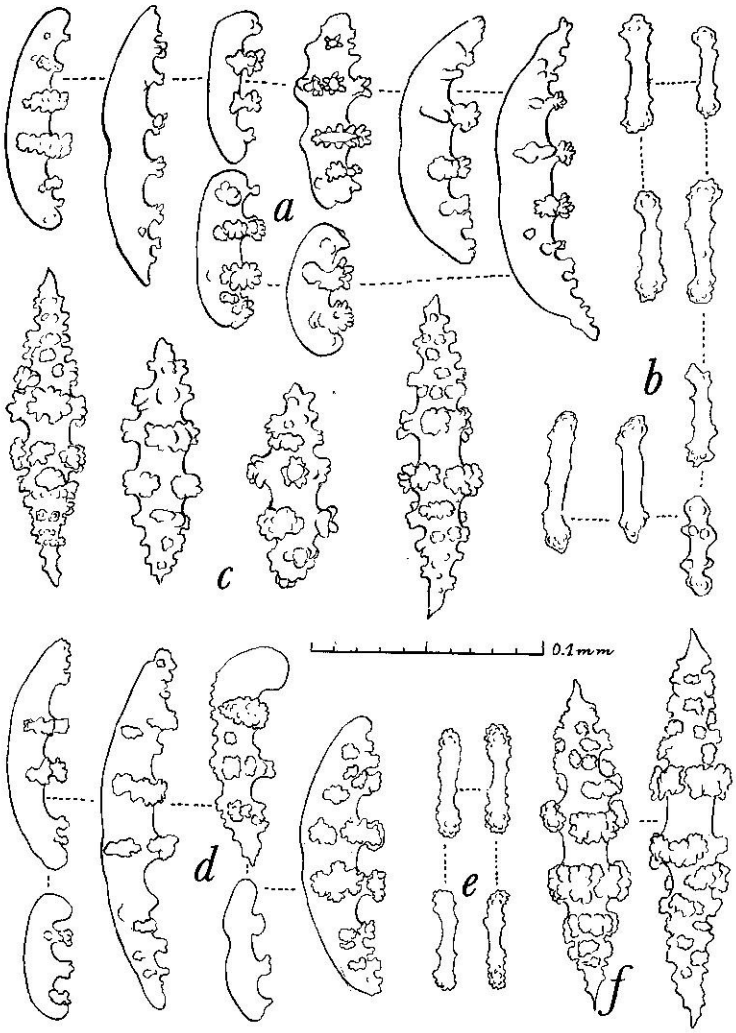


FIGURE 87. *Gorgonia mariae* spec. nov., spicules. *a–c*, of a paratype from St. Eustatius (USNM 50422): *a*, scaphoids; *b*, anthocodial rods; *c*, spindles. *d–f*, of a specimen from Puerto Rico (50073): *d*, scaphoids; *e*, anthocodial rods; *f*, spindles. (All figures drawn to the same scale.)

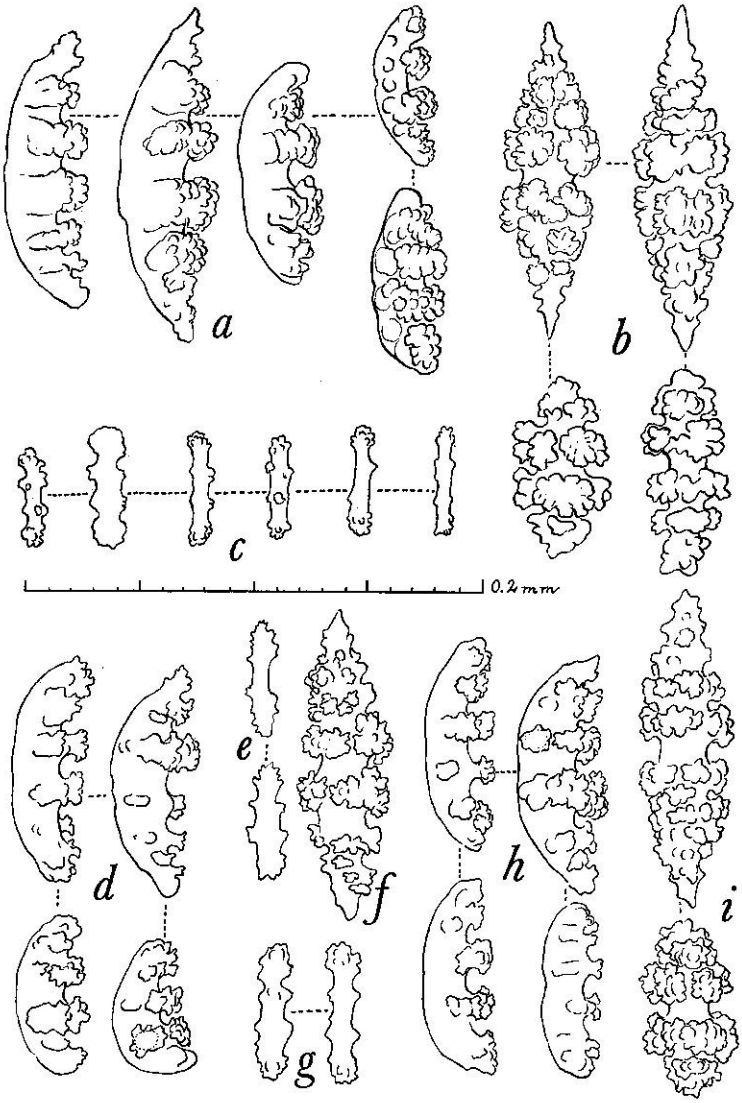


FIGURE 88. *Gorgonia mariae* spec. nov., spicules, *a–c*, of the holotype from St. Eustatius (USNM 50421): *a*, scaphoids; *b*, spindles and capstans; *c*, anthocodial rods. *Gorgonia mariae* forma *cymosa* nov., spicules, *d–i*, of two specimens from St. Martin (50423): *d* and *h*, scaphoids; *e* and *g*, anthocodial rods; *f* and *i*, spindles. (All figures drawn to the same scale.)

most of them are of the usual '*Gorgonia*-type' with transverse belts of very complicated tubercles (Figs. 87 c, f; 88 b). A few short, stubby capstans may be present, in some colonies but seem to be missing from others. The anthocodial rods, which are narrow and have enlarged ends (Figs. 87 b, e; 88 c), reach a length of 0.06 mm. Dry colonies lemon yellow, occasionally tinged with violet near the base; specimens from deeper water nearly white.

Material. From Dr. Hummelinck's collection: St. Eustatius, Gallows Bay, rocks, 2 m., sta. 1116B, 15.VII.1949, 14 specimens (holotype USNM 50421, paratypes 50422). Anguilla, Upper Prickly Pear Island, 17.VI.1949, 1 spec. (USNM 50653).

Other USNM material: One of the specimens reported by Hargitt & Rogers, from off St. Thomas, Sail Rock W. by N., 1/2 N., 6 miles, 20–23 fms., *Fish Hawk* sta. 6079, 6.II.1899 (42153); St. John, 50–200 feet, T. Chess, 1960 (51747–51749); Puerto Rico, 18°27′35″ North, 65°33′35″ West, 26

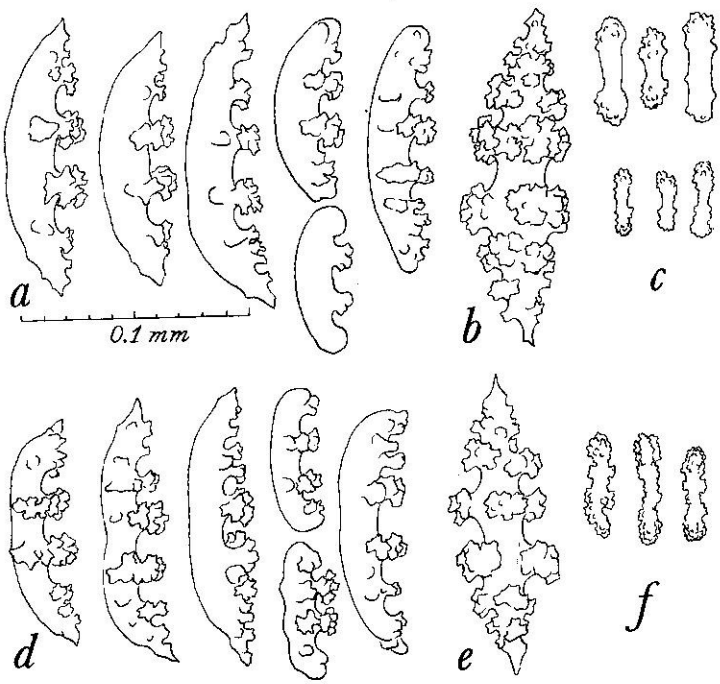


Figure 89. *Gorgonia mariae* spec. nov., forma *plumosa* nov. Spicules of two paratypes from Anegada (USNM 51027): *a*, scaphoids; *b*, spindle; and *c*, anthocodial rods of specimen at left in Pl. XI fig. 4; *d*, scaphoids; *e*, spindle; and *f*, anthocodial rods of specimen at right in Pl. XI fig. 4. (All figures uniformly enlarged according to 0.1 mm. scale.)

fms., *Caroline* sta. 75, Johnson-Smithsonian Exp., 25.II.1933, large but fragmentary spec. (50073); near Santurce, Ted Arnow, XII.1958 (51348); SABA Bank, 17°28′ North, 63°13′ West, Smithsonian-Bredin Exp., sta. 106–56, 13.IV.1956, two spec. (50345). Through courtesy of Dr. Elisabeth Deichmann of the Museum of Comparative Zoölogy, a specimen from CUBA (MCZ 3979), and another without locality (MCZ 3980). Specimens from between St. Thomas and St. John, 15–20 fms., 23. XII. 1905, and between St. John and Thatch Cay, 15± fms., 9. III. 1906, both Th. Mortensen, were examined in Univ. Zool. Museum Copenhagen.

Distribution. Recorded with certainty from Cuba, Puerto Rico, St. Thomas, St. John, Anguilla, and St. Eustatius; the forma *cymosa* from Puerto Rico and St. Martin; the forma *plumosa* from Puerto Rico and Anegada. From a little below low tide to 26 fathoms.

Remarks. *Gorgonia mariae* was first figured by HARGITT & ROGERS under the name *Gorgonia bipinnata* (Verrill), but only the colony was figured. It has, of course, nothing whatever to do with VERRILL's species, which has entirely different spicules.

85a **Gorgonia mariae** spec. nov.
forma **cymosa** nov.

(Fig. 88 d–i; Pl. X fig. 5)

Diagnosis. Regularly anastomosing, flabellate colonies with numerous short, free branchlets arising from one or both faces of the fan. Yellow with purplish tints. Spiculation identical with that of the typical form.

Material. Five colonies of this growth form, collected by Hummelinck on ST. MARTIN, Point Blanche Bay, cast ashore, 5.VI.1955 (USNM 50423).

Five dry specimens, found by Ted Arnow on the north coast of PUERTO RICO, Santurce, 20.VI.1959 (USNM 51351).

Remarks. Two of the above-mentioned colonies demonstrate the fullest development of the *occatoria*-condition, with numerous short branchlets (some of them sub-branched) springing densely from both surfaces of the fan. The other colonies show it to a lesser degree, one of them only slightly. In all cases the spicules (Fig. 88 d–i) are like those of the typical form.

85b **Gorgonia mariae** spec. nov.
forma **plumosa** nov.

(Fig. 89; Pl. XI fig. 1)

Diagnosis. Tall, plumose colonies with anastomosis of inner and

lower branchlets but with many terminal twigs remaining entirely free. Bright yellow, infrequently with purplish tints. Spiculation as in the typical form.

Material. Five colonies of this growth form, collected by Dr. Waldo Schmitt on ANEGADA, Pomato Point, depth about 1 m., Smithsonian – Bredin Caribbean Exp. II, sta. 42–58, 8.IV.1958 (USNM 51027). Dry material found by Ted Arnow on the north coast of PUERTO RICO, near Punta Puerto Nuevo, 24.III.1959, 5 spec. (51349), and 6.VI.1959, 7 spec. (51350).

Remarks. These tall plumose colonies, which reach a height of about 40 cm., have much the appearance of a *Pseudopterogorgia*, and indeed are quite like *P. hummelincki*, although larger. Closer examination reveals a lax but constant anastomosis of branchlets never found in species of *Pseudopterogorgia*, and the terminal portions of these colonies are identical with the free tips of fully anastomosed examples of typical *G. mariae*. The bright yellow color of the rind is the same as in typical *mariae* from shallow habitats, showing similar weak tints of purple. The spiculation (fig. 89) is in such close conformity with that of *G. mariae* forma *mariae* and forma *cymosa* that there can be no doubt that we are here dealing with a single morphologically labile species with at least three growth forms.

Genus **Phyllogorgia** Milne Edwards & Haime, 1850

Phyllogorgia MILNE EDWARDS & HAIME 1850, p. lxxx. (Type species, *Gorgonia dilatata* Esper 1806, by original designation.)

Hymenogorgia VALENCIENNES 1855, p. 13. (Type species, *Hymenogorgia quercifolia* = *Gorgonia Quercus folium* Ehrenberg 1834 = *Gorgonia dilatata* Esper 1806, by monotypy.)

Diagnosis. Colonies flabellate, ramification pinnate, lax, loosely anastomosing; coenenchyme greatly expanded in the plane of ramification, more or less completely filling in the spaces between branches to produce laciniated, leaf-like, or broadly-lobed colonies. Cortical spicules are scaphoids with echinulate convex profile, and stout, belted spindles.

Distribution. Guadeloupe? Brazil.

Remarks. VERRILL (1912, p. 394) correctly observed that anastomosis of the axis occurs in typical *G. quercusfolium*, and that the spicules do not differ from *G. dilatata*, making it impossible to maintain VALENCIENNES' genus *Hymenogorgia*.

Several species and varieties of these leaf-corals have been described, largely because of their extraordinary variation in growth form. There is also a wide range of variation in the spicules but, unfortunately, the two variables do not correlate so it is impossible to recognize more than a single species.

86 **Phyllogorgia dilatata** (Esper), 1806

(Fig. 90; Pl. X fig. 6)

Gorgonia dilatata ESPER 1806, Fortsetz. 2, p. 25, pl. 51. ("Wahrscheinlich das Meer des südlichen America.")

Gorgonia Quercus folium EHRENBERG 1834, p. 367.

Phyllogorgia dilatata, MILNE EDWARDS & HAIME 1850, p. lxxx. (Bahia.)

Phyllogorgia foliata VALENCIENNES 1855, p. 13. (Guadeloupe.) [Nomen nudum.]

Phyllogorgia foliata VERRILL 1912, p. 397, pl. 33 fig. 5. (Guadeloupe; locality doubtful.) [Spicules of type in Paris Museum described and figured; name validated.]

Phyllogorgia frondosa VERRILL 1912, p. 395, pl. 31 fig. 2, pl. 33 fig. 4, pl. 35 fig. 8. (Abrolhos Reefs, Brazil.)

Phyllogorgia quercifolia var. *quercifolia* + var. *lacerata* VERRILL 1912, p. 394, pl. 30 fig. 3, pl. 32 fig. 1, pl. 33 figs. 1–1a; p. 395, pl. 30 fig. 4, pl. 32 fig. 2, pl. 33 fig. 2. (Cape Frio to Pernambuco.)

Phyllogorgia dilatata, VERRILL 1912, p. 396, pl. 33 fig. 3. (Bahia.) [Spicules of Milne Edwards' specimen in the Paris Museum.]

Phyllogorgia dilatata, BAYER 1959, p. 20.

Diagnosis. As for the genus. The spicules of the cortex are scaphoids of various curvature (Fig. 90 b, c, e, g) and belted spindles, some acute, some blunt (Fig. 90 a, d, f, i). The anthocodiae seem to lack flat rods, but have small octoradiate rods (Fig. 90 h).

Material. Several USNM specimens from Periperí, the Abrolhos Islands, and Fernando de Noronha, BRAZIL, collected by the Hartt Exp. They include specimens of the typical *dilatata* form (5245, 5258), *frondosa* form (5249), *quercifolia* form (5252, 5253, 5257), and *lacerata* form (5256).

Distribution. Guadeloupe? Coast of Brazil from Cape Frio to Pernambuco.

Ecology. VERRILL (1868a, p. 359) quotes HARTT's observations on this species: This is a very common species on the Brazilian coast, and ranges from Cape Frio northward to Pernambuco. It is very abundant at the entrance to the Bay of Victoria, as well as at the Abrolhos, Porto Seguro, and Bahia. It sometimes occurs in some of the larger tide pools on the surface of the reefs at low-tide level, but its usual station is on the edges of the reef, and ranging from low-water mark downward to a depth of 5–6 feet or more. It is sometimes laid bear [*sic*] by spring tides. The color, when alive, is yellowish or pinkish; the latter tint is apt to fade in drying. A small *Ovulum* (*O. gibbosum*) is parasitic on this species.

Genus **Pterogorgia** Ehrenberg, 1834

Pterogorgia (part) EHRENBERG 1834, p. 368. (Type species, *Gorgonia anceps* Pallas, by subsequent designation: MILNE EDWARDS & HAIME 1850, p. lxxx.)

Xiphigorgia (part) MILNE EDWARDS & HAIME 1857, 1, p. 171. (Type species, *Gorgonia anceps* Pallas, by subsequent designation: BIELSCHOWSKY 1918, p. 62.)

Pterogorgia, BAYER 1951, p. 96.

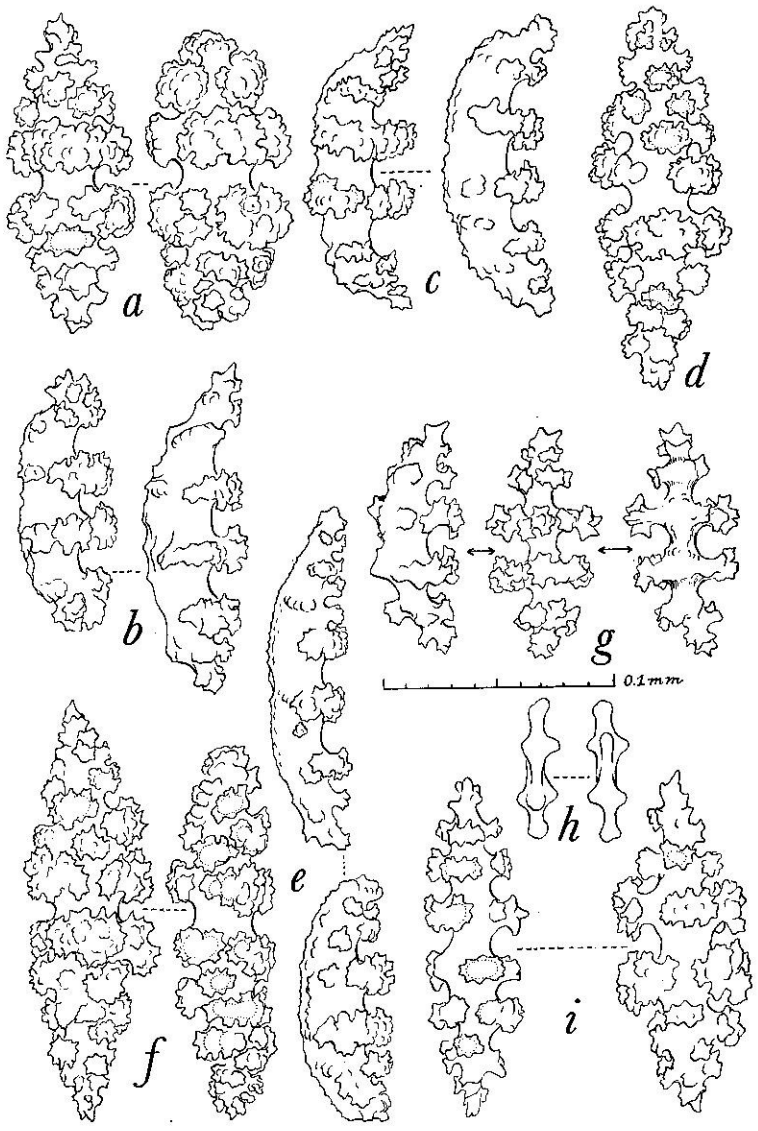


FIGURE 90. *Phyllogorgia dilatata* (Esper), from Brazil, spicules. *a–b*, of a specimen of the *lacerata* form (USNM 5526): *a*, scaphoids; *b*, spindles. *c–d*, of a specimen of the *frondosa* form (5249): *c*, scaphoids; *d*, spindle. *e–f*, of a specimen of typical *dilatata* form (5428): *e*, scaphoids; *f*, spindles. *g–i*, of another specimen of *dilatata* form (5252): *g*, three views of the same scaphoid; *h*, octoradiate rods from polyps; *i*, spindles. (All figures drawn to the same scale.)

Diagnosis. Gorgoniids with lateral branching; polyps retractile into thin, longitudinal cortical flanges. Scaphoids blunt, with coarse ornamentation.

Distribution. Bermuda, southern Florida and the Keys; Greater Antilles south to Curaçao.

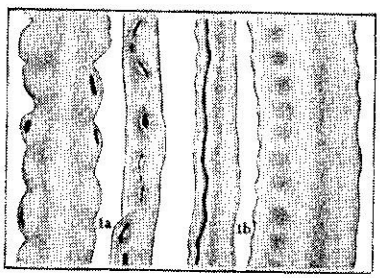
Remarks. I have already pointed out (1951, p. 96) that the application of EHRENBERG's generic name *Pterogorgia* was narrowed by MILNE EDWARDS & HAIME's selection of *Gorgonia anceps* Pallas as genotype to those species having the polyps retractile within longitudinal coenenchymal flanges which impart to the branches a flat or triangular cross section. *Xiphigorgia*, proposed in 1857 and containing *G. anceps* Pallas and *G. setacea* Pallas was consequently stillborn; the genotype designation of *G. anceps* Pallas by BIELSCHOWSKY consigned it irrevocably to its nomenclatural grave as a junior synonym of *Pterogorgia*. Only by extralegal means could it now be re-established, an action that I feel would scarcely be justifiable.

KEY 22

ILLUSTRATED KEY TO THE SPECIES OF *Pterogorgia*

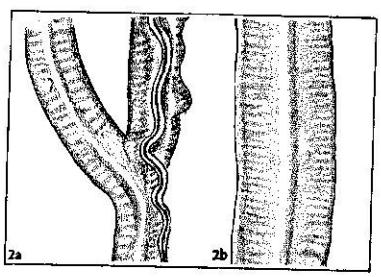
1a. Polyps retracting into low, distinct calyces each with its own separate slit-like aperture, along the two narrow edges of the branches. Color commonly yellow with reddish purple calyces appearing as marginal spots; occasionally uniform olivaceous gray: *Pterogorgia citrina* (Esper)

1b. Polyps retracting into close-set calyces within a common groove along the narrow edges of the branches, calicular apertures usually not appearing as separate slits: 2



2a. Branches 3–6 mm. wide, usually with 3 or 4 edges even in young specimens; some colonies with only a few scattered calyces along one flat side, or with no trace at all of a third edge; colonies tall and bushy when fully developed: *Pterogorgia anceps* (Pallas)

2b. Branches 7–10+ mm. wide, always flat, never more than 2 distinct margins bearing polyps; colonies broad, rather sparingly branched, tending to remain in one plane: *Pterogorgia guadalupensis* Duchassaing & Michelin



87 **Pterogorgia citrina** (Esper), 1792

(Fig. 91 d–f; Pl. IX fig. 5)

Gorgonia citrina ESPER 1792, *2*, p. 129, pl. 38. ("Es wurde diese Coralle aus America beygebracht, und nach jener Anzeige ist die Küste von Neuspanien der bestimmtere Aufenthalt.")
Pterogorgia citrina, DUCHASSAING & MICHELOTTI 1860, p. 30. (Antilles.)
Xiphigorgia citrina, KÜKENTHAL 1916, p. 498, figs. W–Y, pl. 23 fig. 5. (St. Thomas; Tortugas.)
Pterogorgia citrina, BAYER 1951, p. 97.

It is scarcely necessary to redescribe this common shallow-water gorgoniid. Drawings of the spicules (Fig. 91 d–f) and branches (Key 22, la) are given for comparison with those of the other two species. A photograph of the colony is given on Pl. IX fig. 5.

Material. From Dr. Hummelinck's collection, now in the U.S. National Museum: ARUBA, Pova Beach, cast ashore, 27.IV.1955, dry specimen (50737). CURAÇAO, Boca Grandi, cast ashore, sta. 1016A, 2.V.1930, dry fragments (50199). BONAIRE, 1948, spec. in alcohol (50198); Lac, sandy reef, 1.5 m., sta. 1068a, 1.X.1948, alc. spec. (50744). GRENADA, near St. George's, cast ashore, sta. 1392, 22.I.1955, dry spec. (50739). ST. EUSTATIUS, Gallows Bay, rocks, 2 m., sta. 1116B, 15.VII.1949, 6 dry spec. (50195); J. H. Stock, 11.II.1959, purple (51308; Amsterdam). ST. MARTIN, Simpson Bay, cast ashore, 27.V.1949, dry spec. (50197). ANGUILLA, North of Sandy Ground, rocky beach with sandy reef, 1–2 m., sta. 1142, 19.VI.1949, 6 dry spec. and fragments in alc. (50196, 50667).

In addition many other USNM specimens from various West Indian localities including FLORIDA, Palm Beach (49717), Florida Keys (4043), BAHAMAS (14372), JAMAICA, Hanover, Bull Bay (51368), GUADELOUPE (44054), Aruba (50200, received from the Leiden Museum), and MEXICO, Cozumel Island (51771).

Distribution. Bermuda; southern Florida and the Keys to Curaçao.

88 **Pterogorgia anceps** (Pallas), 1766

(Fig. 91 a–c; Pl. IX fig. 4, XXVI)

Gorgonia anceps PALLAS 1766, p. 183. (Mare Americanum.)
Gorgonia anceps, ESPER 1792, *2*, p. 38, pl. 7 ("Die südlichen Küsten von America, und besonders ... Cürassao.")
Pterogorgia anceps, EHRENBERG 1834, p. 369.
Xiphigorgia anceps, KÜKENTHAL 1916b, p. 493, figs. R–V, pl. 23 fig. 4. (Drunken Man Cay, Bai von Kingston, Jamaika.)
Pterogorgia anceps, BAYER 1951, p. 96.

This species is probably as widely known as *P. citrina*. It has much the same geographic range, excepting Bermuda, but inhabits a slightly lower zone. It is a larger species, whose branches come off at an acute angle suggestive of dichotomy. The terminal twigs are always longer, wider, and flatter than those of *P. citrina*. In

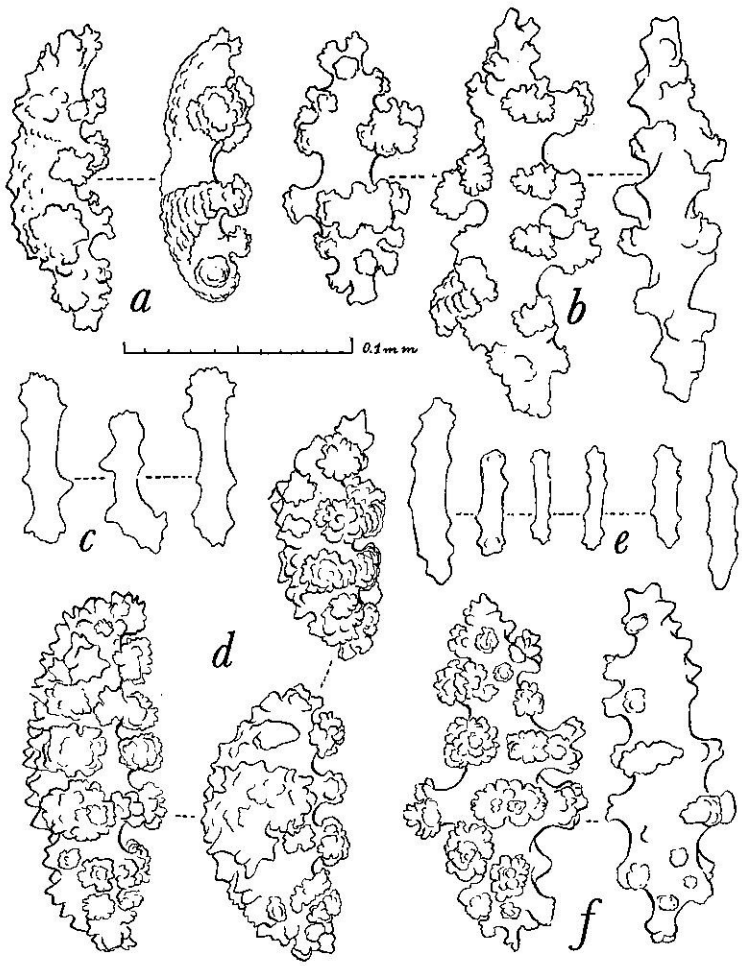


FIGURE 91. *Pterogorgia anceps* (Pallas), spicules of a specimen from Florida (USNM 8855): *a*, scaphoids; *b*, spindles; *c*, anthocodial rods. *Pterogorgia citrina* (Esper), spicules of a specimen from St. Eustatius (50195): *d*, scaphoids; *e*, anthocodial rods; *f*, spindles. (All figures drawn to the same scale.)

the lower parts of the colony there is a strong tendency toward three-flanged branches which is characteristic. Rarely, both *P. citrina* and *P. guadalupensis* may have a few polyps along the flat side of the lower branches, but they never occur so regularly and abundantly as to form a third continuous flange. *P. anceps* ordinarily is brownish purple in color, sometimes olive green or gray, rarely dull yellow. Spicules are illustrated on Fig. 91 a–c, and the complete colony on Pl. IX fig. 4 and XXVI.

Material. A number of USNM specimens, mostly from localities around FLORIDA, Palm Beach (49720), Florida Keys to Dry TORTUGAS (49756, 50369, 50616, 50666), and Sarasota on the Gulf coast (50057); also specimens from the BAHAMAS (50558), CUBA (50701), JAMAICA, Yallahs Point (51407), GRAND CAYMAN (51408, 51409), and MEXICO, Mujeres Hbr., Quintana Roo (51759–51762), Cozumel Isl. (51770), Bahia de la Ascencion, Quintana Roo (51763).

Distribution. Southern Florida to Curaçao; apparently absent from Bermuda.

89 **Pterogorgia guadalupensis** Duchassaing & Michelin, 1846

(Fig. 92; Pl. IX fig. 6)

Pterogorgia guadalupensis DUCHASSAING & MICHELIN 1846, p. 218.
Xiphigorgia guadalupensis, DUCHASSAING & MICHELOTTI 1860, p. 33, pl. 4 fig. 3. (Guadeloupe.)
Pterogorgia guadalupensis, BAYER 1951, p. 97. (Gulf of Mexico.)

An examination of the spicules of this species reveals that they are little different from those of *P. anceps* and *P. citrina*. They include a somewhat higher proportion of branching forms than is usual in the other species, and their sculpture is very coarse (Fig. 92). The specimen collected by Dr. HUMMELINCK in Curaçao has larger tentacular rods (up to 0.1 mm. long) than has *P. anceps*, but those of the specimen from Florida and of another from Curaçao measure 0.08 mm., rarely 0.09 mm.

The wide, flat branches, over 7 mm. across in the terminal regions and 10 mm. or more toward the base, are highly distinctive. All the colonies that I have seen show an inclination to branch in one plane, thus producing a flabellate form (Pl. 9 fig. 6), whereas *P. anceps* is typically quite bushy, branching in all directions.

Material. From Dr. Hummelinck's collection: ARUBA, J. G. v. d. Bergh coll., 1955, dry spec. (USNM 51311). CURAÇAO, received from the Curaçao

Museum, dry spec. (USNM 50315); Boca Santoe Pretoe, rocky beach, about 1 m., sta. 1022, 12.III.1949, several branches in alcohol (USNM 50201).

In addition, the specimens reported by Bayer, 1951 (p. 97), which were collected 4 miles S.W. by W. of Smith Shoal Light, FLORIDA, 24°41′ North, 81°58′ West, in $7^1/_4$ fathoms, by J. Q. Tierney, University of Miami Marine Laboratory Gulf Exp., 29.IX.1948 (USNM 44233).

Distribution. Florida Keys to Curaçao.

Family **ELLISELLIDAE** Gray, 1859

Gorgonellidae DEICHMANN 1936, p. 202.

Diagnosis. Holaxonians branching mostly in one plane, free or anastomosing, or unbranched. Calyces in biserial single or multiple rows; always with a naked tract along the main longitudinal

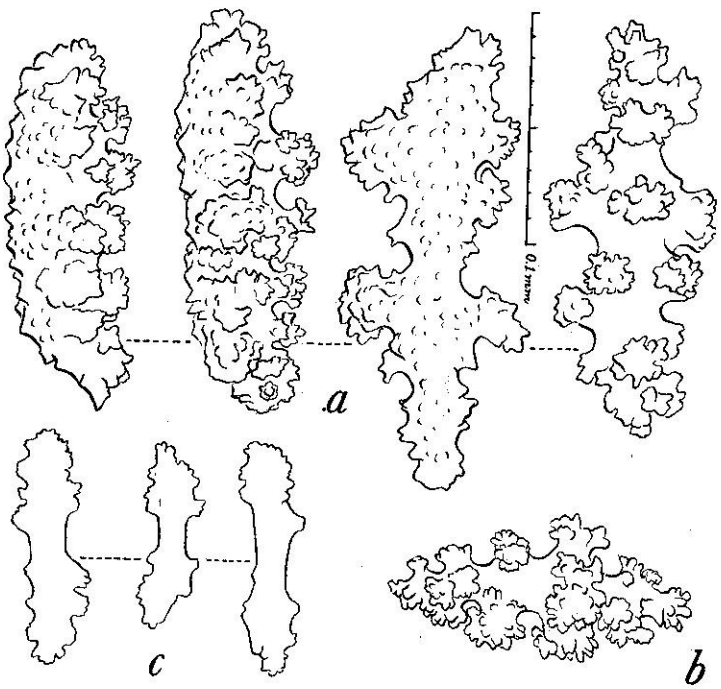


FIGURE 92. *Pterogorgia guadalupensis* Duchassaing & Michelin; spicules of a specimen from Curaçao (USNM 50201): *a*, scaphoids and irregular spindles of outer rind; *b*, spindle of inner rind; *c*, anthocodial rods. (All spicules drawn to the same scale.)

stem canals, of which there are usually two, sometimes three. Cortical sclerites characteristically as small double clubs, 0.05–0.1 mm. long, in some genera becoming more elongate in the calycular walls, where they may reach 0.2 mm. Axis heavily calcified in a radial pattern, the core calcareous and not chambered.

Remarks. This family is unmistakably characterized by the distinctive dumbbell-shaped or double head spicules and the strongly calcified axis with radial structure present in all species.

In the West Indies, there are about a dozen species inhabiting depths ranging from 25 to about 450 fathoms; they have been described and figured in detail by DEICHMANN. Keys to all the genera are given by KÜKENTHAL (1919, 1924), TOEPLITZ (1929), and DEICHMANN (1936).

A key to the West Indian genera is presented below, along with the description of a new species of *Nicella* from the Caribbean Sea.

KEY 23

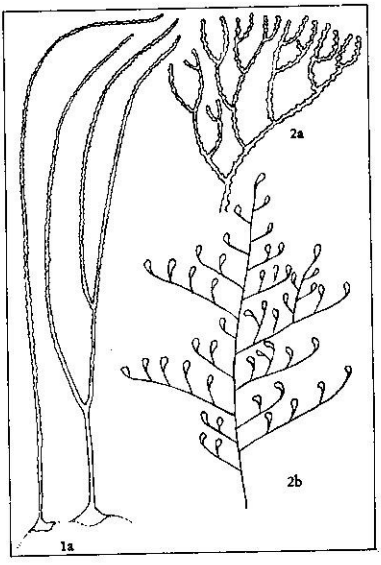
ILLUSTRATED KEY TO THE WEST INDIAN GENERA OF ELLISELLIDAE

1a. Colonies unbranched or with a few long, slender, whiplike branches: Genus *Ellisella*

1b. Colonies with numerous branches mostly in one plane, not long and whiplike: 2

2a. Branching lateral or dichotomous; sympodial: Genus *Nicella*

2b. Primary branching lateral, terminal branching pinnate; monopodial; Genus *Riisea*



Genus **Ellisella** Gray, 1858

Ellisella Gray 1858, p. 287. (Type species, *Gorgonia elongata* Pallas 1766, by subsequent designation: Nutting 1910, p. 31.)
Scirpearia Ehrenberg 1834, p. 288.
not 'Scirpéaires' Cuvier 1817, *4*, p. 85. [*Scirpearia* in several later editions.]
Scirpearia, Deichmann 1936, p. 206.

Diagnosis. Whiplike or sparsely branched ellisellids with polyps biserial or in bilateral tracts. Rind with double spheres 0.05–0.1 mm. in length; calycular walls with spindles or double spindles up to about 0.2 mm. in length.

Distribution. Western Atlantic: Bermuda, Florida, Gulf of Mexico, Caribbean and West Indies. Eastern Atlantic: Azores to South Africa. Red Sea, Indian Ocean, East Indies, eastward in the warmer parts of the Pacific to the Gulf of California (new records, to be reported elsewhere).

Ellisella elongata and *E. barbadensis* occur from the northern shore of the Gulf of Mexico and southern Florida to the vicinity of the mouth of the Amazon River, Brazil, the former at depths from 15 to 120 fathoms and the latter from 11 to 262 fathoms.

Remarks. The differences of spiculation employed in the discrimination of species in this genus are exceedingly subtle and difficult both to interpret and to express in words and simple drawings. The typical size range of the cortical spicules, the relative sizes of cortical and calicular spicules, and the arrangement of tubercles on the dumb-bell shaped cortical sclerites all must be taken into consideration. The size and, to a lesser extent, the form of the pharyngeal sclerites seems to differ among the various species and should be investigated more thoroughly. Due to their small size and the need for careful dissection to locate them, they have not been described for most species and their variability is not known.

Because of its uniformity, the colonial form is of scant importance in the recognition of species, although branching, when it occurs, appreciably narrows the field that must be searched. The development of calyces is also a character of limited value, because in a single colony the polyps in the upper parts may produce tall, cylindrical verrucae but retract fully toward the base; however, species that usually have tall, rigid verrucae almost always show some indication of them. Color is consistent in some species but not in others and is therefore unreliable.

Large species of Ellisellidae, such as *Ellisella barbadensis* and *E. elongata*, require a rocky substrate for attachment. Where conditions are suitable, they may grow

in dense stands at depths from a few feet below low tide down to 10 or 20 fathoms. Smaller species may inhabit sandy or muddy bottoms, where they attach to any small pebbles or shells that may be present, or even lie prone and grow quite free of any attachment.

Six valid species are described from the western part of the Atlantic under the generic name *Scirpearia* by DEICHMANN (1936). Two of these are found in shallow water in the West Indian region, where they can be dredged with limited equipment or collected by diving. These two species that extend upward into shallow water are described as representatives of the genus. *Ellisella atlantica*, *E. juniculina*, and *E. grandis* also occur at moderate depths (BAYER 1958a, p. 386); at present, *E. grandiflora* Deichmann is known only from 191–218 fathoms.

90 **Ellisella barbadensis** (Duchassaing & Michelotti)

(Fig. 93)

Juncella barbadensis DUCHASSAING & MICHELOTTI 1864, p. 22, pl. 5 figs. 5–6. (Barbados; Guadeloupe.)
not *Juncella barbadensis*, WRIGHT & STUDER 1889, p. 159.
Scirpearia rigida typica Toeplitz in KÜKENTHAL 1919, p. 859. (No locality.)
Scirpearia rigida var. *tenuis* Toeplitz in KÜKENTHAL 1919, p. 859. (No locality.)
Scirpearia rigida, TOEPLITZ 1929, p. 297, fig. 11, pl. 6 fig. 5 (Barbados, 100 fms.)
Scirpearia rigida, var. *tenuis*, TOEPLITZ 1929, p. 299, fig. 12, pl. 6 fig. 5a. (Barbados, 183 meters.)
?*Scirpearia flagellum*, TOEPLITZ 1929, p. 308, fig. 16. (Barbados, 55 meters.)
Scirpearia barbadensis, DEICHMANN 1936, p. 208, pl. 24 figs. 1–19. (Havana; St. Croix; Grenada; Barbados; 92–262 fms.)
Ellisella barbadensis, BAYER 1958a, p. 386, fig. 4b. (South of Mobile, Alabama, 41–42 fms.)
Ellisella barbadensis, BAYER 1959, p. 21, fig. 9. (Surinam; Brazil; 75–110 fms.)

Diagnosis. Flagelliform colonies reaching a large size. Calyces upturned, prominent; biserial or in multiple lateral bands. Spicules of outer cortex predominantly dumb-bell forms in the shape of double heads, reaching a length of 0.06 mm.; capstans infrequent, chiefly localized in the axial sheath, where they reach a length of 0.07–0.08 mm. Spicules of the calyces including many double spindles up to 0.11 mm. in length. Color of colony (dry) white to brick red.

Description. The specimen from which the accompanying illustrations were made is an exceptionally large one collected by diving off the south east coast of Florida. The colony was more than 6 feet in length, with a diameter of about 8 mm. near the base.

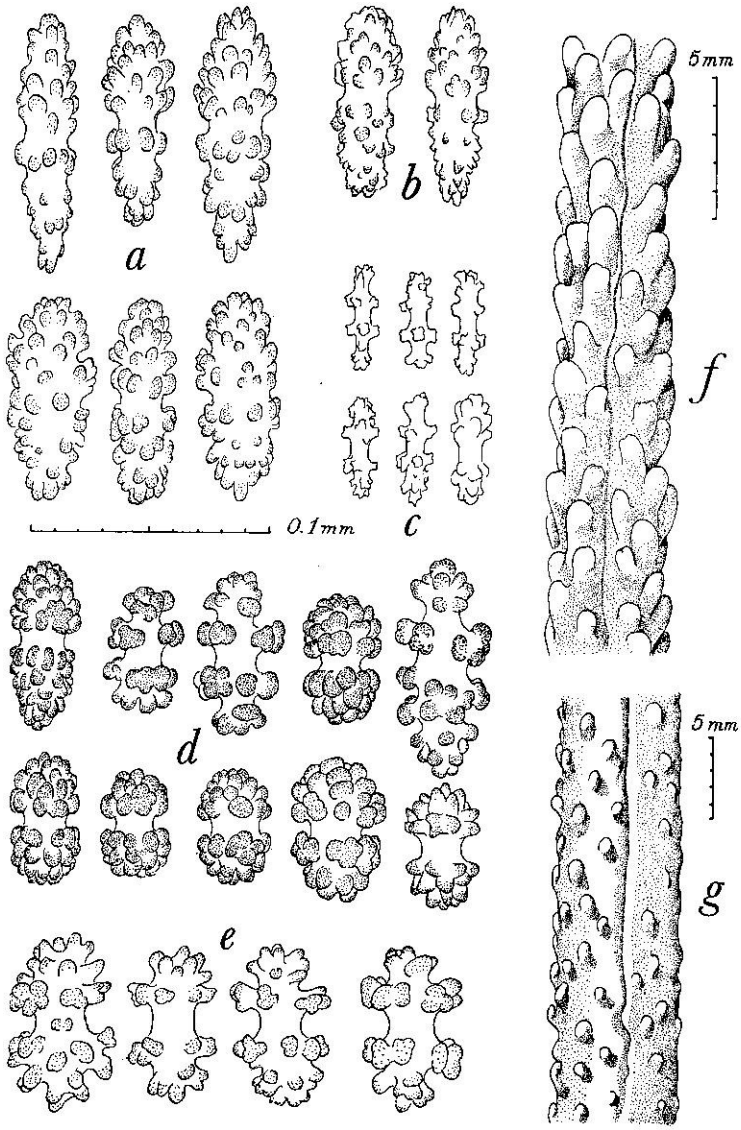


FIGURE 93. *Ellisella barbadensis* (Duchassaing & Michelotti): a specimen from Port Everglades, Florida (UMML 7-181; also USNM 51342). *a*, pale yellow, flattened calycular rods; *b*, practically colorless, flattened tentacular rods; *c*, colorless pharyngeal rodlets; *d*, deep amber-colored double-head (predominant) and capstan types of dumb-bells from outer cortex; *e*, more or less flattened, pale yellow capstans from axial sheath; *f*, part of the colony within about 1 foot of apex; *g*, part of the colony close to the base. (All spicules uniformly enlarged according to 0.1 mm scale; enlargement of *f* and *g* indicated by individual 5 mm. scales.)

The extreme tip is not preserved, but the uppermost part observed has a diameter of about 3.5 mm. (exclusive of calyces) and carries the polyps in two bilateral tracts of 3–4 rows, separated by two longitudinal grooves that mark the position of the main stem canals (Fig. 93 f). The calyces are prominent and upturned, in the lower part of the colony appressed and scale-like (Fig. 93 g). In the type specimen, the polyps were originally described and figured as being biserial, but DEICHMANN (1936, p. 208) indicates that the species is of extremely variable external form, and mentions specimens with as many as three rows of polyps in the lateral tracts.

The spicules of the present specimen agree in size and form with those described by DEICHMANN (1936, p. 208). The predominant form in the outer cortex is the double head with regular, close-set tubercles, the plump ones mostly 0.05–0.06 mm. long, the slender ones up to 0.07 mm. (Fig. 93 d). A few spicules of the capstan type, with tubercles arranged in two belts and terminal clusters, are present in the outer cortex, but are found mainly in the axial sheath, where they are distinctly flattened and up to 0.08 mm. in length (Fig. 93 e). The special sclerites of the calyces are elongated, flattened double spindles up to 0.12 mm. in length (Fig. 93 a); similar but smaller bodies occur in the tentacles (Fig. 93 b). The tops of the tubercles are granulated, most conspicuously in the double heads of the outer cortex, more weakly in those of the calyces, tentacles and axial sheath. The pharynx contains rodlets about 0.04 mm. long, with two belts of warts, and a few that resemble the cortical heads on a miniature scale (Fig. 93 c).

In this specimen, the spicules of the outer cortex are of a deep amber color, those of the axial sheath and calyces are pale yellow, and those of the tentacles and pharynx colorless or nearly so. When alive, the colony was bright vermilion red in color; dry, it is dull brick red that brightens to indian red upon moistening with alcohol. The color of the preserved specimen is due to the concentration of colored spicules, but the vermilion hue of the living animal must have been due, at least in part, to unstable cellular pigments.

Five additional specimens, from Miami, Florida, are of closely similar external form, varying somewhat in the size of the calyces and in the size of the spicules, which tend to be smaller than those of the colony from Port Everglades.

Material. Two miles southeast of Port Everglades, FLORIDA, off jetties, depth 65+ feet, collected by Eugene Shinn, 15.VI.1958; tip and lower part of a large colony more than six feet long (USNM 51342). Off sea buoy at entrance of channel to Miami harbor, 115 feet, Eugene Shinn, 1.III.1959; one complete colony 71.5 inches in length, and the uppermost parts of four others measuring 73 inches (broken at both ends), 78.75 inches (broken at both ends), 84.75 inches (cut off at base, attachment missing), and 89.75 inches (cut off at base, attachment missing) (USNM 51343). (Parts of colonies preserved in University of Miami Marine Laboratory reference collection UMML 7–181.) For the privilege of examining these specimens I am indebted to the collector, and to Dr. Harding B. Owre. Also single USNM specimens from off St. Augustine, Florida, 25 fms. (50395); off Havana, CUBA, 213 fms. (10272); south of Mobile, ALABAMA, 41–42 fms (50610); SURINAM, 75–80 fms (51294); and from off the mouth of the Amazon River, BRAZIL, 110 fms. (50904).

Distribution. East coast of Florida and northern shore of the Gulf of Mexico southward through the Antilles to Brazil, at least as far as the mouth of the Amazon River; in depths from 11 to 262 fathoms.

91 **Ellisella elongata** (Pallas)

(Fig. 94)

Gorgonia elongata PALLAS 1766, p. 179. (Oceanus Atlanticus: ex Sinu Gaditano; Curassoa.)

Gorgonia elongata, ESPER 1806, *2*, p. 35, pl. 55. (Trankenbar.)

Ellisella elongata, GRAY 1857, p. 287. (No locality.)

Ellisella elongata, TOEPLITZ 1929, p. 285. (No locality.)

Scirpearia cylindrica TOEPLITZ 1929, p. 306, fig. 15, pl. 7 fig. 7. (Barbados, 40–50 meters.)

Scirpearia elongata, DEICHMANN 1936, p. 212, pl. 24 figs. 46–48. (Montserrat; Barbados; Honduras; 41–120 fms.)

Ellisella elongata, BAYER 1958a, p. 386, fig. 4e–f. (Gulf of Mexico: off Fort Walton, Florida, 13–14 fms.; off Cape San Blas, Florida, 60 fms.)

Ellisella elongata, BAYER 1959, p. 23, figs. 10–12. (Surinam; French Guiana; Brazil; 15–110 fms.)

Diagnosis. Colonies large, branched, with a few long, slender, whiplike but rather stiff branches; young colonies occasionally flagelliform. Calyces hemispherical, low, apertures directed upward; in 2–3 longitudinal tracts composed of 2–5 oblique rows of polyps. Spicules of outer cortex containing many dumb-bells of the capstan type, up to 0.075 mm. long, and smaller double heads mostly 0.05–0.06 mm. Axial sheath containing flattened capstans with weaker tuberculation. Spicules of calyces are short, blunt rods up to 0.09 mm. long. Color (dry) white to brick red, commonly brick red with white calyces.

Description. The specimen from which the accompanying figures were made is a large, branched colony more than a meter in height, with about 25 long, stiff, nearly straight terminal branches. Ramification begins near the base is and dichotomous. The main stem has a diameter of 6 mm. and the terminal branches about 2 mm. (exclusive of calyces). On some branches there are two longitudinal tracts of polyps, on others three. Near the branch tips these tracts are composed of oblique rows of two polyps, gradually increasing in number based up to five; on the largest branches and main trunk the oblique rows of polyps become quite irregular and indistinct.

The spicules of this large example agree in the main with the description and figures of West Indian material given by DEICHMANN (1936). In the outer cortex, dumb-bells of the capstan type (i.e., with two transverse girdles of tubercles and terminal clusters) 0.06–0.075 mm. long predominate but there also are double heads of smaller size, up to 0.05–0.06 mm. (Fig. 94 d). The axial sheath contains flattened capstans up to 0.085 mm. long (Fig. 94 e). The special sclerites of the calicles are blunt double spindles and double rods reaching a length of 0.09 mm. (Fig. 94 a). Similar but smaller spicules are found in the tentacles (Fig. 94 b). As usual, the tubercles of these spicules are granulated, strongly in those of the cortex, faintly in those of the axial sheath and tentacles. The pharynx contains belted rods of remarkably large size – up to 0.085 mm. – longer than the cortical dumb-bells (Fig. 94 c).

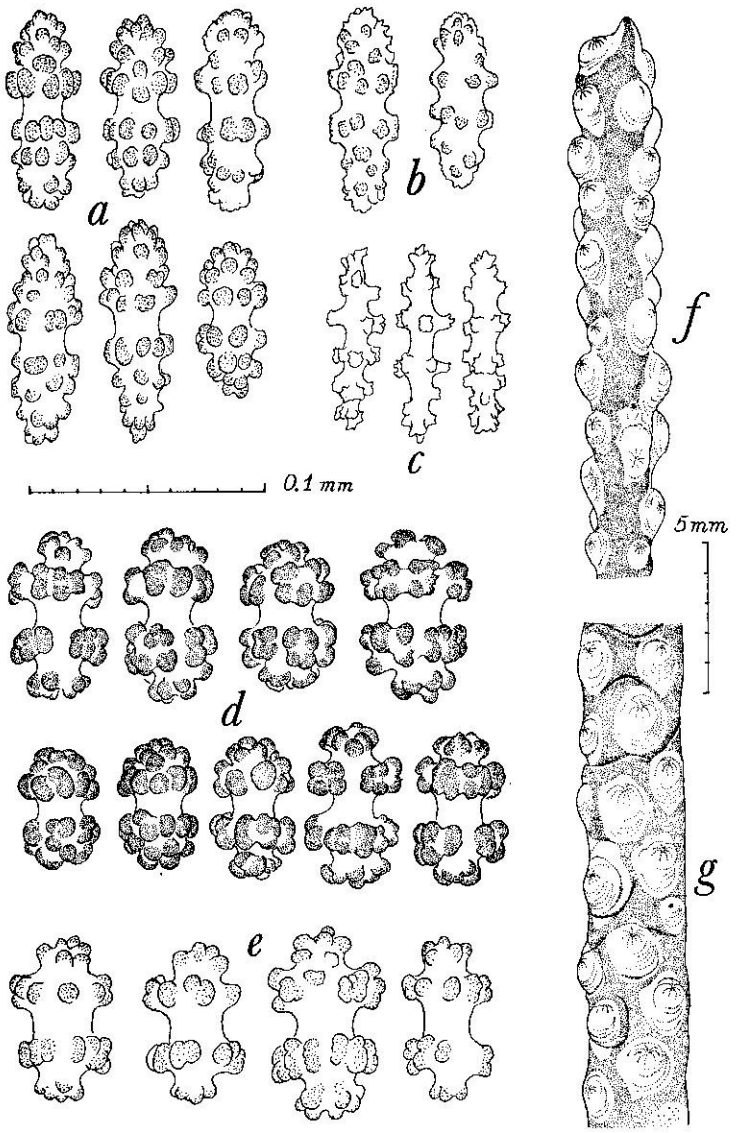


FIGURE 94. *Ellisella elongata* (Pallas): a specimen from off Cape San Blas, Florida (USNM 50415). *a*, colorless, flattened calycular rods; *b*, colorless, flattened tentacular rods; *c*, colorless pharyngeal rods; *d*, amber-colored capstan (predominant) and double-head types of dumb-bells from outer cortex; *e*, more or less flattened, pale yellow capstans from axial sheath; *f*, branch tip; *g*, part of a large branch near its origin. (All spicules uniformly enlarged according to 0.1 mm. scale; enlargement of *f* and *g* indicated by 5 mm. scale.)

In this bicolored specimen, which has white calyces and light brick-red rind ("ferruginous" of RIDGWAY), the spicules of the outer cortex are clear amber yellow in color, those of the axial sheath pale yellow. All spicules of the calyces, tentacles and pharynx are colorless. Other specimens range in color from white to uniform brick-red; the colony illustrated by ESPER is a uniform light red.

Material. A large dry colony roughly 4 feet tall, with about 25 long, stiff endbranches produced dichotomously, dredged off Cape San Blas, FLORIDA, in 60 fms. (Bayer 1958a, fig. 4f) (USNM 50415). Also three other USNM specimens from the Gulf of Mexico, off Fort Walton, Florida, 14–15 fms. (50066; Bayer 1958a, fig. 4e); south of Pensacola, Florida, 30 fms. (50684); and south of Galveston, TEXAS, 47–50 fms. (50900). Specimens from the coast of SURINAM, 75–80 fms. (51295), FRENCH GUIANA, 15 and 19 fms. (50901, 50903) and from BRAZIL, 38 and 110 fms. (50899, 50902; Bayer 1959, p. 23).

Distribution. Northern part of the Gulf of Mexico southward through the Antilles and Caribbean to Brazil, at least as far south as the mouth of the Amazon River; in depths from 14 to 120 fathoms.

Remarks. The 'capstan' form of the cortical spicules differentiates *Ellisella elongata* from *E. barbadensis* and *E. atlantica*, in both of which the 'double head' type of dumb-bell predominates. The branching colonial form further distinguishes it from all other western Atlantic species of *Ellisella* except *E. grandis*, which seems consistently to have slightly larger calicular rods.

Genus **Nicella** Gray, 1870

Nicella GRAY 1870a, p. 40. (Type species, *Nicella Mauritiana* Gray = *Scirpearia dichotoma* Gray, by monotypy.)
Nicella, DEICHMANN 1936, p. 216.

Diagnosis. Ellisellids branched sympodially in one plane, in a dichotomous manner; occasionally lateral. Spicules of rind as blunt double heads, those of the thin axial sheath layer somewhat more flattened and less closely sculptured than those of the outer layer; spicules of the calycular walls as spindles or double spindles about twice as long as the double heads of the rind.

Remarks. Four species of *Nicella* are reported in the West Indies by DEICHMANN (1936) and TOEPLITZ (1929). A fifth, from moderate depths in the Caribbean Sea, is reported below.

92 **Nicella schmitti** spec. nov.

(Fig. 95 a–e)

Diagnosis. Branching unilaterally dichotomous, branches arising at about 45°. Calyces biserial, cylindrical, 1.0 mm. tall, inclined upward. Surface of rind verrucose. Outer cortical spicules as double heads 0.05–0.07 mm. long; axial sheath spicules the same size but flattened and less closely sculptured; spicules of calycular walls as double spindles 0.09–0.1 mm. long. Color of colonies brick red, in alcohol.

Description. Two identical branches from the same dredge haul, and probably from the same specimen, represent the species. The branching is dichotomous in a somewhat unilateral manner, the branchlets almost straight and quite stiff (Fig. 95 a). The diameter of the branches is slightly over 1.0 mm. The calyces are almost cylindrical, about 1.0 mm. tall, and inclined upward; they occur on the two sides of the branches, the individuals alternatingly inclined toward front and back. The surface of the rind is covered with conspicuous papillae and has a distinctly rough appearance. The outer layer of rind contains double heads of the usual type, 0.05–0.07 mm. long (Fig. 95 b); the inner rind, or axial sheath, is extremely thin and contains spicules of the same size but somewhat flattened and less strongly sculptured (Fig. 95 c); the calycular walls contain double spindles about 0.1 mm. long, with a distinct median waist (Fig. 95 d); in the tentacles are small rods with 2–4 whorls of prominent projections (Fig. 95 e). The color of the colony in alcohol is uniformly brick red.

Material. Two branches, from off Colon, PANAMA, 9°32′20″ North, 79°54′45″ West, 34 fms., *Albatross* sta. 2147, 2.IV.1884 (holotype USNM 7587, paratype 7611).

Distribution. Known only from the type locality.

Remarks. This is the first really distinct species of *Nicella* to be reported from the West Indian region since *N. guadalupensis* was described by DUCHASSAING & MICHELOTTI (1860), the other three known forms being either close to or identical with that species. *Nicella schmitti* differs strikingly in external appearance, with its nearly straight branches, prominent cylindrical calyces, and con-

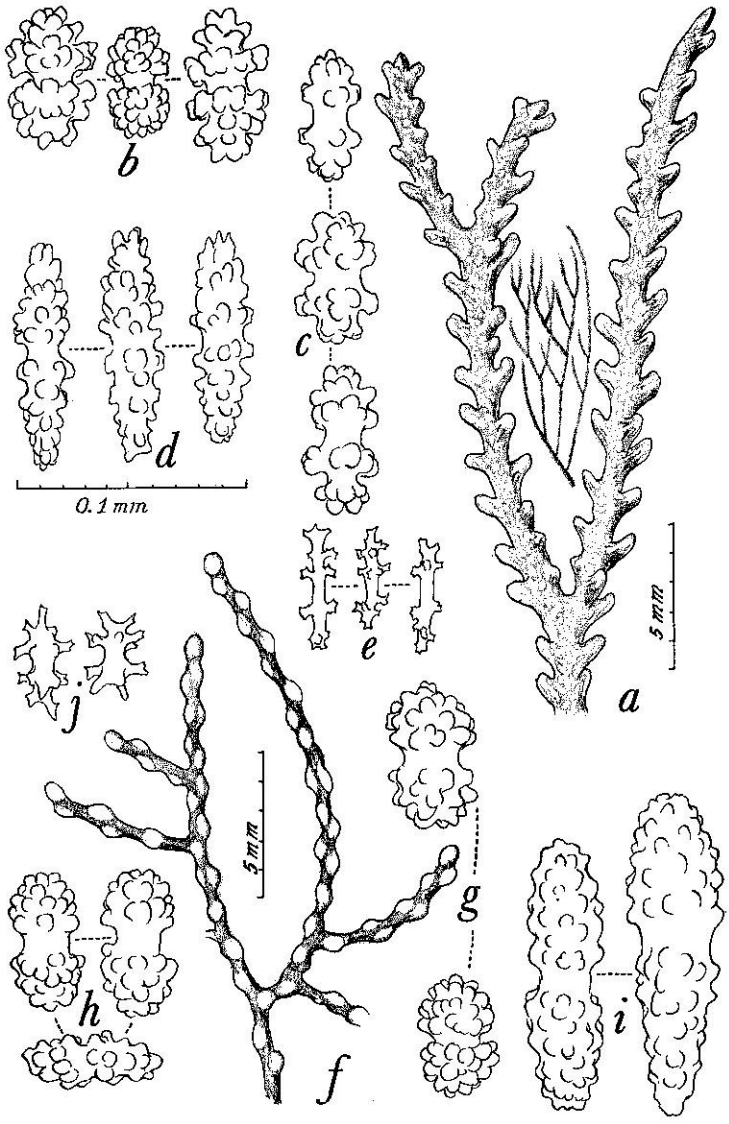


FIGURE 95. *Nicella schmitti* spec. nov., the holotype (USNM 7587): *a*, terminal branches and sketch of branching pattern; *b*, spicules of outer rind; *c*, spicules of inner rind; *d*, spicules of calyces; *e*, spicules of tentacles. *Nicella guadalupensis* (Duchassaing & Michelotti), a specimen from Barbados (49514): *f*, terminal branches; *g*, spicules of outer rind; *h*, spicules of inner rind; *i*, spicules of calyces; *j*, spicules of tentacles. (Enlargement of *a* and *f* indicated by respective scales (but sketch of branching at *a* is reduced); all spicules drawn to the scale indicated at *d*.)

spicuously verrucose rind. The discrepancy in size between the cortical double heads and the calycular spindles is not so pronounced as in *N. guadalupensis*, *N. obesa*, and related species, but much greater than in the species of *Verrucella*.

Spicules of *Nicella guadalupensis* were not figured by DEICHMANN, so a few are shown here for comparison with those of *N. schmitti*.

93 **Nicella guadalupensis** (Duchassaing & Michelotti), 1860

(Fig. 95 f–j)

Verrucella guadalupensis DUCHASSAING & MICHELOTTI 1860, p. 33, pl. 4 figs. 5–6. (Guadeloupe.)
Nicella guadalupensis, DEICHMANN 1936, p. 218, pl. 36. (Dry Tortugas to Barbados.)

Diagnosis. Branching more or less unilaterally dichotomous, branches arising at 80°–90° (Fig. 95 f). Calyces hemispherical or verruciform. Surface of rind smooth. Outer cortical spicules as double heads 0.06 to 0.07 mm. long (Fig. 95 g); those of the axial sheath similar in size and form but flattened (Fig. 95 h); calycular spindles 0.1–0.15 mm. long (Fig. 95 i). Color of rind brick red or dark orange; calyces white or yellow.

Material. The specimen illustrated, a fragmentary colony from BARBADOS, University of Iowa Barbados-Antigua Exped. sta. 65, 1918 (USNM 49514). Also, a number of colonies from off CUBA (7091, 7617, 49492), PUERTO RICO (50949), VIRGIN ISLANDS (43789), ANTIGUA (49424), Barbados (44119, 44122, 44134–44136, 49473, 49487, 49511, 49516, 50579, 51277), YUCATAN (43052, 49437), HONDURAS (50896–50898), and 'West Indies' (43110).

Distribution. Florida Keys to Barbados, 75–170 fathoms.

Remarks. I have dissected apart the outer and inner cortical layers with great care and find that the spicules are the same in both except for a greater degree of flattening in those of the inner layer. The long double spindles occur only in the calycular walls, not in the inner layer of cortex as has been reported.

Genus **Riisea** Duchassaing & Michelotti, 1860

Rusea DUCHASSAING & MICHELOTTI 1860, p. 18. (Type species, *Rusea paniculata* Duchassaing & Michelotti, by monotypy.) [Erroneous spelling.]
Riisea, DUCHASSAING & MICHELOTTI 1864, p. 14. [Corrected spelling.]
Riisea, DEICHMANN 1936, p. 224.
Riisea, BAYER 1956, p. 215.

Diagnosis. Monopodial, pinnately branched ellisellids with spiculation as in *Nicella*. Calyces clavate, usually terminal on short, slender twigs.

Remarks. The ellisellid affinities of *Riisea* were recognized by KÖLLIKER (1865), but subsequent workers removed the genus to the family Chrysogorgiidae. This arrangement was maintained by KÜKENTHAL and DEICHMANN, although the latter author pointed out the doubt entertained by VERRILL. On the basis of the axis structure, which resembles that of *Nicella* and the other ellisellid genera, *Riisea* has recently been returned to the family Ellisellidae.

Family **PRIMNOIDAE** Gray, 1857

Diagnosis. Arborescent gorgonaceans with a strongly calcified but unjointed axis whose concentric layers are distinctly or strongly undulated in conformity with the longitudinally grooved surface. No radial orientation of calcareous material. Polyps large, 1–5 mm. in height, usually bent inward toward the axis, set in whorls, pairs or singly. Polyp sclerites in the form of scales, usually in eight distinct longitudinal rows, the uppermost scale of each row folding inward to form a sector of the operculum; scales show a cruciform pattern when viewed in the dark field of polarizing microscope.

Remarks. The Primnoidae is a large and important family, most of whose species live at considerable depths. In the tropical western Atlantic, however, some species may be found in depths of less than 100 fathoms, and in the Gulf of Mexico *Callogorgia verticillata* has been taken in water as shallow as 20 fathoms.

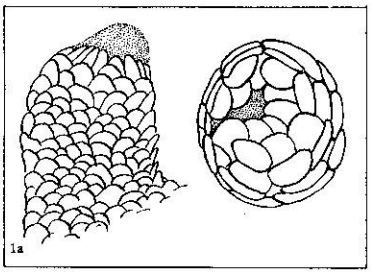
The West Indian primnoids have been thoroughly treated by DEICHMANN (1936), and the large papers of KÜKENTHAL (1919 and 1924) consider the family on a world-wide basis. Detailed treatment in the present work would therefore be superfluous, and coverage is limited to an illustrated key to all of the genera and a few remarks concerning the one species that is known to venture into the bathymetric region under consideration.

Of the thirteen genera herein recognized, seven occur in the West Indian area. DEICHMANN (1936) reports thirteen species and one variety inhabiting depths from 30 to 1742 fathoms.

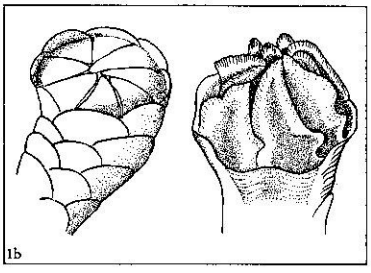
KEY 24

ILLUSTRATED KEY TO THE GENERA OF PRIMNOIDAE

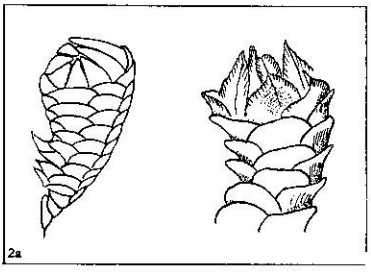
1a. Polyps with scales irregularly arranged; distal scales not differentiated into special marginal and opercular scales: Genus *Primnoeides*



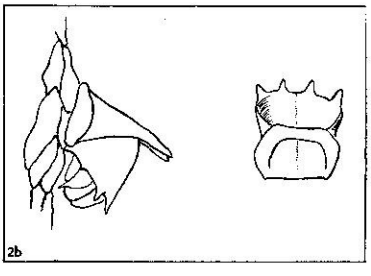
1b. Polyps with scales regularly arranged in longitudinal rows; distalmost scales folding as an operculum over the retracted tentacles: 2



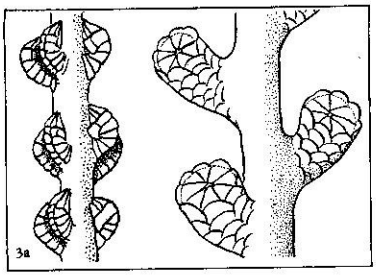
2a. Polyp body protected by numerous scales: 3



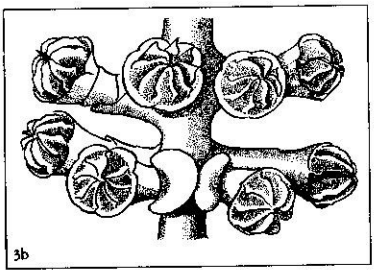
2b. Polyp body encased in a cuirass made up of two or three pairs of large scales that partially or completely surround it and may be fused together ringwise: 11



3a. Polyps inclined upward at angles of 45° or less and often curved inward toward the axis: 4

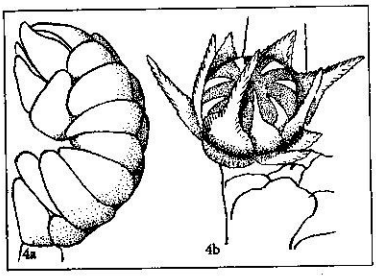


3b. Polyps standing at about 90° with the axis, never curved inward: 9



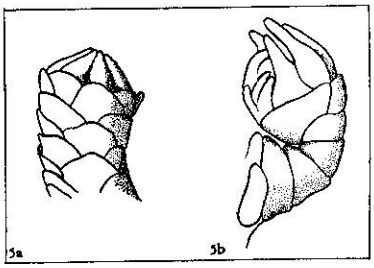
4a. The marginal scales cannot be folded inward over the operculars: 5

4b. The marginal scales can be folded over the operculars, which may be much reduced in size: 8



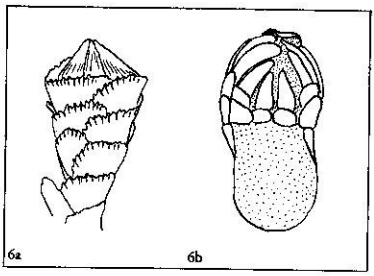
5a. Polyps with eight longitudinal rows of body scales: Genus *Plumarella*

5b. Polyps with fewer than eight longitudinal rows of body scales: 6

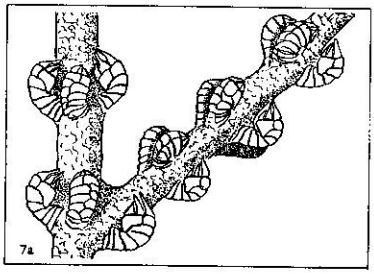


6a. Adaxial body scales about as large as the abaxial: Genus *Pterostenella*

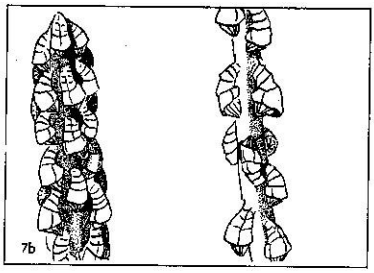
6b. Adaxial body scales reduced in size or completely missing, leaving adaxial surface of polyp almost naked: 7



7a. Polyps regularly arranged in pairs or whorls, usually facing upward: Genus *Callogorgia*

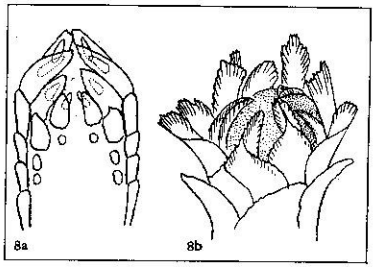


7b. Polyps irregularly arranged, not in whorls, usually facing downward: Genus *Primnoa*

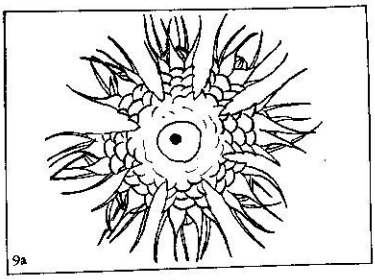


8a. Polyps in whorls, closely appressed to the stem; marginal scales covering operculars which often are reduced in size and completely hidden. Colonies unbranched, whiplike, or with a few long, slender branches produced dichotomously: Genus *Primnoella*

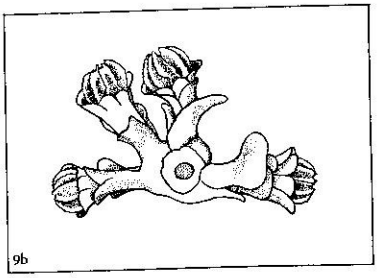
8b. Polyps singly, in pairs, or in whorls but not appressed to the stem; marginal scales not completely covering opercular, which are more or less functional. Colonies profusely branched, usually in the form of a bottle-brush, sometimes dichotomously or pinnately and in one plane: Genus *Thouarella*



9a. Polyps arranged in crowded whorls of eight or more; marginal scales with projecting spines. Colonies unbranched: Genus *Callozostron*

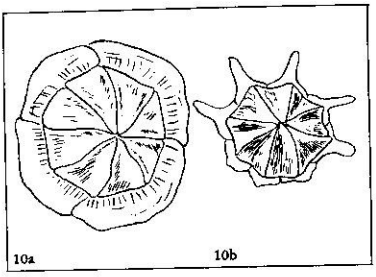


9b. Polyps arranged singly or in widely spaced whorls of five or fewer. Colonies profusely branched: 10



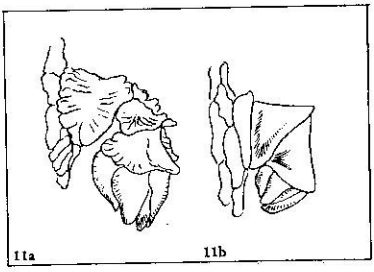
10a. Marginal scales four in number: Genus *Candidella*

10b. Marginal scales eight in number: Genus *Parastenella*

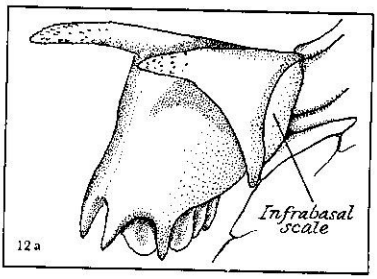


11a. Polyps with three (rarely four) pairs of large body scales: Genus *Navella*

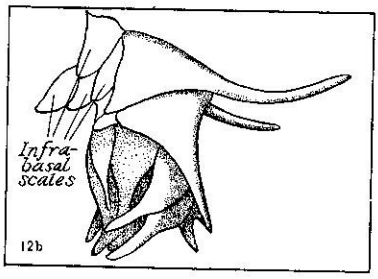
11b. Polyps with two pairs of large body scales: 12



12a. One pair of small infrabasal scales between basal scales and stem scales; no adaxial buccal scales: Genus *Calyptrophora*



12b. Several pairs of small infra-basal scales lie between basal body scales and scales of stem rind; vestigial adaxial buccal scales present: Genus *Arthrogorgia*



Genus **Callogorgia** Gray, 1858

Callogorgia GRAY 1858, p. 286. (Type species, *Gorgonia verticillata* Pallas, by monotypy.)
Caligorgia, DEICHMANN 1936, p. 158.

Calligorgia and *Caligorgia* are quite inadmissible variant spellings; the latter was introduced by WRIGHT & STUDER in the 'Challenger' Report (1889) and so gained wide usage. It must be dropped.

Distribution. This genus has a virtually cosmopolitan distribution, although most of its species belong to the Indo-Pacific region. Two species occur in the West Indies, one of them also in the Mediterranean. One species has been described from the Antarctic and two from cold waters in the North Pacific.

Species of *Callogorgia* characteristically inhabit considerable depths, down to 2472 meters, but in the Gulf of Mexico, the common *Callogorgia verticillata* has been taken as shallow as 20 fathoms.

94 **Callogorgia verticillata** (Pallas), 1766

(Fig. 96)

Gorgonia verticillata PALLAS 1766, p. 177. (Mare Mediterraneum, Atlanticum.)
Caligorgia verticillata, DEICHMANN 1936, p. 159, pl. 25 figs. 5–9, pl. 26 fig. 6. (Cuba, Jamaica, and the Windward Islands.)

This species has been described by DEICHMANN, so it will suffice here only to give a figure and to note that *C. verticillata* has clavate polyps (Fig. 96 b) with strongly sculptured scales (Fig. 96 c) numbering 8–10 in each abaxial row and a low operculum composed of scales with several radial ridges but no terminal tooth (Fig. 96 d), whereas *C. gracilis* (Milne Edwards & Haime) has nearly cylindrical polyps with almost smooth scales numbering 4–7 in each abaxial row, and a tall, conical operculum composed of scales with a strong apical tooth. *C. gracilis* has not yet been found in water as shallow as has *C. verticillata.*

Material. One specimen from the CAMPECHE BANK, Gulf of Mexico, 21°17′ North, 91°18′ West, in 20 fms., *Oregon* sta. 1048, 13.V.1954 (USNM 50527). Also a number of USNM specimens from deeper water (100–250 fms.) off the FLORIDA Keys (44131, 44159, 44160, 44161), Cay Sal Bank (50185), the northern coast of CUBA (10104), and off SURINAM, east of Paramaribo, 75–80 fms. (51257).

Distribution. In the West Indian region, from the Florida Keys to Surinam; also the Mediterranean Sea and probably the eastern part of the Atlantic.

Family **CHRYSOGORGIIDAE** Verrill, 1883

Diagnosis. Holaxonia with axis heavily calcified, its core solid, not cross-chambered; layers concentric, smooth, rarely undulated (one genus); calcification not radial. Sclerites of rind and of polyps in the form of rods or needles, in many species modified into thin scales or plates, with granular or aculeate ornamentation; calcification concentric, no cruciform pattern under polarized light. Basal disk calcareous, simple and adherent to solid objects, or root-like for securing the colony in mud.

Remarks. Inasmuch as this deep-water family has been thoroughly covered by DEICHMANN (1936), treatment here is limited to a key to the genera.

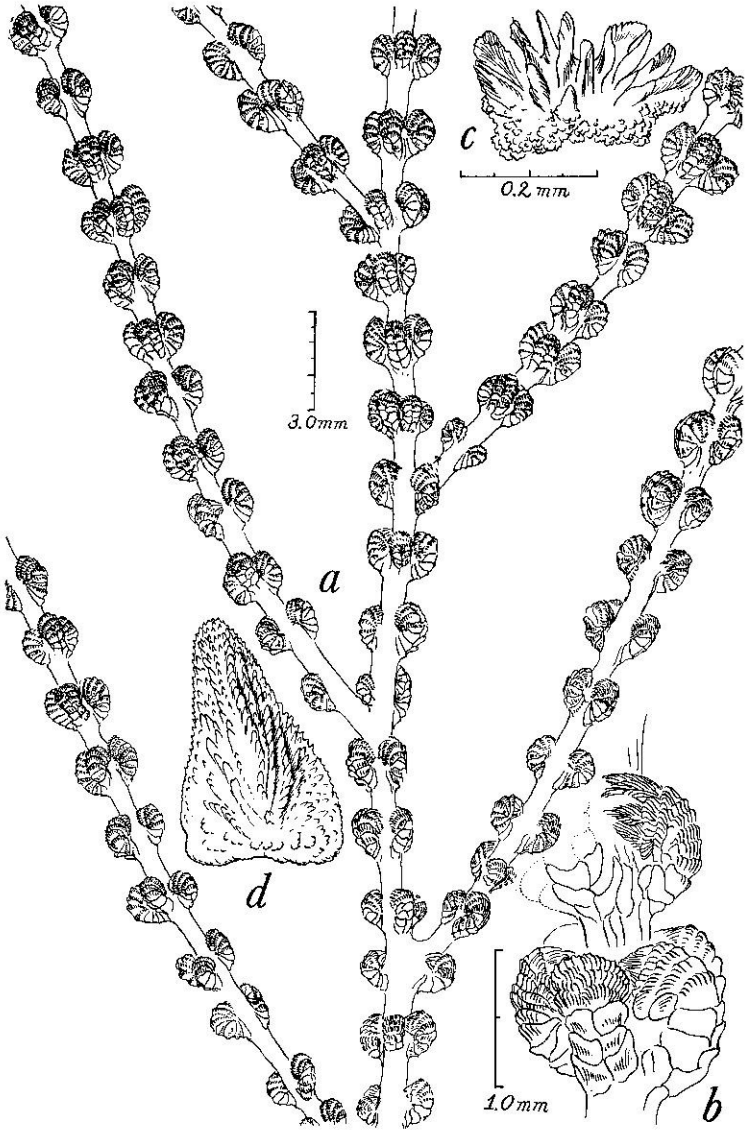


FIGURE 96. *Callogorgia verticillata* (Pallas); a specimen from the Florida Keys (USNM 44159): *a*, part of a branch (enlarged as indicated by 3.0 mm. scale); *b*, whorls of polyps (enlarged as indicated by 1.0 mm. scale); *c*, abaxial body scale (enlarged as indicated by 0.2 mm. scale); *d*, opercular scale (at same magnification as *c*.)

KEY 25

KEY TO THE GENERA OF CHRYSOGORGIIDAE

1a. Polyps without an operculum of eight large plates: 2

1b. Polyps with an operculum of eight triangular plates: Genus *Chalcogorgia* Bayer

2a. Colonies unbranched: Genus *Radicipes* Stearns

2b. Colonies branched: 3

3a. Polyps closely crowded, sometimes in two rows: Genus *Trichogorgia* Hickson

3b. Polyps widely scattered, on all sides or uniserial: 4

4a. Branchlets dichotomizing several times: 5

4b. Branchlets simple, unilateral: 6

5a. Colonies sympodial, usually with a zigzag main trunk: Genus *Chrysogorgia* Duchassaing & Michelotti

5b. Colonies monopodial, with a long, straight main trunk: Genus *Metallogorgia* Versluys

6a. Branchlets arising from the outside of a main stem coiled in an upright spiral. Spicules as plates and spindles: Genus *Iridogorgia* Verrill

6b. Branchlets arising from one side of a straight main setm not spirally twisted. Spicules as irrgular bodies: Genus *Pleurogorgia* Versluys

In the West Indies the Family **ISIDIDAE** Lamouroux, 1812, occurs exclusively in deep water, and therefore is not considered here. See DEICHMANN 1936, p. 237.

Order **PENNATULACEA** Verrill, 1865

Diagnosis. Unbranched colonial octocorals consisting of a primary polyp that elongates to produce a barren proximal stalk, which anchors the colony in a soft substrate, and a polypiferous distal rachis from which secondary polyps arise. Gastric cavity of primary polyp divided into two primary and two secondary longitudinal canals by fleshy partitions at the center of which a more or less calcified horny axial rod usually is produced. Secondary polyps dimorphic. Spicules in the form of smooth, cylindrical or three-flanged rods or needles, rarely tuberculated; or small scales or plates.

Remarks. The order Pennatulacea is not conspicuously represented in the shallow waters of the West Indian region, and since its species are adapted for life on sandy or muddy bottoms they are not to be expected in the reef community. In the western Atlantic, two species of *Renilla* are found intertidally, and could occur in sandy areas associated with reefs. One species of *Virgularia* has been trawled at moderate depths in a number of localities along the Gulf and southeast coasts of the United States, and may be expected in favorable localities throughout the Caribbean area.

Since a complete treatment of the western Atlantic pennatulids is found in DEICHMANN's monograph of 1936, only a few species likely to be encountered in shallow water are mentioned here.

Suborder ***SESSILIFLORAE*** Kükenthal, 1915

Family **RENILLIDAE** Gray, 1860

Diagnosis. Pennatulacea with a slender stalk lacking an axial rod, and a broad, flat frond bearing dimorphic polyps on the upper surface only. Spicules in the form of three-flanged rods or needles.

Genus **Renilla** Lamarck, 1816

Renilla LAMARCK 1816, p. 428. (Type species, *Renilla americana* Lamarck = *Renilla reniformis* (Pallas), by monotypy.)
Renilla, DEICHMANN 1936, p. 257.

Diagnosis. As for the family.

Distribution. From Cape Hatteras to the Straits of Magellan, and from California to Chile; endemic amphi-American.

The species of the Atlantic coast of the southeastern United States is *Renilla reniformis* (Pallas), which also extends into the Antilles. *Renilla mülleri* Kölliker occurs along the Gulf and Caribbean coasts of the mainland south to Brazil. As far as I know, *R. reniformis* does not enter the Gulf of Mexico and *R. mülleri* does not occur outside of it to the northward.

95 **Renilla reniformis** (Pallas), 1766

Pennatula reniformis PALLAS 1766, p. 374. (Mare Americanum.)
Renilla reniformis forma *typica* DEICHMANN 1936, p. 259. (North and South Carolina; northern Florida.)

Diagnosis. Frond cordate, not conspicuously wider than long; stalk longer than the radius of the frond, projecting distinctly beyond the notch in which it is inserted. Spicules of stalk shorter than those of the frond. Color rose or pale purple. Some specimens with frond white or yellow and stalk deep purple.

Material. CURAÇAO: Westpunt Baai, in sand near rampart wall, 2.5 m., J. S. Zaneveld, 27.XII.1958, 2 specimens in alcohol (USNM 51276), one with pale violet frond and purple stalk, the other pale yellow with purple stalk; cast ashore, J. S. Zaneveld, 16.IX.1956, 2 spec. in alcohol (USNM 51275), one with pale violet frond and purple stalk, the other with yellow frond and purple stalk. (Both have the frond unusually broad and the stalk unusually short, almost as in *R. mülleri*, but this difference appears to be due in part to the state of contraction; the spicules are quite typical of *reniformis*.) Plaja Djerimi, sandy shore, 11.XII.1948 (USNM 50669). Santa Marta Baai, 7.XII.1958; Vaersen Baai, 25.XI.1958 and 6.I.1959 (USNM 51304); Piscadera Baai, 21.II.1959 (USNM 51303); all collected by J. H. Stock (Amsterdam). Caracas Baai (?), IV.1955, spec. in alc. (USNM 51274). ST. MARTIN: Little Bay, in sand, 1 m., J. H. Stock, 2.II.1959, purple (Amsterdam).

The collections of the U.S. National Museum contain a number of specimens from various localities on the North American coast, including NORTH CAROLINA (43256, 49594), SOUTH CAROLINA (43212, 43251, 50132), and FLORIDA (49723).

Distribution. Southeast coast of the United States from Cape Hatteras to Florida; Antilles; east coast of South America.

Remarks. Specimens from northern localities, especially the eastern coast of the United States, tend to be pale in color, whereas those from the South American coast are usually a much darker purple. The former are referred by DEICHMANN (1936) to forma *typica*, and the latter to forma *americana* Lamarck. These color forms seem to be inconsistent, since specimens from the Antilles may be either uniformly dark purple, or pale (yellowish or purplish white) with a deep purple stalk, and retention of names for them seems to serve no useful purpose.

96 **Renilla mülleri** Kölliker, 1872

(Fig. 97)

Renilla Mülleri KÖLLIKER 1872, p. 106, pl. 20 figs. 172, 176. (Mazatlan; Desterro, Brazil.)
Renilla mülleri, DEICHMANN 1936, p. 258. (Gulf of Mexico; Venezuela; Brazil; Chile; west coast of Central America.)
Renilla mülleri, BAYER 1959, p. 31, fig. 14 (Surinam.)

Diagnosis. Frond reniform, broader than long; stalk short, usually less than the radius of the frond, not conspicuously projecting beyond the notch in which it is inserted. Spicules of the stalk about as long as those of the frond. Color white to deep purple.

Material. Several specimens from the GULF OF MEXICO, between Apalachee Bay and the coast of TEXAS (USNM 49575, 49633, 49680, 49681, 49743, 49810). Five lots from SURINAM, in 10–28 fathoms (USNM 50826–50830).

Distribution. Continental shore of the Gulf of Mexico and Caribbean south to Brazil; west coast of Central America to Chile.

Family **KOPHOBELEMNIDAE** Gray, 1860

Diagnosis. Bilateral seapens commonly of clavate form with tendency toward radial symmetry. Autozooids in more or less distinct ventral and lateral longitudinal rows, leaving a dorsal streak naked. Siphonozooids distributed between the autozooids everywhere on the rachis except along the dorsal streak. Axial rod well developed.

Remarks. This family comprises two genera, both of which are represented in the western Atlantic. *Kophobelemnon* Asbjörnsen, an inhabitant of cold or deep water from the Grand Banks south to the latitude of Virginia, in 215 to 2369 fathoms (mostly deeper than 500 fathoms), is characterized by three-flanged, twisted rods, often with tubercles and serrated edges; *Sclerobelemnon* Kölliker occurs in warm, shallow water in the Caribbean area where it

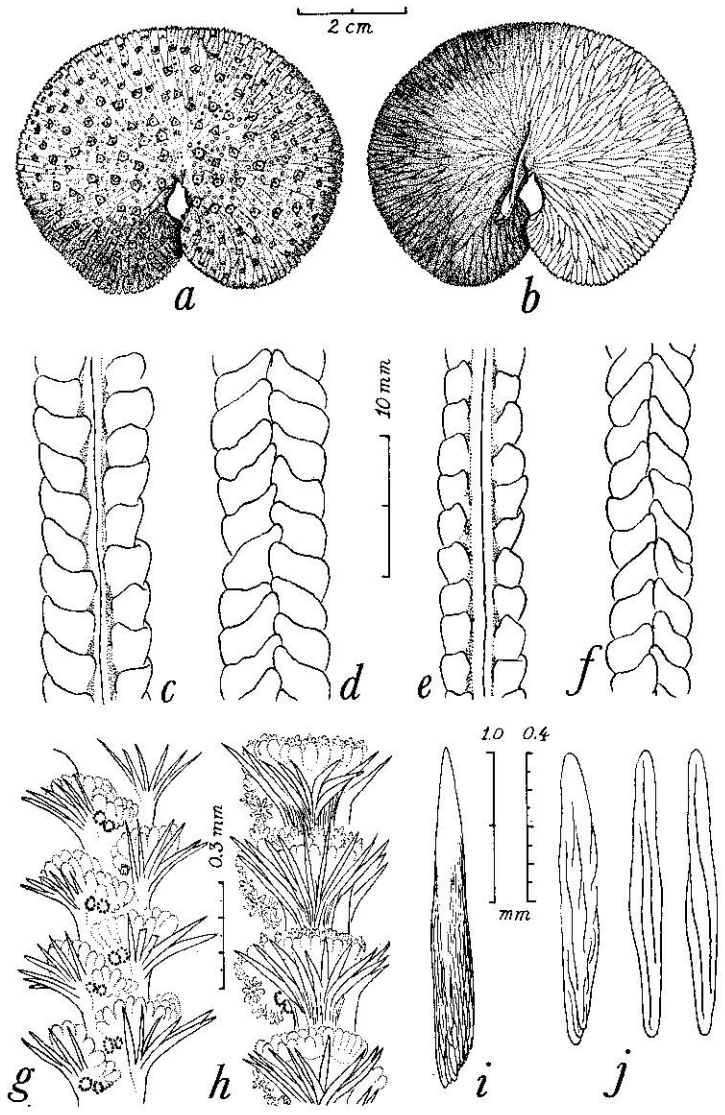


FIGURE 97. *Renilla mülleri* Kölliker, from Surinam: *a*, dorsal view; *b*, ventral view. *Virgularia presbytes* Bayer, from Surinam: *c* and *e*, dorsal view; *d* and *f*, ventral view. *Stylatula diadema* Bayer, from Surinam: *g*, ventral view, and *h*, lateral view of part of rachis of type; *i*, large needle from the supporting fan; *j*, smaller, 3-flanged rods from supporting fan. (Enlargement as indicated by scales.)

is known at present from Trinidad (Gulf of Paria) to Surinam in 30–34 fathoms, and is distinguished from *Kophobelemnon* by its spicules, which take the form of oval platelets that may be somewhat constricted medially and have serrated ends. Both genera have wide ranges outside the western Atlantic.

Genus **Sclerobelemnon** Kölliker, 1872

Sclerobelemnon KÖLLIKER 1872, p. 117, 131. (Type species, *Sclerobelemnon Schmeltzii* Kölliker, by monotypy.)

Mesobelemnon GRAVIER 1907, p. 159. (Type species, *Mesobelemnon gracile* Gravier, by monotypy.)

Sclerobelemnon, HICKSON 1916, p. 77.

Remarks. These clavate seapens resemble some of the radially organized veretillids in both colonial form and spiculation, but have a clearly discernible naked dorsal tract along the rachis, which places them in the section "Pennatulina biserialia" (KÜKENTHAL 1915, p. 26).

97 **Sclerobelemnon theseus** Bayer, 1959

(Fig. 98)

Sclerobelemnon theseus BAYER 1959, p. 33, figs. 18–21. (Gulf of Paria, 31–24 fms.; Surinam, 30 fms.)

Diagnosis. Slender, elongate, slightly clavate *Sclerobelemnon* with stalk slightly more than half the total length. End-swelling of stalk inconspicuous or absent in most specimens. Autozooids in about 9 irregular longitudinal rows, leaving a dorsal streak naked, with indication of pseudocalyces dependent upon degree of contraction. Siphonozooids numerous, in irregular longitudinal rows on all sides of the rachis including the dorsal streak. Autozooids with proximal portion of body wall filled with flat scales somewhat resembling a double-bitted axe head, tentacles with tiny needles longitudinally arranged; surface of rachis with scales like those of pseudocalyces but smaller; stalk with small, oval platelets usually with median constriction and serrated ends.

Description. See BAYER 1959, p. 33.

Material. The type series. TRINIDAD, Gulf of Paria, 31–34 fms., *Albatross* sta. 2121–2122, holotype (USNM 50954) and 19 paratypes (7072); SURINAM, *Coquette* sta. 226, 30 fms., paratype (50955), and one other specimen trawled off Surinam (50956).

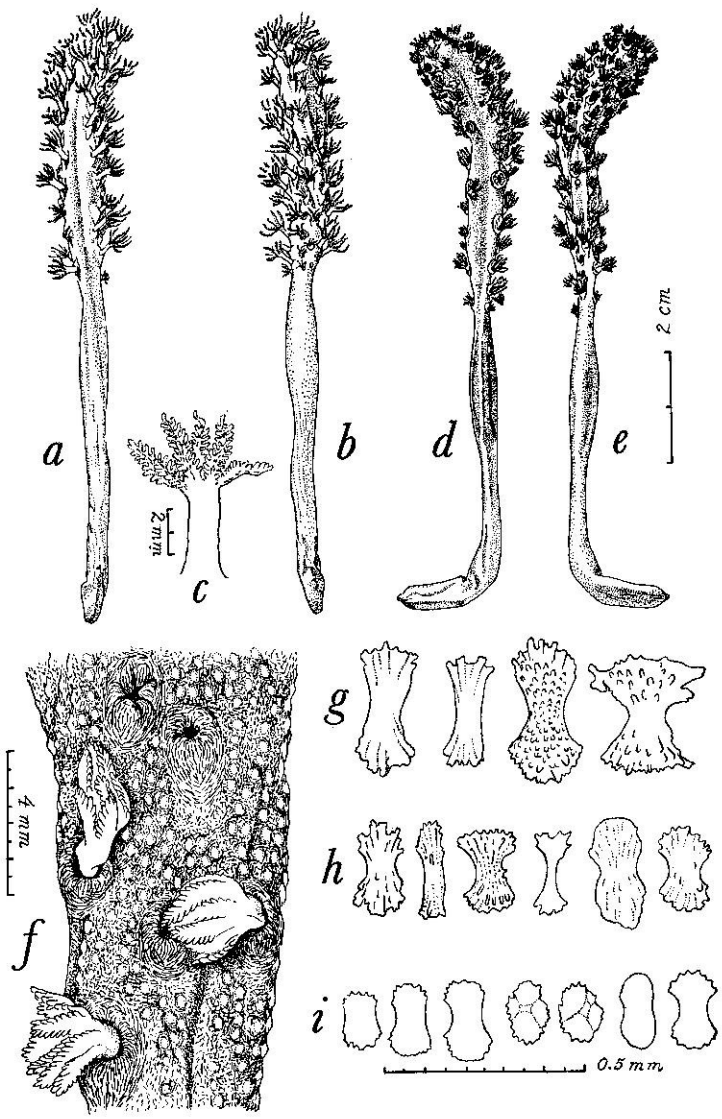


FIGURE 98. *Sclerobelemnon theseus* Bayer: *a*, dorsal, and *b*, ventral view, and *c*, autozooid of paratype from Surinam; *d*, dorsal, and *e*, ventral view, *f*, part of rachis showing expanded autozooids and pseudocalyces of retracted individuals, *g*, scales from pseudocalyces, *h*, scales from surface of rachis, and *i*, platelets from stalk of holotype from Trinidad. (*a–b* and *d–e* drawn to the same scale, as indicated at *e*; *c* and *f–i* as indicated.)

Remarks. This seapen seems to be common at least locally along the northeastern coast of South America, and is no doubt widely distributed on soft ground in the proper bathymetric range along this coast.

Sclerobelemnon theseus can be recognized by its *Kophobelemnon*-like form and its distinctive spiculation, and can be confused with no other species at present known from the Caribbean area.

As seems also to be the case in *Sclerobelemnon schmeltzii* Kölliker from Japan, there is no perceptible midline free of siphonozooids in *S. theseus*, although such a midline is described in *S. burgeri* (Herklotz) and in the species of *Kophobelemnon*.

Suborder ***SUBSELLIFLORAE*** Kükenthal, 1915

Family **VIRGULARIIDAE** Verrill, 1868

Diagnosis. Long, slender Pennatulacea with autozooids arranged in leaves bilaterally along the rachis.

Remarks. Both of the genera included in this family by DEICHMANN, *Virgularia* and *Stylatula*, occur in the West Indian region. The former is represented by a species that is not infrequently dredged in moderate depths.

Genus **Virgularia** Lamarck, 1816

Virgularia LAMARCK 1816, p. 429. (Type species, *Pennatula mirabilis* MÜLLER 1776, by subsequent designation: MILNE EDWARDS & Haime, 1850.)
Virgularia, DEICHMANN 1936, p. 272.

Diagnosis. Virgulariids with crowded leaves composed of autozooids of nearly equal size. Spicules in the form of small corpuscles very sparsely distributed in the stalk or absent entirely.

Distribution. Practically cosmopolitan.

98 **Virgularia presbytes** Bayer, 1955

(Fig. 97)

Virgularia spec. DEICHMANN 1936, p. 274. (Corpus Christi, Texas.)
Virgularia presbytes BAYER 1955, p. 295, figs. 1, 2a–e. (Cape Canaveral, Florida; Mobile, Alabama; Galveston and Corpus Christi, Texas, 9–32 fms.)

Diagnosis. Virgularias with thick, fleshy polyp leaves composed of 13–30 autozooids united by the full length of their anthosteles, showing no distinct projecting calyces and without marginal tubercles; leaves in pairs fused more or less completely on the ventral side of the rachis but well-separated on the dorsal side, leaving free a distinctly grooved dorsal track; siphonozooids in 2–7 irregular, crowded rows between the polyp leaves, in the larger specimens extending out onto the dorsal track in an irregular longitudinal row or field on either side of the median groove. Axis stout, in cross section round toward the apex, oval or dorso-ventrally flattened toward the base. No spicules were found in either the polyp leaves or the rachis.

Material. The original specimens from FLORIDA, off Cape Canaveral, 9 fms. (holotype USNM 50143, paratypes 49755); and USNM material from ALABAMA, vicinity of Mobile (49758), TEXAS, Galveston (43023), Corpus Christi (43214), and SURINAM (50821–50824, 50910).

Distribution. Southeast coast of the United States; Gulf of Mexico; Surinam; probably occurs in the Caribbean. Depths from 9–32 fathoms.

Genus **Stylatula** Verrill, 1864

Stylatula VERRILL 1864b, p. 30. (Type species, *Stylatula elongata* Verrill 1864, non Gabb, by subsequent designation: Kükenthal 1915.)
Stylatula, KÜKENTHAL 1915, p. 67.
Stylatula, DEICHMANN 1936, p. 269.

Diagnosis. Virgulariids with autozooids united to form ridge-like or distinctly foliate polyp leaves supported beneath by a "fan" or "plate" of stout, radiating spicules that may project beyond the margin of the leaves. Spicules in the form of prismatic needles.

Remarks. There appear to be at least four distinctly different species of *Stylatula* in tropical western Atlantic waters. Since they may be locally common in shallow water throughout the area, the following key, based upon information contained in KÖLLIKER's monograph (1870–72) and upon the examination of a limited amount of material, is offered as a provisional guide for their separation.

KEY 26

PROVISIONAL KEY TO THE WESTERN ATLANTIC SPECIES OF *Stylatula*

1a. Siphonozooids lateral on the rachis in the leaf axils, not on the leaves: 2

1b. Siphonozooids in rosettes on the lower surface of the polyp leaves near their ventral end. Autozooids 25–30, in alternating double rows; bodies of autozooids without spicules. 8–12 pairs of leaves in 2 cm. of rachis. Spicular plate with 8–12 large spines: *Stylatula diadema* Bayer

2a. Autozooids 15 or fewer in each leaf: 3

2b. Autozooids 26 or more in each leaf; 9 pairs of leaves in 2 cm. of rachis. Spicular plate with 7–8, sometimes up to 12, large spines: *Stylatula antillarum* Kölliker

3a. Each leaf with a single row of 3–7 distinctly separated autozooids joined only in their lowest parts; tentacles and body walls of autozooids often with spicules. 3–4 pairs of polyp leaves in 2 cm. of rachis; 10–12 large, spinelike spicules in the supporting plate: *Stylatula elegans* (Danielssen)

3b. Each leaf with a single row of 7–8 (up to 12 according to Kölliker) autozooids fused together except for a short, free, distal calycular part; tentacles and body walls devoid of spicules. 6–8 pairs of polyp leaves in 2 cm. of rachis; 4–5 large, spinelike spicules in the supporting plate (my observation of the types in the British Museum; according to Kölliker, 7–8 spines, based upon the same material): *Stylatula brasiliensis* (Gray)

99 **Stylatula diadema** Bayer, 1959

(Fig. 97)

Stylatula diadema BAYER 1959, p. 38, fig. 17 (Surinam.)

Diagnosis. Slender *Stylatula* with 8–12 pairs of polyp leaves in 2 cm. of rachis. Autozooids 25–30 in each leaf, arranged in alternating double row near middle of leaf, becoming a single zigzag row dorsally and ventrally. Supporting plate with 8–12 large needles 2.2–2.7 mm. long, and numerous smaller needles. No spicules in tentacles and body walls. Spicules in rachis arranged in two narrow lateral bands from which the spicules of the supporting plates extend. Siphonozooids placed on lower surface of polyp leaves, in one or two circles or rosettes near the ventral end of the leaves. Axis stiff, rounded-quadrangular, with a shallow groove along each side.

Description. See BAYER 1959, p. 38.

Material. The USNM type series, from four *Coquette* localities off SURINAM: sta. 2, 15 fms.; sta. 144, 14 fms.; sta. 188, 15 fms.; and sta. 191, 14 fms.; 11.V.–10.VI.1957 (holotype 50834; paratypes 50833, 50835).

Remarks. The peculiar location of the siphonozooids serves to distinguish *Stylatula diadema* from all species of the genus heretofore described.

ECOLOGY

The distribution of alcyonarians in diverse habitats is obviously controlled by the physiological requirements of the organisms themselves, and they will occur wherever the environment satisfies these requirements. Unfortunately, little experimental work has been performed upon alcyonarians, so the bulk of knowledge in this field is assumed from work on other anthozoans or depends upon observations on the distribution of various species under diverse ecological situations. The important limiting factors are temperature, salinity, light, and depth. Concomitant factors are the nature of the substrate and sedimentation.

Limiting Factors

Temperature

The only work done on the temperature relations of alcyonarians is that of Cary (1918) who determined the upper limit of tolerance for twelve species growing on the reefs around the Dry Tortugas. He found that the various species were killed by one hour's exposure to temperatures between 34.5° and 38.2° C. The most resistant of the species studied was *Briareum asbestinum* (Pallas), which died after exposure to 38.2° C., and the least resistant were the plexaurids, all of which succumbed to 34.5°–35.0° C. The gorgoniids were intermediate with death temperatures between 37.0° and 37.5° C. Cary found no constant relationship between respiration rate and resistance to high temperatures. The most heat-resistant species, *Briareum asbestinum*, had the lowest rate of respiration, contrary to the situation found in madrepores by Mayer (Vaughan & Wells 1943, p. 56), but the gorgoniids showed the highest rate of respiration, and resistance to high temperature exceeded only by *Briareum*.

In the peripheral populations of a tropic-derived fauna it is naturally the annual minimum water temperature that controls distribution and not the maximum. It has been pointed out by students of coral reefs that hermatypic corals make vigorous growth only in areas with a minimum water temperature not less than 20°C. (= 69°F.) in the coldest part of the year. Since most of the shallow-water alcyonarians in the West Indian region are members of the reef community, we can safely assume that they will conform to the temperature requirements of coral reefs in general, even though we know almost nothing about the requirements of the alcyonarians themselves. Most species must be able to withstand a few degrees less than the minimum temperature required for reef growth or they could not exist in Bermuda where the minimum surface temperature is 66°F. (= 18.9°C.) (FUGLISTER 1947, p. 23), and even in the vicinity of Miami, Florida, surface temperature may be as low as 19.58°C. =(67.3°F.) in mid-winter (Voss & Voss, 1955, p. 207).

Reasonably healthy reef growth occurs at Bermuda, and the alcyonarian component consists of typical Antillean species. VERRILL (1907) reports seventeen species, which represent less than 25% of the Antillean fauna. On the continental shore, the West Indian gorgonian fauna stops roughly at Jupiter Inlet at the northern border of Palm Beach County, perhaps in part because the necessary solid bottom does not prevail north of that point, but no doubt in part also because the warm waters of the Florida Current swing offshore at about that point on the coast. Because of the resultant drop in temperature, a faunal break occurs on the coast of Florida at about Palm Beach, which is therefore a critical area from a zoogeographic standpoint. It would be most instructive to have detailed collections of gorgonians from a number of localities between Miami and Jupiter Inlet, with observations on water temperatures during the cold months.

On the West coast of Florida, Antillean species extend northward in greatly reduced numbers to Alligator Harbor and vicinity, but along this coast the bottom is generally inhospitable to gorgonians, being sandy, and it is difficult to separate the effects of temperature from those of the poor substrate.

North of Palm Beach to the vicinity of the Virginia Capes and Chesapeake Bay, the shallow water fauna is very distinctive, being virtually limited to three species, *Leptogorgia virgulata*, *L. setacea*, and *Lophogorgia hebes*. In slightly deeper water, *Muricea pendula* and *Telesto fruticulosa* also occur. Of these, the first two, and probably also the third, have a disjunct distribution omitting south Florida and resuming along the Gulf coast to extend southward to the reefs of Brazil. The last two species seem to be restricted to the northern part of this range and are characteristic of the so-called Carolinian fauna that has an isolated arm in the northern Gulf of Mexico. These species, which tolerate both low temperatures (less than 45°F. minimum at the mouth of Chesapeake Bay) and low salinities, are not restricted by the maximum temperatures in the tropical part of their range, but according to present records they do not range out into the Antillean islands and must be excluded from that area by some other factor. Their distribution seems intimately tied to the continental shore. Too little collecting has been done along the coastline between Corpus Christi, Texas, and the reefs of Brazil to provide any clear picture of the distributional behavior of the alcyonarians occurring in that region.

The temperature requirements of species typical of deeper waters certainly differ widely from those of reef-dwelling species, but probably are sufficiently narrow to restrict distribution to a limited bathymetric range.

Salinity

Very few species of alcyonarians can be found in waters subject to fluctuations in salinity. Along the southeastern coast of the United States *Leptogorgia setacea* and *L. virgulata* inhabit inshore waters of salinity less than that of the adjacent sea. In Chesapeake Bay, for instance, *L. setacea* has been found generally over the lower half of the Bay or as far north as the mouth of the Potomac River, where bottom salinity was 17.2‰. *Leptogorgia virgulata* has not been recorded from areas of such low salinity although it, too, occurs within Chesapeake Bay. Both species are known also to inhabit purely marine environments.

In areas where coral reefs are best developed, the surface salinity

averages 36‰, but madrepores normally living under these conditions can endure appreciably higher and lower concentrations for short periods. At the Dry Tortugas, experimental work showed that reef corals could tolerate water reduced to 80% of the normal 36.01‰ concentration for 24 hours without ill effects, and concentrations from 110% to 133% of normal salinity for 12 hours (VAUGHAN & WELLS 1943, p. 58). There is no reason to assume that alcyonarians have the same tolerances as reef corals and it remains for experimental work to determine what their capacity is in this regard.

Illumination

Alcyonarians are affected by light in the same way that reef corals are, and for the same reason. Reef-dwelling species are, without known exception, heavily infested with symbiotic algae, the zooxanthellae, which require light for processes of photosynthesis. In the case of madrepores, experimental work has shown that the algae are not essential to the coral, which can live for some months in complete darkness as long as food is provided (YONGE & NICHOLLS 1931). It is therefore not clear whether the algae are indeed the factor limiting the distribution of reef corals to depths receiving sufficient light for photosynthesis. A more intimate relationship has been demonstrated between certain alcyonarians and their zooxanthellae (GOHAR 1940, 1948). In these cases, the algae are necessary to the nutrition of the alcyonarians, which die if deprived of light even though food is provided, and which thrive in light even though starved. No experimental work has been done on the relationship of zooxanthellae to the reef-dwelling Gorgonacea of the West Indian region.

Depth of water

The bathymetric distribution of alcyonarians seems to follow phylogenetic lines, some families being restricted to moderate depths, others to intermediate ranges, and still others to the deep seas. The reef-dwelling species ordinarily do not quite reach the low tide level, since they cannot tolerate exposure to air for any