MARINE BRYOZOANS (ECTOPROCTA) OF THE INDIAN RIVER AREA (FLORIDA)

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ABSTRACT

The distribution and ecology of marine bryozoans of the Indian River area on the east coast of Florida was studied through collections made at 21 stations over the course of a year. Bryozoans were identified from collections of all substrata (e.g., shells, hydroids, algae, rock, seagrasses) on which colonies might be able to grow.

Eighty-four species of bryozoans have been obtained thus far from the waters of the Indian River region. All collections indicated that the availability of a suitable substratum is the chief factor governing distribution of bryozoan species. In the river the main substrata are the relatively short-lived blades of seagrasses on which small, rapidly growing bryozoan species are found. Eighteen species were found in the Indian River; 12 of them in waters of salinities less than 30‰ (estuarine conditions). Coastal stations, with more varied substrata available for settlement and with a wider range of microenvironmental conditions, were richer in species. Twenty-three species were found at Sebastian Inlet inner breakwater, 31 at North Beach breakwater, Fort Pierce, 36 at Walton Rocks, and 31 at Seminole Shores. Offshore areas were also sampled. Twenty-one species were found at Capron Shoals. Twenty-eight species were identified in samples from two R/V *Gosnold* cruises.

In the Indian River area some bryozoan reproduction occurred year-round, but many species reproduced primarily from late fall to early spring, in contrast to the late summer-early fall peak reproduction of bryozoan populations in temperate seas. Biogeographically, the species collected offshore had generally tropical affinities, whereas those collected at coastal and river stations included a number of tropical species, but also many species with broader Western Atlantic or cosmopolitan distributions.

INTRODUCTION

Bryozoans are tiny marine organisms, which form encrusting or arborescent colonies in almost any marine environment where there is a suitable surface for attachment.

From the number of studies (Smitt, 1872, 1873; Osburn, 1914, 1927, 1940; Canu and Bassler, 1928a; Lagaaij, 1963; Shier, 1964; Maturo, 1968; Long and Rucker, 1970; Powell, 1971) that have been carried out in the last hundred years on the bryozoan fauna of the Gulf of Mexico and the Caribbean Sea it might be supposed that this fauna was one of the best known in the world. According to the checklist given by Schopf (1973) 278 species of cheilostomes (the most diverse order of living bryozoans) have been reported from the tropical Western Atlantic region in water of less than 125 m. depth. However, most of these studies were carried out by dredging material. Less is known of the species found in the shallowest coastal waters and the subtidal and intertidal habitats of the inlets and estuaries. Osburn (1914, 1940) did some intertidal collecting and shallow water (less than 55 m.) dredging in the Tortugas and Puerto Rico, and Maturo (1968) included shallow water stations in his study of the bryozoans from the southeast coast of the United States. Shier (1964) collected bryozoans from beach drift material on the northwest coast of Florida. Because no one has collected bryozoans from intertidal and estuarine localities along the Atlantic coast of Florida, it seemed important not only to obtain data on the distribution of species, but also to make collections in various habitats throughout the course of a year, in order to learn more about substratum preference, temperature and salinity tolerance, reproductive periods and other ecological considerations.

ACKNOWLEDGMENTS

The collections and observations for the present study were carried out in 1974 and 1975 during the tenure of a Smithsonian Post-doctoral Fellowship. Systematic study, museum comparisons, and illustration of specimens continued over the next few years, and I am indebted to many people for their

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MATERIAL AND METHODS

Localities Studied

The Indian River is a shallow bar-built estuary, separated from the Atlantic Ocean by a continuous line of barrier islands. It extends along the east coast of Florida for about 180 km., from Cape Canaveral south to Stuart. Three inlets (Sebastian, Fort Pierce, and St. Lucie) cut through to the river in the southern half of the region. At its northern edge, the river is connected to Mosquito Lagoon by the Haulover Canal. In the river salinity ranges from extremely brackish to hypersaline (5–55‰), averaging about 25‰. The average water depth is 1.5 m., therefore, wind-driven tidal movements, turbulence, and temperature changes can affect much of the water column. North of the inlet-influenced areas (above Sebastian) ranges of environmental conditions are wider and more unpredictable than in the southern part of the region (Young and Young, 1977).

Biogeographically this area lies in a temperate-subtropical transition zone between the Carolinean and Caribbean faunal provinces. Many tropical species reach their northern limits in the area (Briggs, 1974). Low temperature stress may be particularly severe, sometimes causing spectacular mortality of tropical fishes (Gilmore, Bullock, and Berry, 1978), and affecting invertebrates as well.

Bryozoans were collected by various means at four stations within the Indian River, four coastal stations, and 13 offshore stations (fig. 1).

Indian River Stations

The seagrasses *Syringodium filiforme* and *Halodule wrightii* form extensive beds in the river. There are a few beds of *Thalassia testudinum* (which is approaching the northern limits of its distribution in this area) (Thompson, 1978). In addition to the seagrasses, free-drifting macroalgae may contribute a large amount to the benthic biomass, as well as providing space and food for other organisms (Benz, Eiseman, and Gallaher, 1979).

Bryozoans were obtained from the Indian River from samples of seagrasses taken by quantitative methods (Young, 1975). Qualitative collections were made at the same stations (Haulover Canal, Titusville, Banana River, Eau Gallie, Sebastian Grass Flat, Sebastian, Link Port Grass Bed, Link Port, Fort Pierce) in March to obtain bryozoans from all substrata (e.g., pilings, mangrove roots, shells, submerged wood, beverage cans, buoys and floats). The stations at Haulover, Sebastian and Link Port were visited also at other times of the year. Bryozoan traps, consisting of wooden slide boxes, filled with glass microscope slides and covered with plastic window screening, were suspended from a piling and from panel arrays in the canal at Link Port. Bryozoans settled and grew on the undersurface of the slides, which were removed, examined, and replaced periodically.

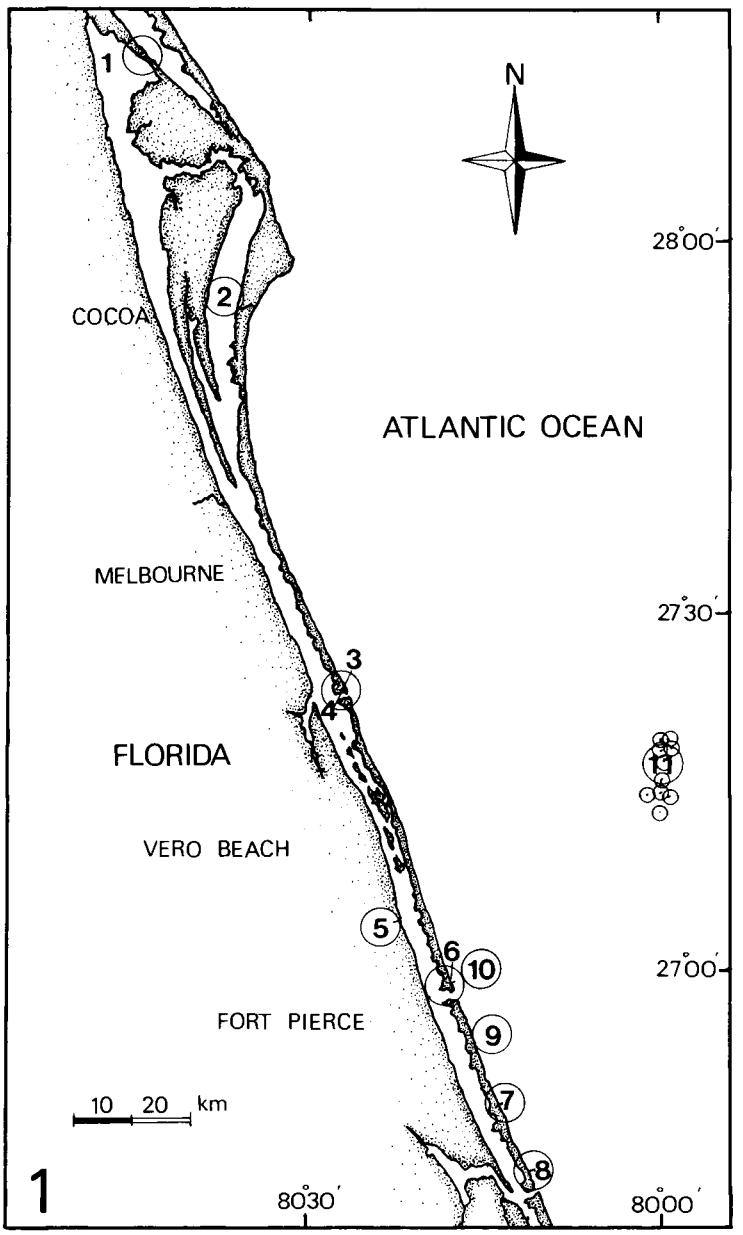


FIG. 1. Map of Indian River region showing collecting localities. 1. Haulover Canal. 2. Banana River. 3. Sebastian Inlet. 4. Sebastian Grass Flat. 5. Link Port. 6. Fort Pierce Breakwater. 7. Walton Rocks. 8. Seminole Shores. 9. Capron Shoals. 10. *Gosnold* Station 766. 11. *Gosnold* stations 696–698, 700–702, 734, 735, 737, 738, 757, 759; Sebastian pinnacle area.

COASTAL STATIONS

Both intertidally and subtidally substrata along the outer coast of the barrier islands consist primarily of sand and shell gravel. Hard substrata are provided subtidally by coquinoid rock ledges and sabellariid worm

mounds, and intertidally by sabellariid mounds, beach rock ledges and the rocks of inlet breakwaters.

Four coastal stations (Sebastian Inlet Breakwater, North Beach Breakwater, Fort Pierce Inlet, and Walton Rocks and Seminole Shores, Hutchinson Island) were sampled several times during the year. Each of the localities differed in ecological conditions and in the types of environments available for bryozoan colonization. The locality chosen for sampling within Sebastian Inlet was the breakwater adjacent to a muddy tidal flat area. On one side of this breakwater, the strong current passing through the inlet exposes organisms living on the rocks to strong water action. On the tidal flat side of the breakwater, the chief influence on distribution of sessile animals appears to be the large amount of fine sediment which settles from the water in this calm area. The North Beach Breakwater at Fort Pierce Inlet is exposed to very strong wave action, but many protected habitats are present within caves and crevices between the rocks. The Walton Rocks locality is on the ocean side of Hutchinson Island, immediately south of the intake canal for coolant water for the nuclear power plant (at the time of this study the power plant was not yet in operation). Here the primary substrata for attachment are beachrock ledges and loose rock in sandy channels between the ledges and the shore. The habitat is exposed to strong wave action, causing constant movement of sand and changes in sand level, and, on very low tides to the drying action of sun and wind. The sabellariid reefs at Seminole Shores are strongly developed on the coquinoid ledge base, and habitats available to bryozoans include the worm tubes themselves, as well as loose rocks and rock ledges and hydroid and algal substrata.

Offshore Stations

In addition to these intertidal stations, samples were taken several times during the year at Capron Shoals, a subtidal (8–15 m. depth) area about 7 km. south of Fort Pierce Inlet, where substrata ranged from coarse shell debris to fine shell hash and sand.

Cruises of the R/V *Gosnold* in September 1974 and February 1975, yielded specimens of bryozoans from the fossil *Oculina* reef pinnacles at 60–90 m. depth. Stations sampled were all in the vicinity of the Sebastian Pinnacle System (20°49.5′ N and 79°58′ W) a complex of topographic prominences formed by oolitic limestone mounds and relict coral reefs, with substrata ranging from rock, shell hash, sand, to *Oculina* rubble, other unconsolidated coral debris, and a small amount of living *Oculina varicosa* (Avent, King, and Gore, 1977; Thompson and Gilliland, 1980). On the February cruise collections were also made at two stations immediately off Fort Pierce Inlet (at 10 m. depth) in a sand bottom area.

Examination of Specimens

In making these collections, the different microenvironments such as crevices, protected surfaces of rocks, shells, various algae, hydroid stems, and roots were examined carefully for bryozoans. Samples of each substratum were taken to the laboratory and examined further under the dissecting scope, so that detailed observations could be made on behavior and morphology of bryozoan species living on them. Examining such substrata as large masses of hydroids in this way was a tedious process, but many tiny and non-calcified species were found that would probably have been overlooked in the field. Morphological measurements were made of the most common species and notes were taken on the characteristic behavior and coloration of the species when alive and information was recorded on growth stage of the colony, presence of reproductive structures or embryos, and occurrence of degenerated zooids with storage granules (common in overwintering or oversummering colonies).

Illustration of Specimens

Most of the species found in these collections have been illustrated. For species without calcification or with very delicate calcification drawings have been made from preserved material or slides of living colonies. Calcified species are illustrated by SEM.

The specimens were first treated in Clorox (either thoroughly or lightly depending on degree of calcification), then cleaned ultrasonically in distilled water, air-dried and mounted on stubs. Specimens were sputter-coated with gold-palladium and scanned using a Zeiss Novascan 30 Scanning Electron Microscope. Representative groups of zooids were photographed at 100×. Each specimen illustrated by SEM has received an AMNH catalogue number. This number is given in parentheses at the beginning of the description of that species.

SYSTEMATIC ACCOUNTS

Eighty-four species of bryozoans were collected from river, coastal, and offshore stations of the Indian River area. These species are described below. The classification of the Ctenostomata follows Prenant and Bobin, 1966; of the Cyclostomata, Osburn, 1953; and of the Cheilostomata, Cook, 1968a; Ryland and Hayward, 1977; Hayward and Ryland, 1979.

ORDER CTENOSTOMATA BUSK, 1852
SUBORDER CARNOSA GRAY, 1848
FAMILY ALCYONIDIIDAE JOHNSON, 1849
GENUS *ALCYONIDIUM* LAMOUROUX, 1812

Alcyonidium polyoum (Hassall), 1841
Figure 3

Sarcochiton polyoum Hassall, 1841, p. 484.
Alcyonidium polyoum: Marcus, 1937, p. 125. Osburn, 1953, p. 727. Maturo, 1957, p. 18. Shier, 1964, p. 642. Amor and Pallares, 1965, p. 299.

DESCRIPTION: Colonies forming a gelatinous whitish to brownish crust, never rising into knobs or branches. Zooids hexagonal to irregularly polygonal .46 × .22 mm. in size, with transparent frontal wall through which the polypide may be distinguished. Raised oral papillae present or not depending on degree of retraction of polypide. Polypide with 14 tentacles; lophophore averaging .331 mm. in diameter.

OCCURRENCE AND ECOLOGY: Occurred only once in this study, on the panels at Link Port in April.

DISTRIBUTION: Cold and warm-temperate waters of both the Atlantic and Pacific. Gulf of Mexico.

Alcyondium polypylum Marcus, 1941
Figure 2

Alcyonidium polypylum Marcus, 1941, p. 63.

DESCRIPTION: Colonies transparent orange (single layer) to opaque brick red, forming a uni- to multi-laminar crust from which erect knobs may arise. Zooids polygonal in shape, averaging .47 × .34 mm. Walls thick, with a smooth, glistening surface. No oral papillae. Polypides with orange tentacles and gut, and translucent tentacle sheaths. Fifteen tentacles, lophophore diameter averaging .523 mm.

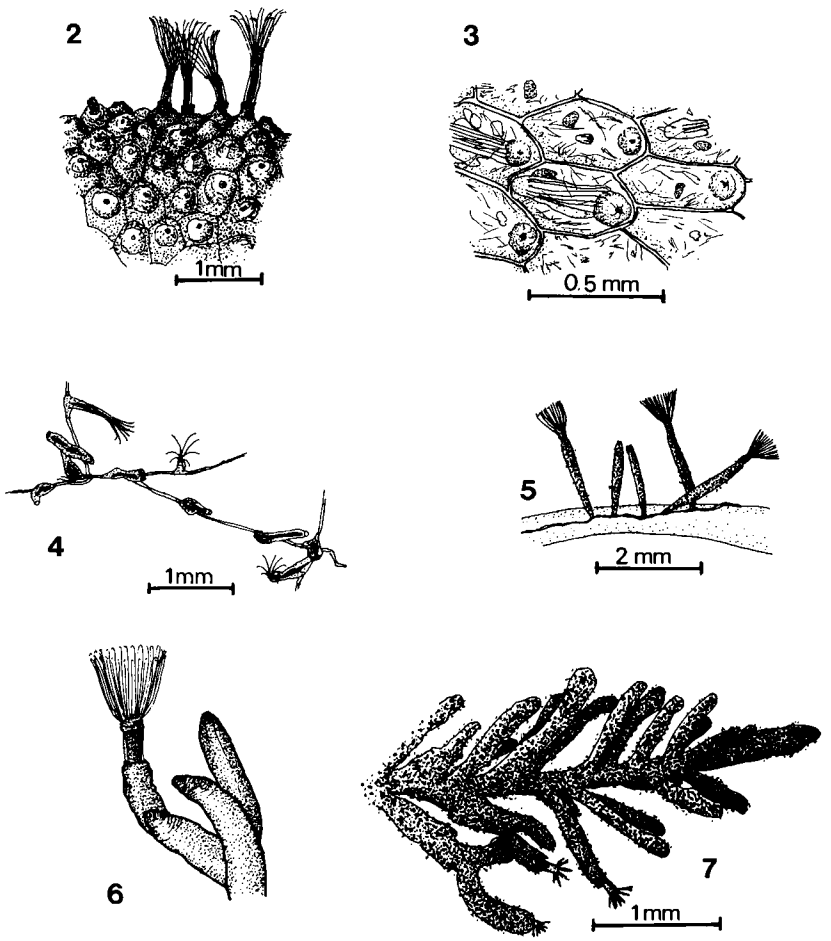
OCCURRENCE AND ECOLOGY: Collected at three locations, Walton Rocks, Seminole Shores (on beach rock and shell) and Capron Shoals (on shell). At Walton Rocks *A. polypylum* formed thin crusts on the undersurfaces of flat pieces of beach rock in the sandy channel between the beach and the first beach rock ledge. According to Marcus (1941), colonies live four years or more. However, in this unstable habitat (face down on sand with level of sand and water constantly changing) it is unlikely that colonies achieved this age, though multilayer crusts occurred. Massive colonies found in April and present through the summer months. In September only single-layered colonies collected at Walton and Seminole. Reproduction of colonies from Capron Shoals noted in October and November. Reproducing zooids have polypides with large intertentacular organs and yellow-orange eggs visible through the thin walls of unilaminar parts of the colonies.

DISTRIBUTION: Brazil, Atlantic coast of Florida. This is the first record of the species from Florida.

SUBORDER PALUDICELLEA ALLMAN, 1856
FAMILY NOLELLIDAE HARMER, 1915
GENUS *NOLELLA* GOSSE, 1855

Nolella stipata Gosse, 1855
Figure 5

Nolella stipata Gosse, 1855, p. 35. Osburn, 1953, p. 737. Maturo, 1957, p. 21.



FIGS. 2–7. 2. *Alcyonidium polypylum.* 3. *Alcyonidium polyoum.* 4. *Victorella pavida,* showing stolon arising from base of zooids, rather than zooids budded separately from stolon as in *Bowerbankia* spp. 5. *Nolella stipata.* 6. *Sundanella sibogae,* group of four zooids. 7. *Anguinella palmata.*

Nolella gigantea Marcus, 1937, p. 131.
Nolella dilatata Marcus, 1938, p. 53. Osburn, 1940, p. 337.

DESCRIPTION: Colony of widely spaced tubular zooids connected by a delicate stolon. Zooids tall and cylindrical (2.1 × .17 mm.), their chitinous walls usually covered with a layer of silt, thus resembling the mud tubes of amphipods or polychaetes. Only careful examination for the presence of stolons or lophophores reveals that the tubes belong to a bryozoan. Polypide with 17 tentacles and an equi-tentacled lophophore averaging .616 mm. in diameter.

OCCURRENCE AND ECOLOGY: Collected at three stations in the river, the Link Port grass beds, Fort Pierce Breakwater and Walton Rocks. Occurs year round. Cryptic in habit, collected on shells, algae, seagrass, and the bryozoan *Zoobotryon.*

DISTRIBUTION: Western Atlantic: Canada to Brazil. Caribbean.

GENUS *ANGUINELLA* VAN BENEDEN, 1845

Anguinella palmata van Beneden, 1845
Figure 7

Anguinella palmata van Beneden, 1845, p. 34. Osburn, 1914, p. 219; 1940, p. 338. Marcus, 1937, p. 133. Maturo, 1957, p. 21. Shier, 1964, p. 649.

DESCRIPTION: Colonies limp brown tufted masses resembling dirt-coated seaweed. Zooids cylindrical (averaging .79 × .13 mm.), covered with fine layer of silt making them completely opaque. Polypide with 10 tentacled lophophore (averaging .205 mm. in diameter) which is protruded from the terminal aperture of zooid. No zooids budding off sides of mature zooids. Only zooids at branch tips with functional polypides.

OCCURRENCE AND ECOLOGY: Common only at one locality, Sebastian Inlet. Most abundant in April when breakwater rocks were coated with mud and muddy masses of *Anguinella* dangled from them. Collected only between January and April with the exception of a colony ½ cm. in height which was found at Walton Rocks, in September.

DISTRIBUTION: Cosmopolitan. Western Atlantic: Massachusetts to Brazil, Gulf of Mexico, and Caribbean.

FAMILY VICTORELLIDAE HINCKS, 1880
GENUS *VICTORELLA* SAVILLE KENT, 1870

Victorella pavida Saville Kent, 1870
Figure 4

Victorella pavida Saville Kent, 1870, p. 34. Marcus, 1940, p. 329; 1953, p. 312. Osburn, 1944, p. 17.

DESCRIPTION: Colonies consisting of creeping chains of zooids, often developing into fuzzy branching masses. Superficially resembling *Bowerbankia,* but while *Bowerbankia* zooids bud from a stolon the stolon arises from the base of each zooid in *Victorella* (fig. 4). Zooid chains simple in young colonies as colonies develop zooids elongate and bud additional stolons or zooids forming a massive network. Zooids cylindrical, averaging .15 × .60 mm. (reported to reach 2–3 mm. in old colonies). Polypides with eight tentacled campylonemidan lophophore, averaging .369 mm. in diameter.

OCCURRENCE AND ECOLOGY: Known to prefer brackish water (Braem, 1951). Collected only once in the Indian River, settling on the panels at Link Port in December, but to be expected in brackish water throughout the area.

DISTRIBUTION: Cosmopolitan in brackish water. Western Atlantic: Chesapeake Bay to Brazil. Not previously reported from Florida.

GENUS *SUNDANELLA* BRAEM, 1939

Sundanella sibogae (Harmer), 1915
Figure 6

Victorella sibogae Harmer, 1915, p. 45. Marcus, 1937, p. 129. Osburn, 1940, p. 336.
Sundanella sibogae: Braem, 1939, p. 267. Marcus, 1941, p. 69. Maturo, 1957, p. 20. Shier, 1964, p. 648.

DESCRIPTION: Colonies encrusting, zooids budding distally producing a single series (unlike *Victorella* the stolon portion only occasionally visible because zooids are large and jumbled on top of each other). Lateral budding occurring, but not observed in uniserial Indian River area specimens. Zooids oval to teardrop-shaped, .50 × 1.45 mm. in size, yellowish brown in color (partially due to adherence of silt particles). Lophophore with 31 tentacles and an average diameter of .820 mm.

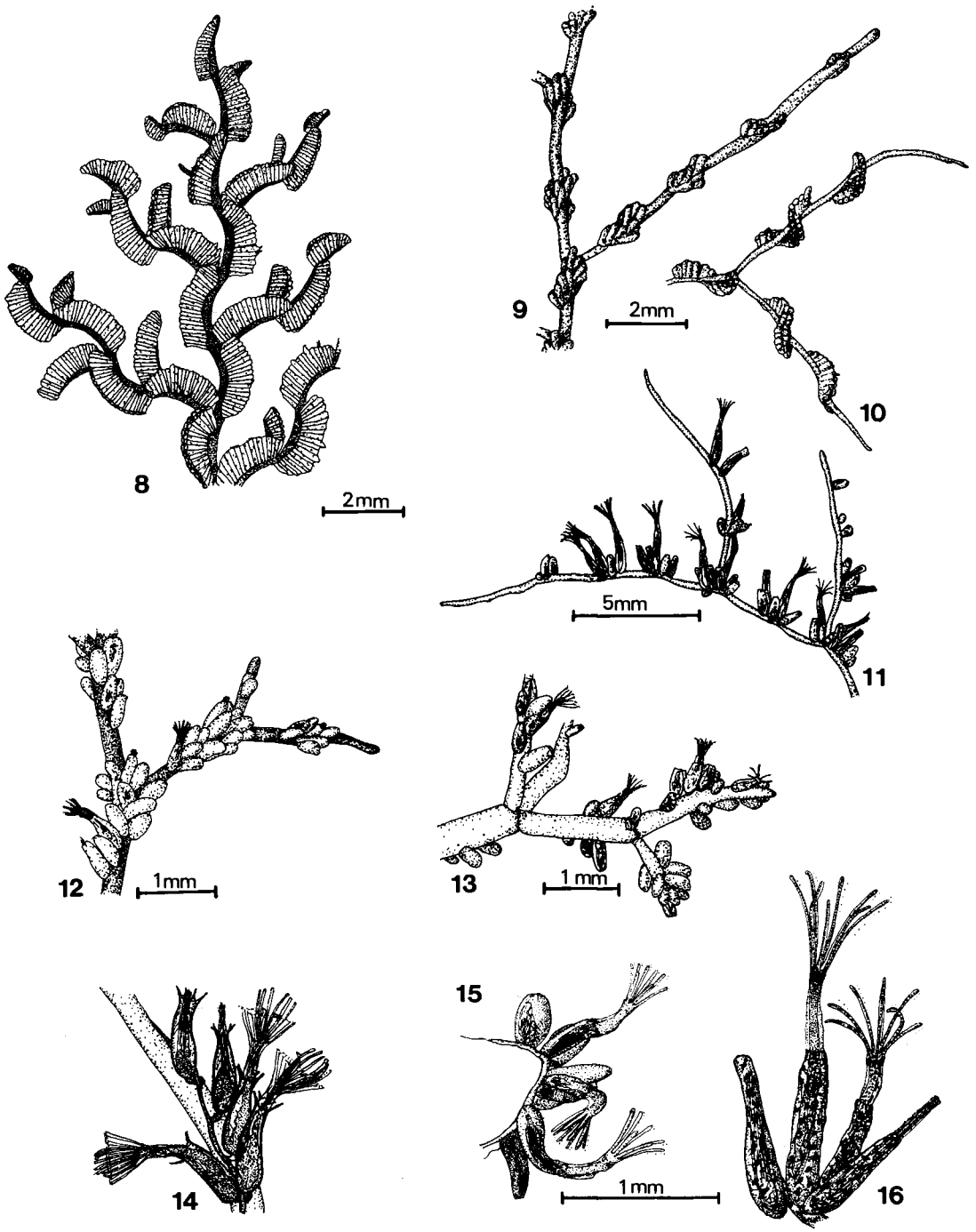
OCCURRENCE AND ECOLOGY: Collected both in the river (at Haulover Canal, Titusville) and along the coast (Walton Rocks and Seminole Shores). Probably occurs year-round. As colonies consist of very small encrustations on *Syringodium,* algae, and hydroid roots it is found only by careful examination of these substrata. Reproductive season unknown.

DISTRIBUTION: Western Atlantic: Beaufort to Brazil. Gulf of Mexico.

SUBORDER VESICULARINA JOHNSTON, 1847
FAMILY VESICULARIIDAE JOHNSTON, 1838
GENUS *AMATHIA* LAMOUROUX, 1816

Amathia alternata Lamouroux, 1816
Figure 8

Amathia alternata Lamouroux, 1816, p. 160. Shier, 1964, p. 651.
Amathia convoluta (in part) Maturo, 1957, p. 22. Figure 11.



FIGS. 8–16. 8. *Amathia alternata.* 9. *Amathia vidovici.* 10. *Amathia distans.* 11. *Bowerbankia maxima.* 12. *Bowerbankia imbricata.* 13. *Zoobotryon verticillatum.* 14. *Aeverrillia armata.* 15. *Bowerbankia gracilis.* 16. *Bowerbankia maxima* showing size of zooids and expanded lophophores in contrast with those of *B. gracilis* (white pigment appears black in transmitted light).

DESCRIPTION: Colonies erect, bushy and branching, springy to the touch, yellow-brown in color. Zooids tubular, connate to the tips, averaging .56 mm. in length and .15 mm. in diameter, arranged in neatly paired double rows along a stolon, each double row covering about four-fifths of the length along an internode. Lines of zooids straight or twisting as much as 90 degrees around the stolon. Zooids of successive internodes oriented at 180-degree angles to each other. Polypide with eight equal tentacles and an average lophophore diameter of .302 mm.

OCCURRENCE AND ECOLOGY: Collected at Capron Shoals and at Sebastian Inlet, Walton Rocks and Seminole Shores. Occurred year-round, but most abundant in the winter. Colonies attached to shell, to beach rock (especially to rock overhangs), attached to and entangled in red alga *Solieria tenera* (at the Sebastian Grass Flats). No colonies reached the large sizes (up to 30 cm.) Shier (1964) observed on the Gulf Coast; many were quite tiny.

DISTRIBUTION: Cape Hatteras to Florida and Gulf of Mexico. May also occur in the Caribbean where its identity has been confused with *Amathia convoluta.*

Amathia distans Busk, 1886
Figure 10

Amathia distans Busk, 1886, p. 33. Marcus, 1937, p. 134. Osburn, 1940, p. 339. Maturo, 1957, p. 23. Cook, 1968a, p. 228.
Amathia brasiliensis Busk, 1886, p. 34. Osburn, 1940, p. 339.
?*Amathia goodei* Osburn, 1914, p. 219.

DESCRIPTION: Colonies delicate and translucent, consisting of a thin (.11–.12 mm.) dichotomously branching stolon with clumps of zooids at intervals. Walls of zooids and stolons of Florida specimens a chitinous tan color, with bright yellow spots of pigment all over, causing living colonies to appear yellow. Zooids connate and a little shorter than those of *A. alternata,* about .4 mm. in height. Arranged in double series at the distal end of the internodes, each series completing a full or partial spiral around stolon, usually only filling about half the space along internode. Often growing ends of stolons with no zooids for the first two internodes, or with a clump of just a few zooids.

OCCURRENCE AND ECOLOGY: Occurred year-round at Fort Pierce Breakwater, Walton Rocks and Seminole Shores. Most abundant in December at Fort Pierce Breakwater. Also collected associated with algae on the continental shelf of Florida (Winston and Eiseman, 1980).

DISTRIBUTION: Circumtropical. Cosmopolitan in warm seas. Western Atlantic: Beaufort to Brazil. Caribbean.

Amathia vidovici (Heller), 1867
Figure 9

Valkeria vidovici Heller, 1867, p. 128.
Vesicularia dichotoma Verrill, 1873, p. 709.
Amathia dichotoma Osburn, 1912, p. 254.
Amathia vidovici: Osburn, 1940, p. 340; 1953, p. 741. Prenant and Bobin, 1956, p. 283.

DESCRIPTION: Colonies branching, semi-erect, whitish to tan in color, very lightly chitinized. Stolons wider (.13–.20 mm.) and stiffer than those of *Amathia distans.* Zooids only connected for part of their length of about .4 mm. Arranged in small groups, four to eight pairs making a short spiral round the stolon in the distal half of the internode, leaving the proximal half of the internode bare.

OCCURRENCE AND ECOLOGY: Present year-round in the Indian River area: Sebastian Inlet, Fort Pierce Breakwater and Seminole Shores on the coast, and found attached to *Solieria tenera* at the Sebastian Grass Flat in March.

DISTRIBUTION: Western Atlantic: Massachusetts to Gulf of Mexico. Caribbean. Also, Pacific from Southern California to the Galapagos, Mediterranean, East Atlantic and Indian Ocean.

Bowerbankia gracilis Leidy, 1855
Figure 15

Bowerbankia gracilis Leidy, 1855, p. 142. Osburn, 1914, p. 218; 1940, p. 34 (in part; see *B. maxima*). Marcus, 1938, p. 56. Prenant and Bobin, 1956, p. 303. Maturo, 1957, p. 25. Shier, 1964, p. 652 (in part; see *B. maxima*). Ryland, 1965, p. 78. Amor and Pallares, 1965, p. 298.

DESCRIPTION: Colonies straw-colored, creeping along hydroids, algae, or other substrata, often forming entangled masses, consisting of tubular flask-shaped zooids arranged singly or in pairs or clumps along a stolon which is about 0.05 mm. in diameter and divided into internodes by septa. Zooids attached to stolon basally and separately budded from it. Zooid walls lightly chitinized, internal structures visible. With polypides expanded zooids erect and long, in live Indian River area specimens 0.38–0.80 mm. in length (mean .60 mm.) and .09–.14 mm. in width. With polypides retracted or nonfunctional, zooids shorter and commonly flattened against the substratum. Caudate process absent from zooid base in all specimens collected. Polypide with lophophore unpigmented, mean lophophore diameter .315 mm., eight tentacles. Eggs brooded internally in zooids in which polypides have degenerated. Embryos peach colored.

OCCURRENCE AND ECOLOGY: Found both in the Indian River and at coastal stations (Sebastian Inlet, Walton Rocks and Fort Pierce Breakwater). Most common ctenostome in the Indian River, both in these collections and in those of the Indian River Survey. In the river, primarily on seagrasses, but also on wood, dead shells, and aluminum cans. At coastal stations found on algae, dead shell (in the holes left by boring sponges), hydroids, and other bryozoans. Collected year-round at coastal stations. Settled on panels at Link Port from December through June. Colonies with embryos collected in the Banana River in March.

DISTRIBUTION: Western Atlantic: Greenland to Brazil. Probably cosmopolitan in shallow water.

Bowerbankia imbricata (Adams), 1798

Figure 12

Sertularia imbricata Adams, 1798, p. 11.
Bowerbankia imbricata: Rogick and Croasdale, 1949, p. 47. Prenant and Bobin, 1956, p. 293. Ryland, 1965, p. 79. Amor and Pallares, 1965, p. 296.

DESCRIPTION: Colony composed of clusters of zooids, clumped along a relatively thick stolon, remaining creeping or growing up from the surface as bushy tufts. Zooids vase-shaped to subcylindrical. For functional zooids, mean length (N = 5) averaging 0.38 mm., mean width 0.17 mm. For degenerated zooids mean length .38 mm., mean width 0.19 mm. Stolon diameter averaging 0.23 mm. Small star-shaped black pigment spots in zooids and stolons of living colonies, but polypides unpigmented. Polypides with a gizzard and ten tentacles. Lophophore diameter averaging .246 mm.

TAXONOMIC DISCUSSION: The zooids of this species in the Indian River are smaller than those described elsewhere. The zooid clusters of *Bowerbankia imbricata* are supposed to be non-helicoidal; in these specimens the zooids did form a partial spiral around the stolon. Colony morphology and dimensions thus more closely resemble those described for *Bowerbankia pustulosa.* However, polypides have ten tentacles and those of *B. pustulosa* have only eight.

OCCURRENCE AND ECOLOGY: Found from March to September. Commonly associated with algae. At the grass flat at Sebastian Inlet colonies occurred on *Solieria tenera,* but at Fort Pierce Breakwater and Sebastian colonies were found attached to the undersurfaces of rocks and ledges and in holes and channels in the worm reef mounds.

DISTRIBUTION: In the Western Atlantic, previously reported only from cooler water, but known from warm waters in the Mediterranean and Red Sea.

Bowerbankia maxima, new species

Figures 11, 16–18

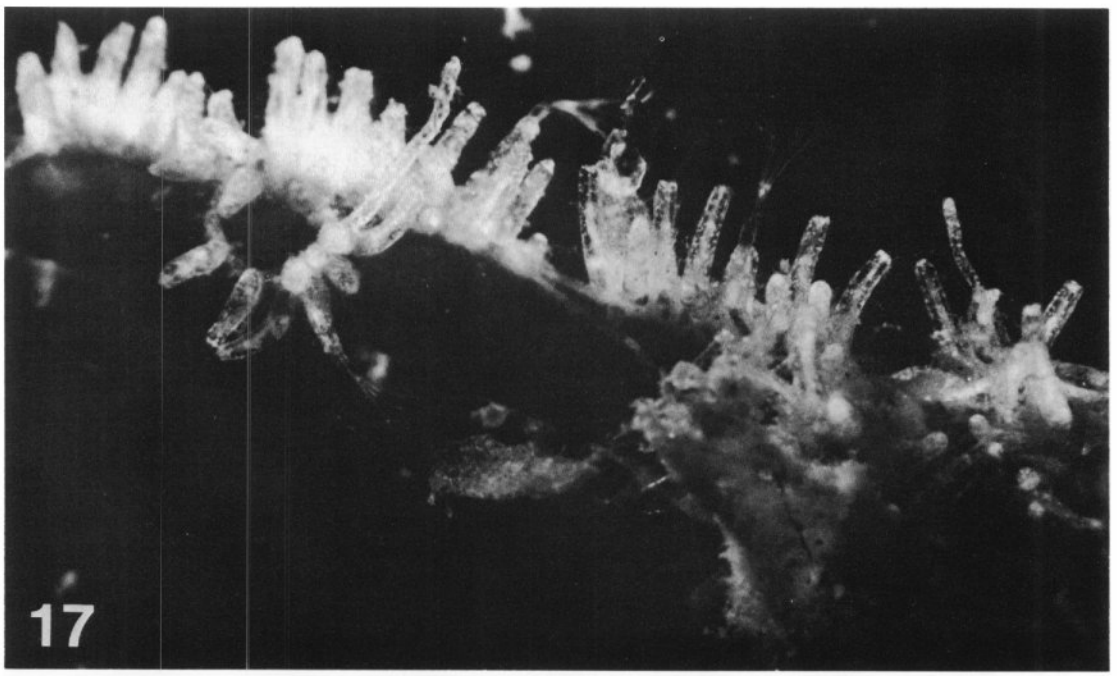
DIAGNOSIS: *Bowerbankia maxima* is similar to *Bowerbankia gracilis,* but distinguishable by its white pigmentation when living. No white coloration is mentioned in any species of *Bowerbankia* described previously. It can also be distinguished from *B. gracilis* on the basis of its greater dimensions.

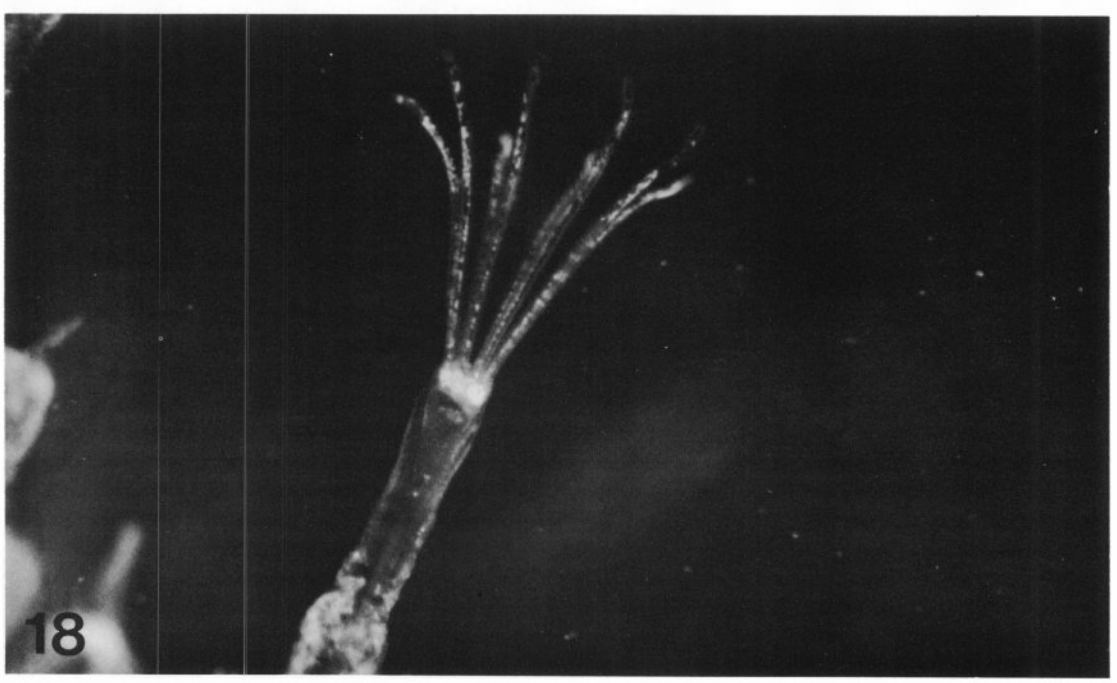
HOLOTYPE: AMNH 572.

PARATYPES: AMNH 573, 574.

ETYMOLOGY: The species name is from the Latin *maximus* (greatest).

DESCRIPTION: Colonies, like those of *B.*





FIGS. 17–18. *Bowerbankia maxima,* new species. 17. Group of zooids encrusting alga *Solieria,* showing white pigmentation. 18. Lophophore of *Bowerbankia maxima,* showing distribution of white pigment in tentacles and lophophore base.

gracilis, found creeping along grasses, hydroids, algae and other substrata; the fuzzy grayish white network of zooids and stolons often developing into partially erect branches and clusters or pendulous masses. Zooids arranged in irregularly sized clumps along the stolons. Functional zooids subcylindrical, becoming more elongated when polypide is expanded.

In living specimens length of functional zooids (N = 25) averaging 1.14 mm. (range 0.91–1.46 mm.), width averaging .230 mm. (range .200–.273 mm.); length of degenerated zooids (N = 21) averaging .575 mm. (range .419–.737 mm.), width averaging .248 mm. (range .200–.300 mm.); stolons (N = 20) averaging .134 mm. (range .091–.182 mm.). Orifice round when polypide expanded and square when polypide retracted. When living, immediately distinguishable from other *Bowerbankia* species because of brilliant white pigmentation of zooids and polypides, the white color being derived from star-shaped white cells in zooids and stolons (fig. 16) and from the diadem of white pigment at the base of the lophophore and the white pigmentation on the tentacles (fig. 18). Polypide with a large well-developed gizzard averaging .119 × .139 mm. in size (N = 20), a long introvert region, and a lophophore averaging .751 mm. in diameter, with eight equal tentacles curved strongly outward at the tips. Eggs and brooding not observed.

DISCUSSION: Maturo (1957) described *Bowerbankia gracilis* from the Beaufort area as having zooids about .70 mm. in length by .15 mm. in width. This fits *B. gracilis* as understood here also. In the Indian River area specimens there was almost no overlap between *Bowerbankia gracilis* and *Bowerbankia maxima* with respect to sizes of functional zooids (as measured in live specimens). The length of degenerated zooids of *B. maxima* was within the range of zooids of *B. gracilis,* but these degenerated zooids were very much wider (.273 mm. vs. .106 mm.) than *B. gracilis* zooids. Some of the variability of "*Bowerbankia gracilis*" as described from the Western Atlantic and Caribbean by various authors may actually be due to the presence of both species in their samples. Shier's (1964) material from the northwest Gulf of Mexico (0.5–1.5 mm. × 0.15–0.20 mm.) and that of Osburn (1940) from Puerto Rico (0.65–1.20 × 0.16–0.20 mm.) probably includes both *B. gracilis* and *B. maxima.* The species which Marcus (1937) called *B. caudata* is in the same size range as *B. maxima* (1.0–1.5 mm. × 0.16–0.20 mm.) and, as the presence or absence of caudate processes has been shown to be a variable character, perhaps might have affinities with it.

OCCURRENCE AND ECOLOGY: Collected from March to November in the Indian River on grass and the alga *Solieria.* At coastal stations on shells, algae, hydroids, other bryozoans and rock. Young colonies found in late March and larger colonies in succeeding months. Most abundant in September, especially at Walton and Sebastian where colonies formed large masses directly on the beach rock ledge or breakwater surface, and overgrew hydroids and other organisms. Reproductive season unknown.

DISTRIBUTION: Atlantic coast of Florida. Also found at Discovery Bay, and Port Royal, Jamaica. As the taxonomic discussion indicates, distribution may be more widespread.

GENUS *ZOOBOTRYON* EHRENBERG, 1831

Zoobotryon verticillatum (Delle Chiaje), 1828

Figure 13

Hydra verticillata Delle Chiaje, 1828, p. 203.
Zoobotryon pellucidum Ehrenberg, 1831. Marcus, 1937, p. 139. Osburn, 1940, p. 341.
Zoobotryon verticillatum Osburn, 1953, p. 742. Maturo, 1957, p. 25. Cook, 1968a, p. 229.
Zoobothryon verticillatum Prenant and Bobin, 1956, p. 288.

DESCRIPTION: Colonies made up of irregularly or trifurcately branching masses of stolons and zooids. Zooids ovoid, .38 × .58 mm. in size, occurring in clusters on either side of the thick transparent stolon. Individual polypides with a large gizzard. Lophophore with eight short equal tentacles and a diameter averaging .320 mm.

OCCURRENCE AND ECOLOGY: Collected both in the river (Haulover Canal, Sebastian Grass Flats) and along the coast. Most abundant at

Walton Rocks. Overwintering colonies initiated rapid growth about the first of April, producing colonies the size of a fist in two weeks time. In early summer (June) large masses of *Zoobotryon,* intermingling with algae and hydroids, dangled from beach rock ledges. Sexual reproduction began then, and colonies were abundant throughout summer months, though, as the summer passed, the transparent new growth became encrusted with red and green filamentous algae, diatoms, and silt. The muddy masses of mature colonies provided attachment for other bryozoans such as *Savignyella, Amathia, Bowerbankia, Nolella,* and *Aetea.* By October most of these masses, along with most macro-algae found on the ledges, had sloughed off or been ripped away.

DISTRIBUTION: A circumtropical species. Western Atlantic: Beaufort to Brazil. Gulf of Mexico and the Caribbean.

SUBORDER STOLONIFERA EHLERS, 1876
FAMILY VALKERIIDAE HINCKS, 1877
GENUS *VALKERIA* FLEMING, 1823

Valkeria atlantica (Busk), 1886

Farrella atlantica Busk, 1886, p. 37.
Valkeria atlantica: Osburn, 1940, p. 342.

DESCRIPTION: Colonies of this inconspicuous and delicate species found creeping over algae, hydroids, and shells. Zooids tall, slender (.60–.80 × .10 mm. when living), usually paired, arising from the distal end of a very short joint or vestigial internode. Polypides with a campylonemidan lophophore with eight tentacles.

OCCURRENCE AND ECOLOGY: One colony found on a hydroid stem at the North Beach breakwater in August. Because of its small size and creeping habit this species is easy to overlook, but as a careful search of hydroid stems, algae, and other likely substrata was made at each collection in this study, *Valkeria atlantica* seems to be truly rare in this area.

DISTRIBUTION: Brazil, Puerto Rico, Florida. Knowledge of distribution limited, probably circumtropical.

GENUS *AEVERRILLIA* MARCUS, 1941

Aeverrillia armata (Verrill), 1873
Figure 14

Vesicularia armata Verrill, 1873, p. 710.
Aeverrillia armata: Marcus, 1941, p. 76. Maturo, 1957, p. 26. Shier, 1964, p. 652.

DESCRIPTION: Colony composed of a narrow creeping stolon (about .04 mm. in diameter) divided into internodes by irregularly spaced septa. Zooids arising (usually in pairs) from kenozooids placed on either side of stolons. Zooids ovoid, with a rounded base, tapering slightly toward the distal end which is provided with four movable spines. Campylonemidan lophophore with eight tentacles. When the polypide is expanded the lophophore is surrounded by a setigerous collar equal in length to the tentacles. This collar may or may not project from the aperture when the polypide is retracted, depending on the degree of retraction. Gizzard present.

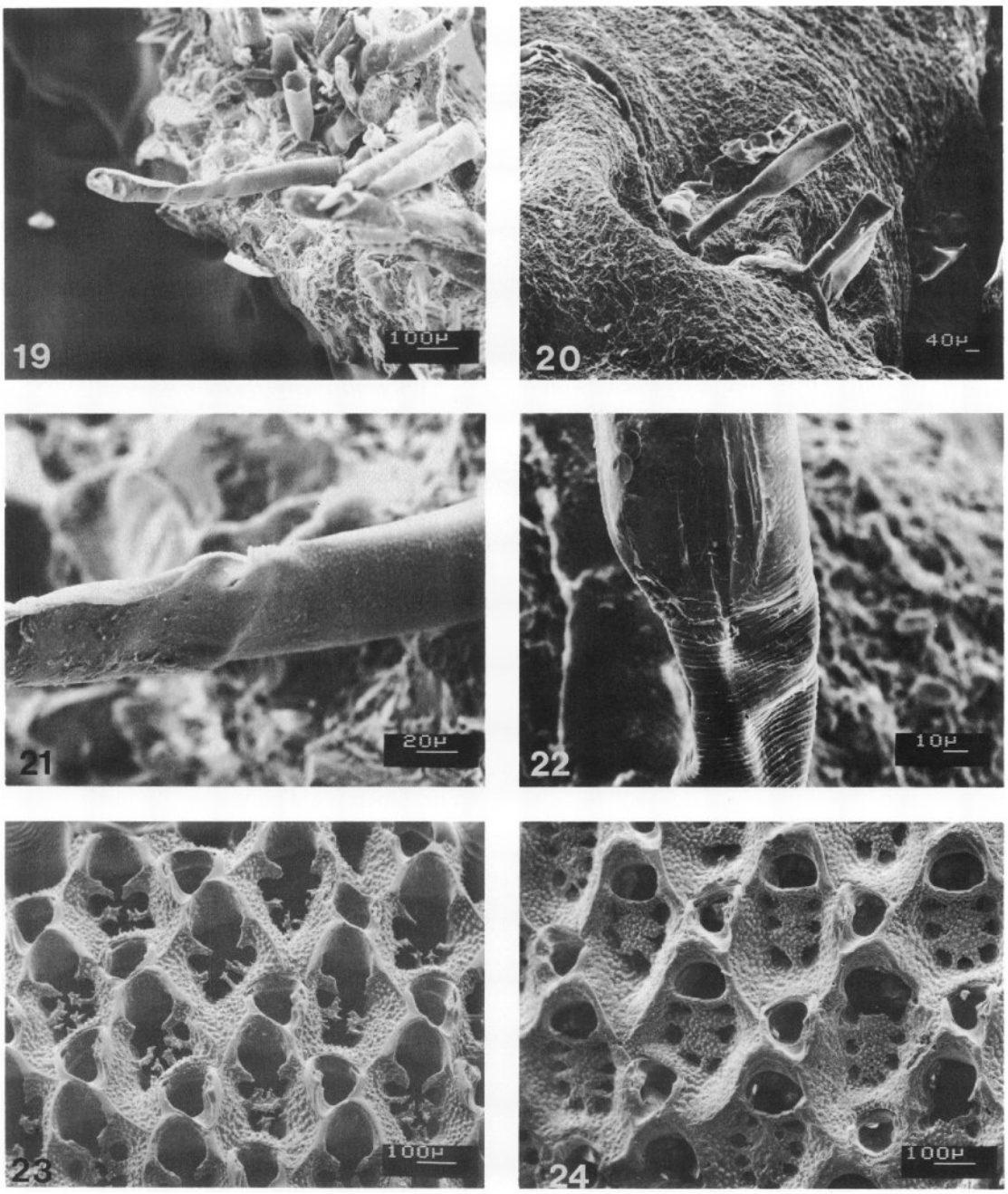
OCCURRENCE AND ECOLOGY: Collected at three coastal stations: Sebastian Inlet, Fort Pierce Inlet and Seminole Shores. Although previously recorded from waters of lowered salinity (to 12‰ in Chesapeake Bay according to Osburn, 1944) it was not taken within the river. Most common from August to January, but probably occurring year-round. Found on stems of the hydroids *Thyroscyphus ramosus* and *Eudendrium carneum* and on *Amathia* spp. No evidence of reproduction seen.

DISTRIBUTION: Western Atlantic: Maine to Brazil and Gulf of Mexico. Distribution not well known; it is another species which is usually only collected accidentally.

ORDER CHEILOSTOMATA
SUBORDER ANASCA LEVINSEN, 1909
FAMILY AETEIDAE SMITT, 1867
GENUS *AETEA* LAMOUROUX, 1818

Aetea truncata (Landsborough), 1852
Figures 19, 21

Anguinaria truncata Landsborough, 1852, p. 288.
Aetea truncata: Canu and Bassler, 1928, p. 51. Hastings, 1930, p. 702. Marcus, 1938, p. 11. Osburn, 1940, p. 346; 1950, p. 12. Cook, 1968, p. 137.
?*Aetea truncata:* Shier, 1964, p. 606.



FIGS. 19–24. 19. *Aetea truncata,* group of zooids. 20. *Aetea sica,* two zooids and stolon. 21. *Aetea truncata,* portion of basal region of zooids, showing lack of annulation. 22. *Aetea sica,* portion of basal region of zooid, showing fine annulation. 23. *Cupuladria doma.* 24. *Discoporella umbellata,* subspecies *depressa.*

DESCRIPTION: (AMNH 575) Colonies consisting of creeping stolonate portions from which tubular portions arise. Tubular portions are divided into a basal "stalk"-like region and a terminal apertural region with the operculum at the upper end of its frontal surface. Polypide extending down into the basal portion. Both stem and terminal regions spotted with minute tubercles, but not annulated (fig. 21). Tubular portions straight, about 0.60–0.80 mm. in height and about .06 mm. at the widest part of the apertural region. Terminal region about one-half to one-third height of tube. No ovicells. Embryos brooded in membranous ovisacs which are only present at the time of reproduction.

OCCURRENCE AND ECOLOGY: Collected in November at Sebastian Inlet, colony creeping over the stems of *Thyroscyphus ramosus*. Not reproducing at the time of collection.

DISTRIBUTION: Worldwide except in polar seas. Western Atlantic: Cape Hatteras to Brazil. Gulf of Mexico and Caribbean.

Aetea sica (Couch), 1844
Figures 20, 22

Hippothoa sica Couch, 1844, p. 102.
Aetea azorensis Jullien and Calvet, 1903, p. 123.
Aetea sica Osburn, 1914, p. 186; 1927, p. 124; 1940, p. 364; 1950, p. 12. Ryland, 1965, p. 18. Prenant and Bobin, 1966, p. 83. Amor and Pallares, 1965, p. 308.
Not *Aetea sica* Canu and Bassler, 1928a, p. 51, pl. 1, fig. 2.
Aetea recta Calvet, 1931, p. 71.

DESCRIPTION: (AMNH 576) Like *Aetea truncata,* colonies consisting of stolons dilated into zooid bases from which protrude erect tubes. Unlike *Aetea truncata* basal portions marked by many fine annulations (fig. 22). Tubular portions of zooids with very slightly expanded apertural regions. Proportion of "head" to "stalk" varying but usually one to three (rather than about one to two as in *A. anguina*). Erect portion about 0.1–1.8 mm. in height. Embryos brooded in external ovisacs.

OCCURRENCE AND ECOLOGY: Occurred from February to October, most abundant in September and October. At Fort Pierce Breakwater, Walton Rocks, and Seminole Shores on drift *Sargassum* and on attached algae and bushy bryozoans: *Amathia, Zoobotryon,* and *Bugula.* In the river on seagrasses and the red alga *Solieria tenera.* Reproductive season unknown.

DISTRIBUTION: Cosmopolitan except in polar regions. Western Atlantic: Cape Hatteras to Brazil. Caribbean.

FAMILY MEMBRANIPORIDAE BUSK, 1854
GENUS *CONOPEUM* GRAY, 1848

Conopeum tenuissimum (Canu), 1908
Figures 32, 44

Membranipora tenuissima Canu, 1908, p. 253.
Electra laciniosa Shier, 1964, p. 612.
Conopeum laciniosum Cook and Hayward, 1966, p. 442.
Conopeum tenuissimum: Dudley, 1973b, p. 284.

DESCRIPTION: (AMNH 584) Colony forming a delicate whitish crust on seagrass, shells and other hard substrata. Zooids oval, averaging .53 × .25 mm. Each zooid with a short pair of distal spines and with lateral spines running along the edge of the gymnocyst; number of lateral spines varies, usually from five to seven pairs. No proximal spine. Operculum chitinous. Budding pattern distal-proximal, primary bud from ancestrula usually distal, and next proximal. Growth of colony proceeding in both directions, with intermediate budding giving rise to a double fan-shaped colony (fig. 44), which eventually becomes rounded in form. Polypide with 11–13 tentacles (averaging 12) and lophophore averaging .475 mm. in diameter. No ovicells, reproduction by means of many small eggs released into sea water through intertentacular organs of polypides and developing into planktonic larvae.

OCCURRENCE AND ECOLOGY: Collected at all six stations in the Indian River, at salinities varying between 18 and 40‰. Present throughout the year. Reproduction chiefly in spring and fall. Large old fouled colonies collected in late March at the Banana River station had areas in which zooids were filled with storage products and the frontal partially

"closed" or calcified, and regenerating areas having new zooids with functional polypides. The species is able to grow to reproductive size in less than a month (Dudley, 1973a), enabling it to live successfully on small and/or unstable substrata. Even the narrow blades of the seagrass *Syringodium* provided enough substratum for colonies to grow to a reproductive stage, as colonies with intertentacular organs were seen on them.

DISTRIBUTION: Estuaries on the Atlantic and Gulf coasts of the United States. Also in some Pacific coast localities, apparently introduced along with oysters from the Gulf Coast (Lagaaij and Cook, 1973).

?*Conopeum seurati* (Canu), 1908
Figures 31, 43

Nitscheina seurati Canu, 1928, p. 26.
Conopeum seurati: Prenant and Bobin, 1966, p. 127. Ryland and Hayward 1977, p. 62.

DESCRIPTION: (AMNH 583) Colonies forming white crusts on seagrasses and other substrata. Zooids ovoid, averaging .55 × .33 mm. in size, having pair of long-pointed distal spines. Lateral spines variable in number or entirely lacking. No proximal spine. Proximal budding pattern, unlike other members of the genus. In colonies from the Indian River the ancestrula first buds proximally and that zooid gives rise to one distal and two distolateral zooids; the distolateral zooids then bud proximally, as well as distally and laterally, thus forming a circle around the ancestrula and ensuring growth in both distal and proximal directions from the ancestrular region (fig. 43). Polypides with mean tentacle number of 15 and mean lophophore diameter of .621 mm. No ovicells. Reproduction by means of non-brooded eggs and planktonic larvae (Cook, 1966).

DISCUSSION: Colonies are not easily distinguishable from those of *Conopeum tenuissimum,* but because of the slightly larger zooid size and the difference in budding pattern, the lacelike pattern appears slightly more regular than in *C. tenuissimum.* Lateral walls of zooids are somewhat more calcified than those of *C. tenuissimum* and the distal spines are longer and more pointed. Lateral spines are fewer than those of *C. tenuissimum* in water of the same salinity, e.g., one to three for *C. seurati* vs. five for *C. tenuissimum* at Link Port, and some colonies with no lateral spines at all. The budding pattern is not exactly as described for European specimens of *C. seurati* by Cook and Hayward (1966), but it appears quite similar. Until further information on early colony astogeny of American specimens can be obtained, it seems best to identify them with *C. seurati.*

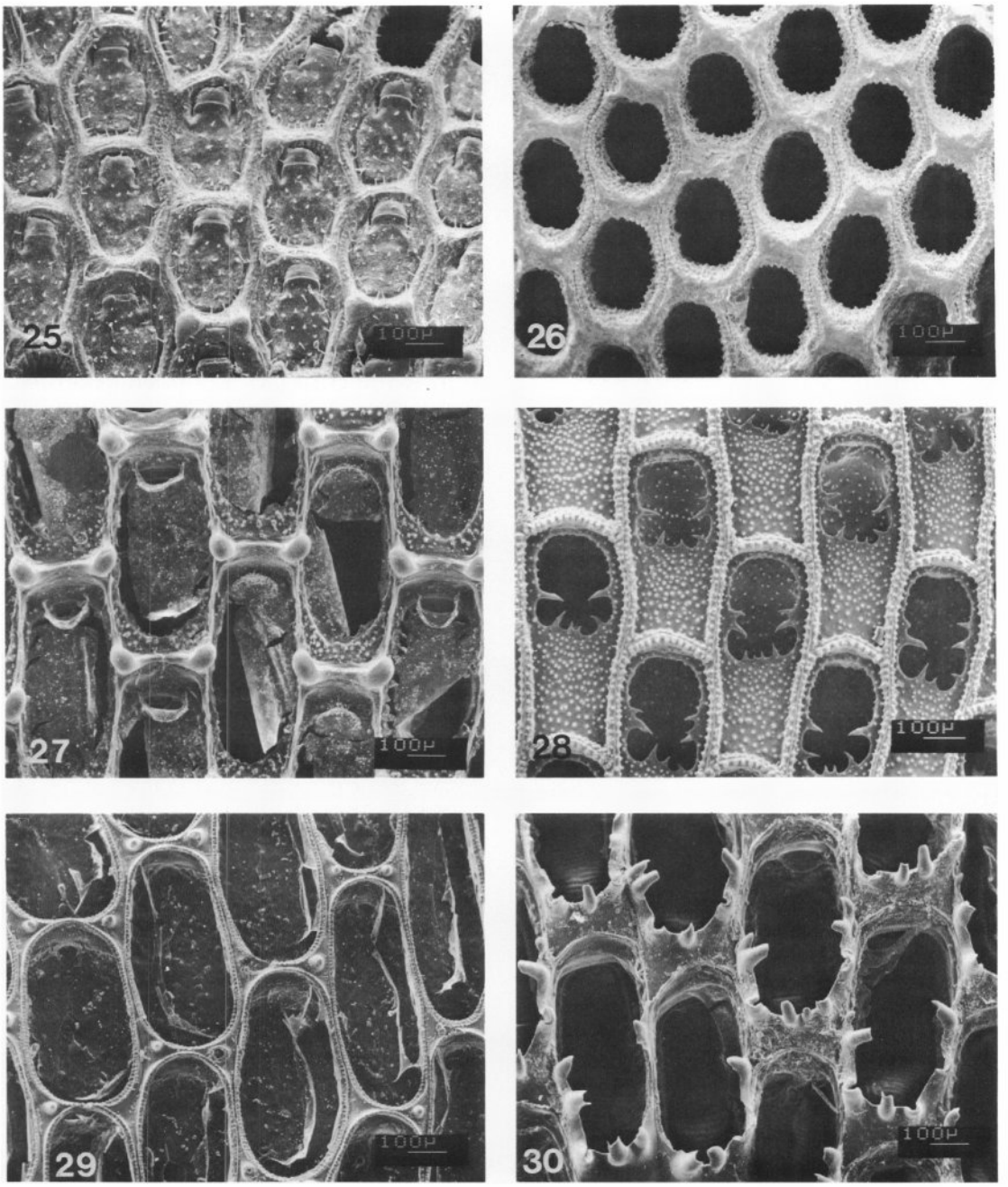
OCCURRENCE AND ECOLOGY: Collected in the Indian River only from the panels at Link Port, but probably widespread within the river. A winter species in Florida, occurring from December through May. In December (when the largest numbers of *C. tenuissimum* were settling) the ratio of *C. tenuissimum* to *C. seurati* colonies was greater than 99-1, but in January the numbers were more equal and by May only *seurati* was settling. Thus, while the two species occurred in the same habitat during the part of the year their seasons of reproduction were offset—the largest peak for *C. tenuissimum* being in late fall—that for *C. seurati* in late winter–spring. *Conopeum seurati* also seemed to be a better space competitor than *C. tenuissimum* (its colonies overgrew those of *C. tenuissimum*). The species occurred here in salinities ranging from 18 to 40‰. In European waters it occurs in salinities down to less than 1‰, and is a true brackish water bryozoan (Winston, 1977).

DISTRIBUTION: East coast of Florida (estuarine habitats). Estuarine habitats in Great Britain, Northern Europe, and Mediterranean. Not previously reported from the Western Hemisphere.

GENUS *MEMBRANIPORA* BLAINVILLE, 1830

Membranipora arborescens (Canu and Bassler), 1928
Figures 25, 26

Biflustra savartii Audouin, Smitt, 1873, p. 20 pl. 4, figs. 92–95 Not *Flustra savartii* Audouin.
Acanthodesia arborescens Canu and Bassler, 1928c, p. 15.
Conopeum commensale Marcus, 1937, p. 35, Not *Conopeum commensale* Kirkpatrick and Metzelaar. Marcus, 1938, p. 16; 1939, p. 126; 1941,



FIGS. 25–30. 25. *Membranipora arborescens,* showing chitinous spinules in frontal membrane. 26. *Membranipora arborescens,* skeleton only. 27. *Membranipora tuberculata.* 28. *Membranipora savartii.* 29. *Membranipora tenella.* 30. *Membranipora* sp.

p. 16; 1950, p. 30; 1957, p. 37. Lagaaij, 1963, p. 166. Shier, 1964, p. 610.
Membranipora arborescens: Cook, 1968a, p. 138; 1968c, p. 121.

DESCRIPTION: (AMNH 577, 578) Colonies white, encrusting, multilaminar, to erect, foliaceous, or bilaminar branching. Zooids regularly shaped, subrectangular (distal and proximal walls straight, lateral walls curving), in encrusting colonies about .30 × .25 mm. in size. Opesia oval, cryptocyst granular, narrow, slightly wider proximally than laterally, with denticles projecting into the opesia giving it a serrated edge. Paired gymnocystal tubercles (occasionally very large and heavy) may occur. Zooids outlined by a dark brown line. Frontal membrane armed with delicate chitinous spinules, oriented into the frontal membrane from its edge and scattered over its surface (see fig. 25). Their development variable, some colonies or areas of a colony lacking them entirely, in other colonies or areas of colonies, strongly developed.

DISCUSSION: This species has long been confused with *Conopeum commensale.* According to Cook (1968c) *Conopeum commensale* occurs only in association with gastropod shells inhabited by pagurid crabs, whereas *Membranipora arborescens* occurs on various substrata, shells, other bryozoans, etc., occasionally including shells occupied by pagurids, but not limited to them. *Conopeum commensale* is not known from the Western Hemisphere. The presence of a dark brown line outlining zooids and chitinous spinules on the frontal membrane is characteristic of encrusting phases of *M. arborescens.*

OCCURRENCE AND ECOLOGY: Collected in April at Walton Rocks, encrusting an empty gastropod shell, and at Capron Shoals on a shell fragment, also in February on a piece of wire in beach drift on the North Beach, Fort Pierce. Probably common subtidally throughout the area.

DISTRIBUTION: Western Atlantic: Cape Hatteras to Brazil. Gulf of Mexico. Also known from West Africa and from the Pacific coast of America, Mexico to Equador.

Membranipora savartii (Audouin), 1926
Figure 28

Flustra savartii Audouin, 1826, p. 240.
Biflustra savartii: Smitt, 1873, p. 20.
Acanthodesia savartii: Canu and Bassler, 1928a, p. 14. Marcus, 1937, p. 40. Osburn, 1940, p. 352.
Membranipora savartii: Osburn, 1950, p. 27. Maturo, 1957, p. 35. Shier, 1964, p. 670. Long and Rucker, 1970, p. 19.

DESCRIPTION: (AMNH 579) Colony whitish, encrusting, one or more layers in thickness. Zooids elongate, rectangular or quadrangular, averaging .27 × .55 mm., with a denticulated shelf formed by cryptocyst under the proximal half of the membranous frontal surface. Denticulation of edge of cryptocyst variable even within colonies. A large proximal tooth often present, sometimes having a number of teeth (as in specimen illustrated) or teeth almost completely lacking. Cryptocyst heavily calcified and covered with fine tubercles, mural rim beaded. No ovicells or avicularia.

OCCURRENCE AND ECOLOGY: Collected at five stations: Sebastian Grass Flats, Sebastian Inlet, Walton Rocks, Seminole Shores, and Capron Shoals. Occurred year round, most abundant in April and October. Found on dead shell and beach rock substrata at all localities.

DISTRIBUTION: Cosmopolitan in warm water. Western Atlantic: Beaufort to Brazil. Caribbean and Gulf of Mexico.

Membranipora tuberculata (Bosc), 1802
Figure 27

Flustra tuberculata Bosc, 1802, p. 143.
Membranipora tehuelcha Osburn, 1914, p. 193.
Nitscheina tuberculata: Canu and Bassler, 1928a, p. 18.
Membranipora tuberculata: Marcus, 1973, p. 33. Osburn, 1940, p. 349. Maturo, 1957, p. 33. Shier, 1964, p. 609.

DESCRIPTION: (AMNH 580) Colonies forming white crust which may almost cover algae (primarily the gulfweed, *Sargassum*). Zooids rectangular, about .24 × .54 mm. in size with large membranous frontal area and

two tall rounded tubercles at the distal corners. In young colonies twinned ancestrula visible, in older colonies origins usually overgrown. Polypide with 15 tentacles and an average lophophore diameter of .478 mm. No ovicells. Eggs released through intertentacular organs into the sea where they develop into cyphonautes larvae.

OCCURRENCE AND ECOLOGY: Found yearround whenever drifting *Sargassum* (*S. natans* and *S. fluviatilis*) collected. Also occurred occasionally on attached brown and red algae at Fort Pierce Inlet, Walton Rocks and Seminole Shores. Reproduction not noted in colonies from drifting algae, but a colony from an attached red alga at North Beach breakwater contained many polypides with intertentacular organs. No information on reproductive season available, but cyphonautes larvae have been collected in offshore plankton tows throughout the year (M. E. Rice, personal commun.).

DISTRIBUTION: Circumtropical. Atlantic coast, Gulf of Mexico, and Caribbean wherever *Sargassum* drifts ashore.

Membranipora tenella Hincks, 1880
Figure 29

Membranipora tenella Hincks, 1880, p. 376.
Electra tenella: Marcus, 1937, p. 38.

DESCRIPTION: (AMNH 581) Colonies yellowish white, encrusting plastic and wood objects deposited in beach drift. Zooids rectangular, about .45–.50 mm. in length, varying in width between about .18 and .25 mm. Opesia elongate-oval, taking up almost all the frontal surface, slightly narrower at the distal end, the rim finely beaded. Gymnocyst very narrow, with a smooth surface in which the intercalary cuticle is only faintly visible and with one or two small (.02–.03 mm.) tubercles developed proximally. No spines present, and specimens lacking the chitinous spinules on the frontal membrane and the cryptocystal denticles characteristic of *Membranipora arborescens.*

OCCURRENCE AND ECOLOGY: Found on various wood and plastic substrata in beach drift deposited by storms. The presence in the same drift of pelagic *Sargassum* spp. and *Physalia* indicated an origin in the Gulf Stream, but *M. tenella* was never found on the *Sargassum* itself.

DISTRIBUTION: East coast of Florida and Brazil. To be expected also wherever Gulf Stream flotsam is cast up.

Membranipora sp.
Figure 30

DESCRIPTION: (AMNH 582) Colonies yellowish white, encrusting hard substrata cast ashore as beach drift. Zooids rectangular, about .50 × .20 mm., distal wall strongly arched, separating lines between zooids. Gymnocyst variable, covering about one-fourth of the zooid length, the opesia irregularly oval. Specimens collected characterized by the presence of broad heavy spines, occurring chiefly on the proximal half of the zooid, broad, and unpointed in shape and projecting forward at an angle over the frontal membrane. The ends may be bent, broadened or bifid and some times large and cervicorn. No ovicells or avicularia.

DISCUSSION: Florida specimens are very similar in appearance to *Electra biscuta* which was described by Osburn (1950) from Mazatlan, Mexico and the Secas Islands, Panama. The specimens described by Osburn had shieldlike spines bending across the distal end of the operculum. These specimens have some of the shieldlike spines, but they project over the opesia from the sides or proximal end. Osburn's specimens show two conical spines opposite the distal end of the operculum. In Florida specimens the distal margin of the opesia has no spines.

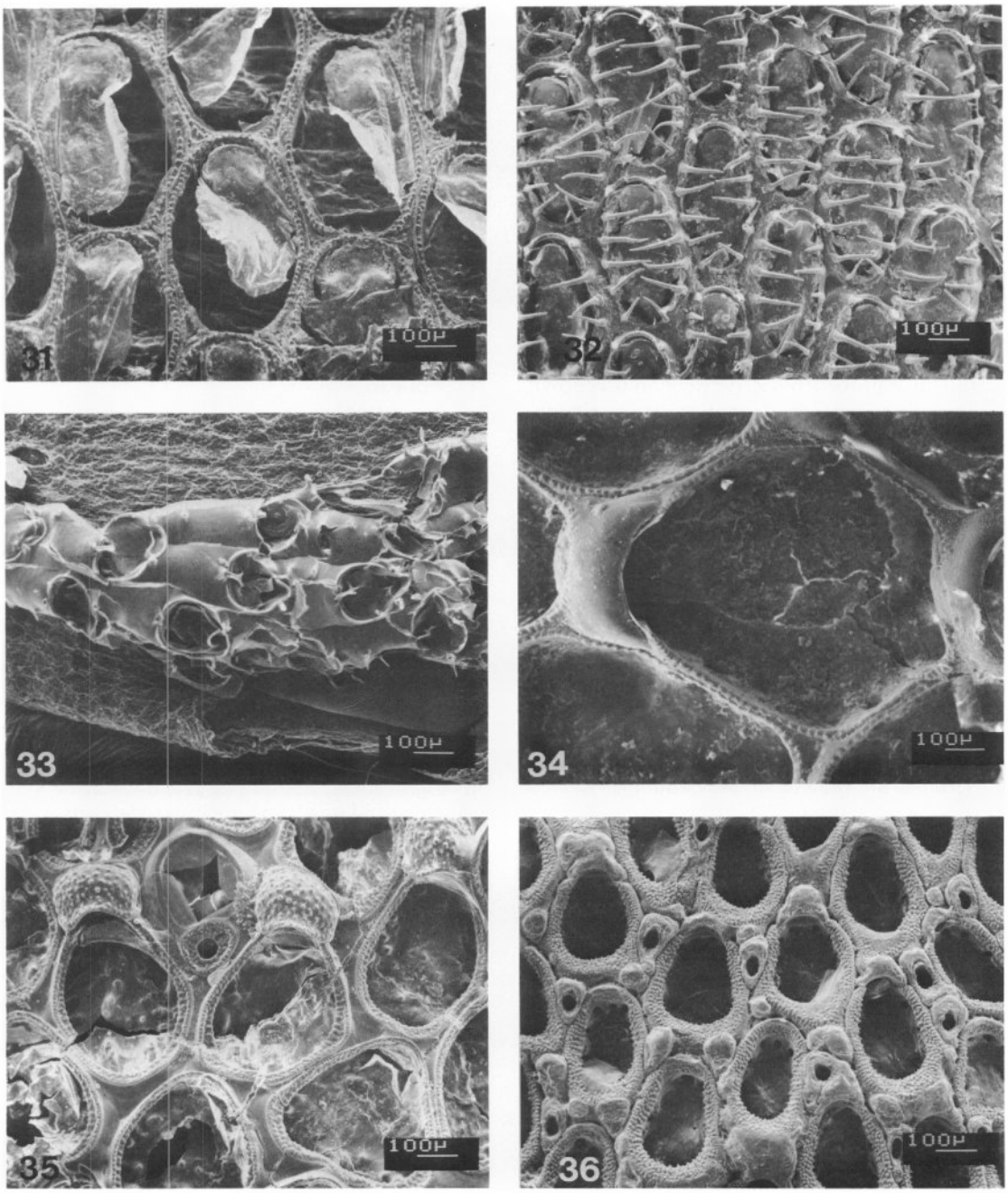
OCCURRENCE AND ECOLOGY: Like *Membranipora tenella, Membranipora* sp. was found only on wood and plastic objects in beach drift. It did not occur on algae.

DISTRIBUTION: East coast of Florida.

FAMILY ELECTRIDAE STACH, 1937
GENUS *ELECTRA* LAMOUROUX, 1816

Electra bellula (Hincks), 1881
Figure 33

Membranipora bellula Hincks, 1881, p. 149.
Electra bellula: Marcus, 1937, p. 37. Osburn, 1940, p. 355. Lagaaij, 1963, p. 170. Shier, 1964, p. 611.



FIGS. 31–36. 31. *Conopeum seurati.* 32. *Conopeum tenuissimum.* 33. *Electra bellula.* 34. *Aplousina gigantea.* 35. *Parellisina latirostris.* 36. *Antropora leucocypha,* zooids of young colony.

DESCRIPTION: (AMNH 585) Colony encrusting, delicately calcified, with a glassy transparent appearance, uniserial, biserial to sheetlike. Zooids about .18 × .34 mm. in size

with an oval opesial region and a generally large narrow calcified proximal gymnocystal region. A large flattened branching spine projecting over the proximal end of the opesia from the calcified region. In addition, usually two distal spines and often several spines projecting from the proximal gymnocyst. Polypides with ten tentacles; mean lophophore diameter .225 mm.

OCCURRENCE AND ECOLOGY: Occurred throughout the year in the Indian River. Collected on seagrass (primarily *Syringodium*) at Link Port and at St. Lucie Inlet. Also collected in April and July at Walton Rocks on brown algae. Reproductive season unknown.

DISTRIBUTION: Western Atlantic: Florida to Brazil. Caribbean and Gulf coast of Florida.

FAMILY CUPULADRIIDAE LAGAAIJ, 1952
GENUS *CUPULADRIA* CANU AND BASSLER, 1919

Cupuladria doma (d'Orbigny), 1859
Figure 23

Discoflustrellaria doma d'Orbigny, 1851, p. 561.
Cupularia doma: Smitt, 1873, p. 15. Canu and Bassler, 1923, p. 77; 1928a, p. 64.
Discoporella doma: Osburn, 1940, p. 374. Maturo, 1957, p. 41. Cheetham and Sandberg, 1964, p. 1022. Shier, 1964, p. 621.
Cupuladria doma: Gautier, 1962, p. 54. Cook, 1965b, p. 216; 1968, p. 145. Prenant and Bobin, 1966, p. 314.

DESCRIPTION: (AMNH 586) Colonies cup-shaped, pink to reddish brown when living, 4–5 mm. in size, free-living on sandy bottoms, basal surface usually flat, showing radial ridges with tubercles. Zooids rhomboidal, small, about .28 × .18 mm. in size, regularly arranged. Opesia subtrifoliate, spade-shaped distally, with lacy proximal portion formed by inward projections of granular cryptocyst as two to three pairs of denticulate spinules. An interzooecial vibraculum distal to each zooid. In mature colonies the central and peripheral zooids closed by continuous granular calcification. Peripheral vibracula large, giving the "cup" a scalloped edge, and occasionally occurring in more than one series. Polypide with 13–16 tentacles (according to Cook, 1965b). No ovicells.

OCCURRENCE AND ECOLOGY: Living specimens collected in 10 m. on a coarse shell-sand bottom off Ft. Pierce Inlet February 1975. The tiny skeletons of this species also found among the shell fragments that make up the beach sand in the area. Most common lunulitiform species in the area, probably occurring everywhere bottom and depth conditions are suitable.

DISTRIBUTION: Tropical and subtropical waters of the Atlantic. Western Atlantic: Cape Hatteras to Florida. Gulf of Mexico and Caribbean.

Discoporella umbellata, subspecies *depressa* (Conrad), 1841
Figure 24

Lunulites depressa Conrad, 1841, p. 348.
Cupularia umbellata Smitt, 1873, p. 14. Canu and Bassler, 1928a, p. 64. Hastings, 1930, p. 718.
Cupularia lowei Osburn, 1914, p. 194.
Discoporella umbellata Osburn, 1940, p. 374; 1950, p. 113. Maturo, 1957, p. 41. Shier, 1964, p. 621. Cheetham and Sandberg, 1964, p. 1022.
Discoporella umbellata subsp. *depressa* Cook, 1965, p. 180.

DESCRIPTION: (AMNH 587) Colony free-living, reddish brown, larger and flatter than that of *C. doma,* cup- or bowl-shaped. Basal surface concave, divided by radial ridges bearing tubercles. Zooids rhomboidal, averaging .34 × .23 mm., regularly arranged, with a granular cryptocyst formed by fused spinous processes dividing up the frontal surface into a distal semicircular opesia and a proximal area punctured by about six or eight small opesiules. Interzooecial vibraculum at the distal end of each zooid. Polypides averaging 13 tentacles; mean lophophore diameter .453 mm. No ovicells.

OCCURRENCE AND ECOLOGY: Living colonies collected in 10 m. of water off Fort Pierce Inlet (in association with *Cupuladria doma*) in February and at Capron Shoals in July. Common in the same sand bottom environments as *C. doma,* although, according to Maturo (1968), it is less abundant than *C. doma* in these environments.

DISTRIBUTION: Primarily a tropical and subtropical western Atlantic subspecies: Cape Hatteras to Florida. Gulf of Mexico and the Caribbean. Also Pacific coast from Point Conception, California to Ecuador.

FAMILY ALDERINIDAE CANU AND BASSLER, 1927

GENUS *APLOUSINA* CANU AND BASSLER, 1927

Aplousina gigantea Canu and Bassler, 1927
Figure 34

Aplousina gigantea Canu and Bassler, 1927, p. 3; 1928a, p. 20. Osburn, 1940, p. 357. Maturo, 1957, p. 38. Shier, 1964, p. 612.

DESCRIPTION: (AMNH 588) Colonies encrusting on shell or *Oculina* rubble. Zooids large, measuring about .80 × 1.00 mm., ovoid to hexagonal in shape, frontal surface membranous, edged by a narrow low-beaded cryptocyst and an occasional narrow proximal gymnocyst. Ovicell endozooidal, a small hood-shaped structure formed by the extension of the distal zooid wall under the gymnocyst and cryptocyst of the distal zooid.

OCCURRENCE AND ECOLOGY: Collected only at offshore stations. One of most abundant species on dead *Oculina* and shell at 80–90 m. depth. Colonies with ovicells were collected in February.

DISTRIBUTION: Western Atlantic: Beaufort to Florida. Caribbean. Gulf of Mexico.

FAMILY ALDERINIDAE CANU AND BASSLER, 1927

GENUS *PARELLISINA* OSBURN, 1940

Parellisina latirostris Osburn, 1940
Figure 35

Parellisina latirostris Osburn, 1940, p. 361. Lagaaij, 1963, p. 175. Long and Rucker, 1970, p. 19.

DESCRIPTION: (AMNH 589) Colony encrusting. Zooids oval to irregular in shape, .45 to .55 mm. in length and .30 to .45 mm. in width. Opesia filling most of frontal area, a beaded mural rim marking the cryptocyst. Small spines occasionally occurring on either side of the orifice (see ovicelled zooids, fig. 35). Ovicell hyperstomial with a beaded surface. Characterized by the presence of vicarious avicularia with a short spatulate mandible, placed at proximal end of an autozooid sized kenozooid.

OCCURRENCE AND ECOLOGY: Encrusting dead shells and *Oculina* from offshore stations. Colonies with ovicells present (September).

DISTRIBUTION: Florida, Caribbean, Gulf of Mexico.

GENUS *ANTROPORA* NORMAN, 1903

Antropora leucocypha (Marcus), 1937
Figures 36, 37

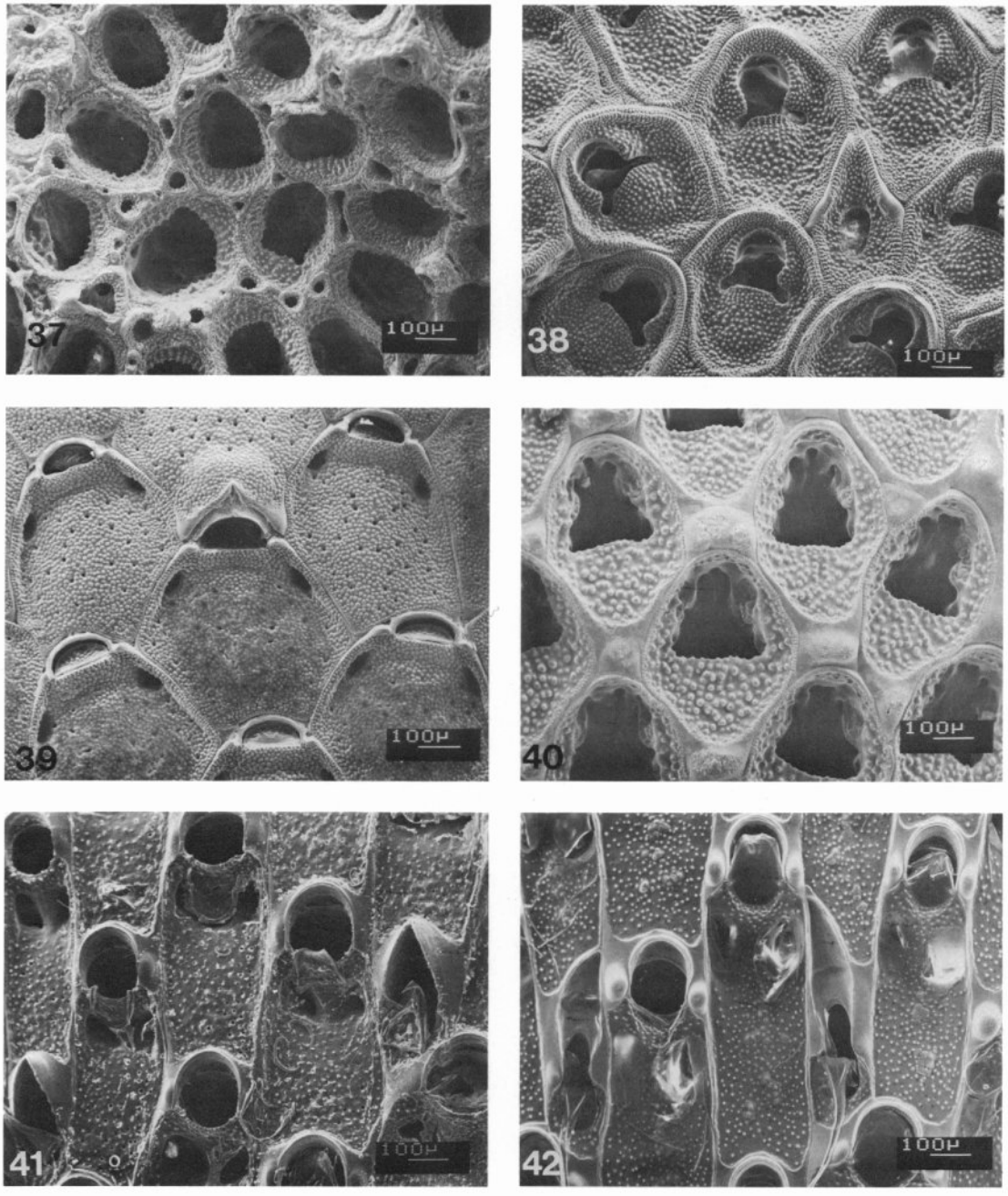
Crassimarginatella leucocypha Marcus, 1937, p. 46; 1938, p. 20. Cheetham and Sandberg, 1964, p. 1017.

Conopeum reticulum (in part) Osburn, 1940, p. 351.

Antropora leucocypha: Shier, 1964, p. 613.

DESCRIPTION: (AMNH 590, 591) Colony encrusting, grayish white to pink or magenta in color, uni- to multilaminar, encrusting various substrata, most commonly gastropod shells. Zooids irregularly oval, narrowing a bit distally, about .30–.35 mm. in length by .20–.25 mm. width. Gymnocyst hardly developed, cryptocyst very narrow distally and laterally, slightly wider proximally, closely beaded and crenulate. Opesia also narrow distally, wider proximally. Triangular spaces between autozooids, filled by kenozooids, calcareous deposits with central openings, or solid tubercles, some transformed into avicularia. Zooids illustrated (fig. 36) surrounded by many small kenozooids, as is often the case, but kenozooids and avicularia also often absent from large areas of colonies. Zooids quite variable in shape, and in secondary layers irregularly oriented. Polypides transparent to whitish in color; mean tentacle number 12, mean lophophore diameter .326 mm. Ovicell endozooidal. Opercula variable in size in both sterile and fertile zooids, and fertile zooids thus difficult to detect.

DISCUSSION: *Antropora leucocypha* is very similar to *A. tincta* and, according to Cook



FIGS. 37–42. 37. *Antropora leucocypha,* zooids of an old multilamellar colony. 38. *Floridina antiqua.* 39. *Micropora coriacea.* 40. *Floridinella typica.* 41. *Thalamoporella floridana.* 42. *Thalamoporella falcifera.*

(1968), can only be distinguished from it by the frequency of occurrence of kenozooids, the size of the avicularia, and the shape of their mandibles. Variation observed in Flor-

ida specimens included these differences as well as differences in texture of the cryptocyst. Smaller (younger ?) unilaminar colonies (generally found on gastropod shells inhabited by gastropods) resembled the description of *Antropora leucocypha* while large multilaminar colonies on gastropod shells inhabited by hermit crabs approached the description of *Antropora tincta* (fig. 37).

OCCURRENCE AND ECOLOGY: Common intertidally at all coastal stations throughout the year. Although occasionally found on dead shells, colonies usually encrusted the shells of living *Thais haemastoma floridana* living on and under breakwater rocks, beach rock ledges, and sabellariid mounds, or dead *Thais* shells inhabited by hermit crabs.

DISTRIBUTION: Western Atlantic: Cape Hatteras to Brazil. Caribbean and Gulf of Mexico.

FAMILY ONYCHOCHELLIDAE JULLIEN, 1882
GENUS *FLORIDINA* JULLIEN, 1881

Floridina antiqua (Smitt), 1873
Figure 38

Mollia antiqua Smitt, 1873, p. 12.
Floridina antiqua: Canu and Bassler, 1928a, p. 60. Hastings, 1930, p. 715. Osburn, 1940, p. 372; 1950, p. 102. Shier, 1964, p. 617. Cook, 1964a, p. 70; 1968a, p. 151.

DESCRIPTION: (AMNH 582) Colonies encrusting, usually unilaminar. Zooids subhexagonal (distal ends rounded, proximal corners sharp) about .40 mm. in length by .40 to .35 mm. in width. Opesia trifoliate with laterally directed opesiular indentations and a curved proximal edge, rest of frontal membrane covered by a granulated cryptocyst, depressed in the center, and with a raised and more closely granulated margin. Distinct grooves between zooids. Vicarious avicularia scattered among the zooids. These are hexagonal structures almost as long as autozooids but narrower and very pointed at the distal end with dark brown winged mandibles which are hooked at the end (specimen illustrated shows skeleton only, mandibles not present). Ovicell endozooidal, opesiae of fertile zooids elongated with proximal edge straight or only slightly curved in comparison with those of autozooids.

OCCURRENCE AND ECOLOGY: One of the most common species from shell and *Oculina* rubble in *Gosnold* collections in September and February. None of these colonies showed zooids with elongated opesiae.

DISTRIBUTION: A warm water species known from both the Atlantic and the Pacific. Western Atlantic: Cape Hatteras to Florida. Caribbean and Gulf of Mexico.

GENUS *FLORIDINELLA* CANU AND BASSLER, 1917

Floridinella typica Canu and Bassler, 1928
Figure 40

Floridinella typica Canu and Bassler, 1928a, p. 372.

DESCRIPTION: (AMNH 594) Colonies encrusting. Zooids irregularly oval with proximal end elongated, about .55–.60 mm. in length by .30–.35 mm. in width, separated from each other by a distinct groove. Opesia triangular, proximal edge serrate, surrounded by a flat, oval, or diamond-shaped, coarsely beaded cryptocyst area. Edge of cryptocyst finely beaded, meeting the rim of the zooids laterally, but having below its proximal border an area of gymnocyst often raised into a large tuberosity deceptively like an ovicell. Ovicells endozooidal. No avicularia.

OCCURRENCE AND ECOLOGY: Collected in September and February encrusting shell and *Oculina* rubble at continental shelf stations. Also encrusting a dead shell fragment at Capron Shoals in October. No information on reproduction.

DISTRIBUTION: East and West coast of Florida.

FAMILY MICROPORIDAE GRAY, 1848
GENUS *MICROPORA* GRAY, 1848

Micropora coriacea (Johnston), 1847
Figure 39

Flustra coriacea Johnston, 1847, p. 349.
Micropora coriacea: Smitt, 1973, p. 13. Canu and Bassler, 1928a, p. 62. Hastings, 1930, p. 719. Osburn, 1940, p. 373; 1950, p. 105. Marcus, 1949, p. 16; 1953, p. 285. Prenant and Bobin,

1966, p. 332 (part). Ryland and Hayward, 1977, p. 113.

DESCRIPTION: (AMNH 593) Colonies encrusting. Zooids regularly arranged, very wide, rhombic in shape, about .50 mm. long by .40–.50 mm. wide, separated by a shallow groove. Frontal membrane flat proximally and concave distally where lateral walls rise to a smooth mural rim. Curving epaulets on either side of semicircular orifice. Cryptocyst finely beaded and penetrated by numerous small round perforations. Ovoid opesiules placed proximal and lateral to the orifice just below "shoulders" of zooid. Ovicell subimmersed, with a beaded imperforate roof formed from cryptocyst and triangular center from gymnocyst of the distal zooid, and a smooth surfaced inner layer surrounding the zooid operculum which closes the ovicell. Embryos orange-red.

OCCURRENCE AND ECOLOGY: Found only at offshore stations encrusting shell and *Oculina* rubble. Colonies with ovicells containing embryos in February.

DISTRIBUTION: Widespread in temperate seas. Western Atlantic: Cape Hatteras to Brazil. Caribbean and Gulf of Mexico.

FAMILY THALAMOPORELLIDAE LEVINSEN, 1909

GENUS *THALAMOPORELLA* HINCKS, 1887

Thalamoporella floridana Osburn, 1940

Figure 41

Thalamoporella rozierii Osburn, 1914, p. 196.
Thalamoporella gothica new var. *floridana* Osburn, 1940, p. 378.
Thalamoporella gothica var. *floridana:* Maturo, 1957, p. 40.
Thalamoporella gothica: Shier, 1964, p. 620.

DESCRIPTION: (AMNH 595) Colonies encrusting sheets, sometimes rising into erect bilaminar frills or rosettes, grayish white in color. Zooids quadrangular in shape, variable in size, about .45–.50 mm. long × .20–.25 mm. wide, separated by distinct grooves. Frontal membrane covered by light perforate calcification except for the distal opesia and two large rounded opesiules proximal to it. Opesia hoof-shaped. Area on either side imperforate and raised into adoral tubercles. One of opesiules usually larger than other and bounded by a descending tubular portion of cryptocyst continuing to the basal wall of the zooid. Interzooecial avicularia shaped like gothic arches; the point of the mandible usually bent. Spicules in the form of large and small calipers occurring in the body cavity. (See specimen illustrated.) No ovicells.

DISCUSSION: Osburn (1940) described *Thalamoporella floridana* as a subspecies of *Thalamoporella gothica. Thalamoporella gothica* was originally described by Busk from the Pacific coast of Mexico. This species has a large bilobed ovicell which may brood several embryos at a time. Ovicells have never been reported from Atlantic specimens. There are other differences: Atlantic specimens seem always to have adoral tubercles, whereas west coast material has wider opesiae and no adoral area. Spicules are variable. Spicules in the form of open compasses occur in *T. gothica.* Only calipers have been described in Florida and Puerto Rico specimens, but a few spicules in the form of open compasses were found in Beaufort area specimens. Until more is known about this species it seems preferable to separate it from *T. gothica.*

OCCURRENCE AND ECOLOGY: Occurred year-round at Fort Pierce Breakwater. Most abundant species encrusting the stems of the hydroid *Thyroscyphus ramosus* in winter months; colonies less abundant in summer. Those collected in October had inner sections filled with brown bodies, but a newly budded outer zone. Also collected encrusting red algae at Walton Rocks, and at Sebastian Inlet where large flower-like masses were found attached to breakwater rocks in January. Polypides of a colony collected in January had large bulbous intertentacular organs.

DISTRIBUTION: Cape Hatteras to Florida. Gulf of Mexico and the Caribbean.

Thalamoporella falcifera (Hincks), 1880

Figure 42

Steganoporella rozieri forma *falcifera* Hincks, 1880, p. 380.
Thalamoporella falcifera: Osburn, 1914, p. 197. Marcus, 1937, p. 52. Maturo, 1957, p. 40.

DESCRIPTION: (AMNH 596) Glassy white colonies encrusting benthic or drifting algae. Zooids elongate, quadrangular, averaging .61 × .26 mm., with distinct grooves between zooids and a delicately tuberculate and perforate cryptocyst covering all but the area of opesiules and opesia. Like *Thalamoporella floridana* this species has a hoof-shaped opesia with rounded tubercles on either side. Avicularia interzooidal, about two-thirds the size of zooids, with elongate, curved mandibles. Spicules in the form of compasses. Ovicells very large and prominent, consisting of two hemispherical valves joined at a median suture. Polypides with a mean tentacle number of 16, and a lophophore averaging .460 mm. in diameter.

OCCURRENCE AND ECOLOGY: Reported only from algae. In the Indian River area collected on *Sargassum fluitans* only, in deep water algae collections (Winston and Eiseman, 1980) also found on three species of benthic algae. Occurred year-round, but most abundant during the fall when almost every plant of *Sargassum fluviatilis* cast ashore was encrusted. *Membranipora tuberculata* sometimes also encrusted *S. fluviatilis* but *T. falcifera* was not found on *S. natans,* the most common species of drift *Sargassum* and the one usually encrusted by *M. tuberculata.* Ovicells very rare. Some found in collections from continental shelf waters.

DISTRIBUTION: Western Atlantic: Beaufort to Brazil. Caribbean. Also reported from Ceylon, Java, and Australia.

FAMILY EPISTOMIIDAE GREGORY, 1893
GENUS *SYNNOTUM* PIEPER, 1881

Synnotum aegyptiacum (Audouin), 1826
Figure 53

Loricaria aegyptica Audouin, 1826, p. 243.
Synnotum aviculare Osburn, 1914, p. 191.
Synnotum aegyptiacum: Osburn, 1927, p. 126; 1940, p. 42; 1950, p. 151. Marcus, 1937, p. 58; 1938, p. 26. Maturo, 1957, p. 42. Shier, 1964, p. 622.

DESCRIPTION: (AMNH 597) Delicate erect branching and stolonate colonies resembling tiny strings of glass beads, entangled among hydroid stems and algae or attached to other substrata. Zooids in pairs, back to back along the branches, with a joint between each pair. Zooids scoop-shaped, averaging .24 × .10 mm. in size, thinly calcified, with a large frontal area. Two types of avicularia: box-shaped sessile avicularia in one or both distal corners of zooids, and sometimes also bulbous pedunculate avicularia on the dorsal surface (shown in colony illustrated). Attachment radicles may have ends elaborated into hook-like processes to grapple the substratum. No ovicells. Embryos brooded in modified (enlarged) individuals (gonozooids). Polypides with ten tentacles, and a lophophore averaging .231 mm. in diameter.

OCCURRENCE AND ECOLOGY: Occurred year-round at all coastal stations. Also collected in April and October at Capron Shoals (10 m.). Found primarily on hydroid stems (both *Thyroscyphus* and *Eudendrium*) but also occurred on shell fragments and beach rock. Zooids containing sperm present in July. Colonies largest and most abundant from October to December. *Synnotum* is a warm water species, and while it can be collected all year-round in the Indian River area, colonies may overwinter in a dormant condition. Those collected at Sebastian Inlet in January after a cold spell had lowered water temperatures, contained only brown bodies in distal zooids, and starchy-looking granular material in proximal zooids.

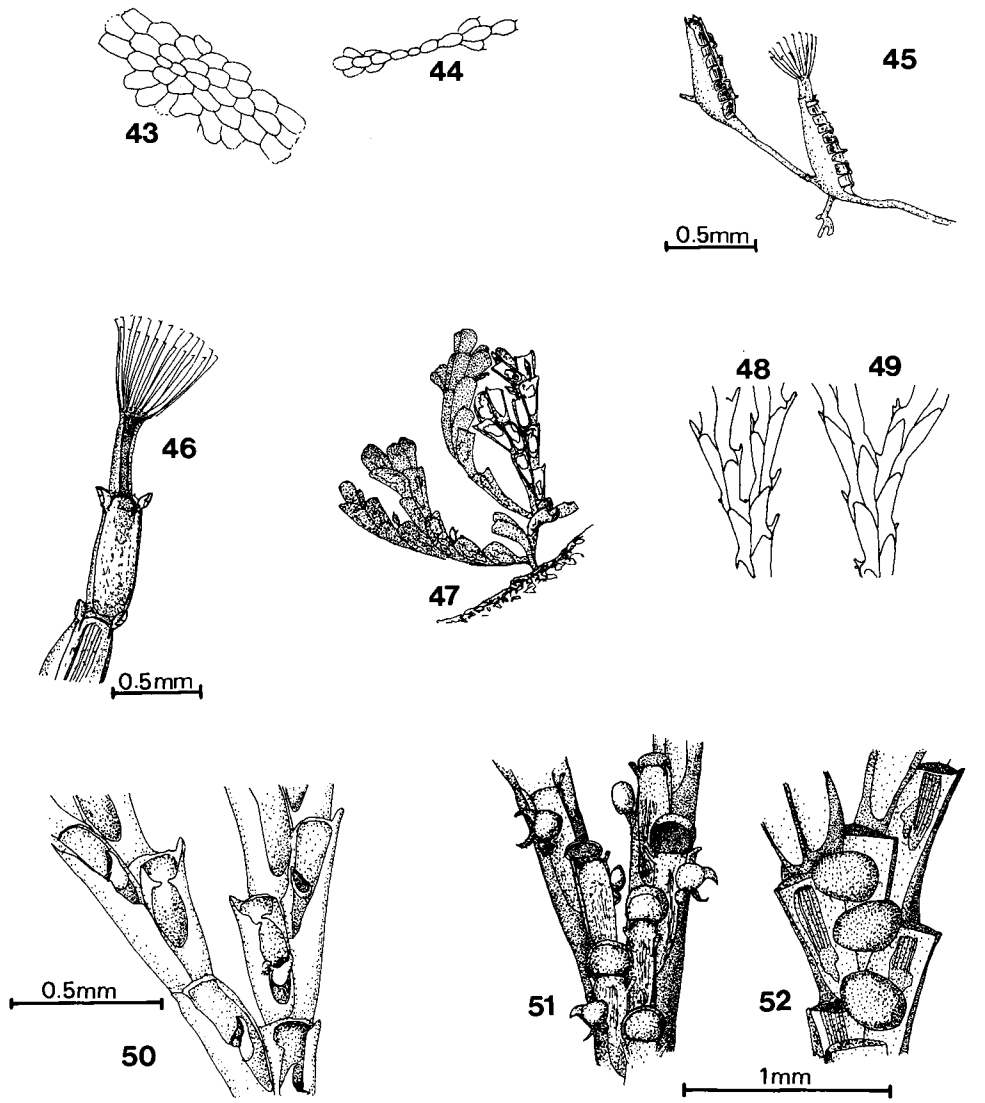
DISTRIBUTION: Distributed around the world in warm water. Western Atlantic: Cape Hatteras to Brazil. Caribbean and Gulf of Mexico.

FAMILY SCRUPOCELLARIIDAE LEVINSEN, 1909
GENUS *SCRUPOCELLARIA* VAN BENEDEN, 1845

Scrupocellaria regularis
Osburn, 1940
Figure 54

Cellularia cervicornis Smitt, 1872, p. 14. Osburn, 1914, p. 192 (not *Scrupocellaria cervicornis* Busk, 1852).
Scrupocellaria regularis Osburn, 1940, p. 384; 1950, p. 144. Cheetham and Sandberg, 1964, p. 1025. Shier, 1964, p. 622.

DESCRIPTION: (AMNH 598) Colony erect, jointed, branching, forming short pinkish tan



FIGS. 43–52. 43. *Conopeum seurati,* initial growth pattern. 44. *Conopeum tenuissimum,* initial growth pattern. 45. *Beania mirabilis.* 46. *Beania klugei.* 47. Entire colony of *Bugula minima* attached to algal surface. 48. Type 3, branching pattern of *Bugula* sp. 49. Type 4, Branching pattern, *Bugula stolonifera.* 50. *Bugula turrita.* 51. *Bugula stolonifera.* 52. *Bugula neritina.* (figs. 48 and 49, after Maturo, 1966).

tufts on various substrata. Zooids narrow proximally and wider distally, opesia ovoid, occupying about two-thirds of frontal area. Zooids averaging .51 mm. in length by .20 mm. in width. Two to seven simple or branched distolateral spines around mural rim. Innermost proximal spine specialized as a shield or scutum bent over membranous frontal area. Scutum large, almost covering the opesia, and paddle-shaped with pointed edges and symmetrical alcicorn decoration (not visible in SEM). Polypides with obliquely truncate lophophores, averaging .464 mm. in diameter, with 13 translucent pink tentacles. Avicularia in two locations: on inner sides of gymnocysts and on outer sides of zooids

at the level of the opesia. Vibracula delicate, relatively short, placed on the proximal part of the back surface of each zooid. Ovicells hyperstomial, flat at the top, with a few large pores. Embryos pinkish red.

OCCURRENCE AND ECOLOGY: Occurred year-round at coastal stations: Sebastian Inlet, Fort Pierce Breakwater, Walton Rocks, and Capron Shoals. Also found in March at the Sebastian Grass Flats on *Solieria.* Young colonies found from January to March. Colonies containing embryos and larvae collected in March and April.

DISTRIBUTION: Western Atlantic: Bermuda, Cape Hatteras to Florida. Gulf of Mexico and the Caribbean. Also, Gulf of California.

FAMILY BUGULIDAE GRAY, 1848
GENUS *BUGULA* OKEN, 1815

Bugula neritina (Linnaeus), 1758
Figure 52

Sertularia neritina Linnaeus, 1758, p. 815.
Bugula neritina: Osburn, 1914, p. 186; 1927, p. 126; 1940, p. 389. Marcus, 1937, p. 67. Shier, 1964, p. 624. Ryland, 1965, p. 45. Maturo, 1966, p. 560. Cook, 1968a, p. 157.

DESCRIPTION: Erect branching colonies forming brownish or reddish purple tufts on any possible substratum. Zooids alternating biserially up the branches, large, averaging .97 × .28 mm. in size, tapering proximally, and with frontal membrane taking up whole frontal surface. No avicularia and no spines, although outer distal corners of the zooids sharply pointed. Polypides also large; mean tentacle number 23, and mean lophophore diameter .764 mm. Ovicells large and globular, attached to distal corners of zooids; oriented at an angle to the branch axis. Embryos dark brown, about .25 mm. in diameter.

OCCURRENCE AND ECOLOGY: In the Indian River collected on seagrasses, oyster shells, docks and canal walls, floats, rotting wood, and algae. Also found at coastal stations (Sebastian Inlet and Walton Rocks) and at Capron Shoals. Settlement on panels and bryozoan traps at Link Port from January through mid-June with peak of settlement in late winter and early spring (Mook, 1976). In more temperate waters *Bugula neritina* reproduces in summer and fall, and old colonies may overwinter. In the Indian River area reproduction occurs in the cooler months and old colonies appear to "over summer." Colonies collected at Walton Rocks in June and July were rusty brown in color and almost completely degenerated, with many zooids dead and filled with ciliates, but with functional polypides still present at the most distal ends of branches. Cold can kill *Bugula neritina,* also, especially exposure to cold air. Large intertidal colonies collected at Sebastian Inlet after a cold spell were dead, whereas subtidal colonies were unaffected.

DISTRIBUTION: One of the most abundant and troublesome fouling organisms, widely distributed throughout warmer waters of the world, especially in harbor and ports.

Bugula stolonifera Ryland, 1960
Figures 49 and 51

?*Bugula californica* Marcus, 1937, p. 71.
Bugula californica Maturo, 1957, p. 45.
?*Bugula avicularia* Shier, 1964, p. 624.
Bugula stolonifera Ryland, 1960, p. 78; 1965, p. 50. Maturo, 1966, p. 568. Cook, 1968a, p. 160.

DESCRIPTION: Colonies grayish tan, erect and branching, forming a fan or funnel (young colonies) or a dense tuft (older colonies). Smaller than the colonies of *Bugula neritina,* usually 3–4 cm. in height. Zooids long and slender, tapering proximally, averaging .78 × .19 mm. in size, and with U-shaped frontal membrane taking up three-quarters or more of frontal surface. Branching pattern predominantly type four (see fig. 49). Outer distal corner of zooid elongated into a spine, occasionally very large, with one or two spines below this, and one spine at the inner distal corner. Pedunculate bird's head avicularia from one-quarter to one-half the way down lateral edge of frontal membrane. Avicularia with rounded heads, decurved beaks, and according to Maturo (1966) occurring in three size classes, large, medium, or small, depending on their position with respect to branch bifurcations. Polypides with an obliquely truncate lophophore av-

eraging .441 mm. in size and 14 tentacles. Ovicells subglobular; embryos yellow-brown.

OCCURRENCE AND ECOLOGY: Also a common fouling species. Collected in December at Sebastian Inlet and January at Sebastian Inlet and Capron Shoals. Settled on panels at Link Port from December through April (Mook, 1976). Colonies commonly occurred in association with *Bugula neritina,* attached to the proximal portions of the *B. neritina* colonies. It is less tolerant of warm temperatures than *B. neritina.* No young colonies were seen in the river after early May, and no oversummering colonies were found.

DISTRIBUTION: Eastern and Western Atlantic and Mediterranean. Western Atlantic: Massachusetts to Florida, Gulf of Mexico, Brazil.

Bugula turrita (Desor), 1848
Figure 50

Cellularia turrita Desor, 1848, p. 66.
?*Bugula turrita:* Marcus, 1937, p. 68.
Bugula turrita: Maturo, 1957, p. 123; 1966, p. 563.

DESCRIPTION: Erect, branching colonies, with biserially arranged zooids, main branches having secondary branches arranged in a spiral pattern about the long axis. Branch bifurcations type three (fig. 48). Zooids averaging .58 × .17 mm. tapering proximally, frontal membrane taking up about two-thirds of their frontal length. Distal spine formula 2:1, the frontal outer distal spine usually very short, the outer dorsal one may be very long. Inner distal spines also sometimes well developed, although those of Indian River specimens quite short. Polypides with an obliquely truncate lophophore averaging .393 mm. in diameter and 14 tentacles. Avicularia located about halfway down the frontal margin, about .15 mm. in length, with a decurved beak. Ovicells positioned slightly to one side of the center of the zooid and tilted toward the axis of the branch. Ovicells containing embryos globose. Developing or senescent ovicells shallow caplike structures.

OCCURRENCE AND ECOLOGY: Collected in April and November at Walton Rocks, attached to undersides of beach rock ledge. Maturo (1966) noted that specimens from the south coast were smaller and less robust than those from New England. The specimens from Walton Rocks were also small (less than 2.5 cm. in height). Colonies collected in April contained ovicells with embryos.

DISTRIBUTION: Massachusetts to Florida. Also reported from Brazil (Marcus, 1937), but according to Maturo (1966) that record may refer to closely related species.

Bugula minima Waters, 1909
Figure 47

Bugula neritina var. *minima* Waters, 1909, p. 136. Osburn, 1914, p. 187. Hastings, 1930, p. 704.
Bugula minima: Osburn, 1940, p. 390; 1950, p. 155.

DESCRIPTION: Colony brownish red, resembling a miniature *Bugula neritina* colony. First two zooids budded uniserially, rest of colony consisting of biserial branches. Zooids with frontal membrane covering most of frontal surface, outer distal end a sharp angle. Avicularia rather elongate, with a long beak, attached at proximal end of zooid.

OCCURRENCE AND ECOLOGY: Collected at two stations: Fort Pierce Breakwater and Seminole Shores, from January until June. Found on algae, *Thyroscyphus,* sponges, and *Amathia distans.*

DISTRIBUTION: Probably circumtropical. Western Atlantic: East coast of Florida, Tortugas, Brazil, and Caribbean.

Bugula uniserialis Hincks, 1884

Bugula uniserialis Hincks, 1884, p. 367. Hastings, 1930, p. 705. Marcus, 1937, p. 72.

DESCRIPTION: A tiny delicate, straw-colored species, similar to *Bugula minima,* but lacking its red coloration. Zooids alternating, proximal portion very narrow, frontal membrane taking about half zooid length, outer distal edge sharply angular but not developed into a spine. Bird's beak avicularia attached by a peduncle to the most proximal portion of the zooid. Polypides with 16 tentacles. Ovicells described but not occurring in our specimen.

OCCURRENCE AND ECOLOGY: Collected at Seminole Shores in October on a red alga (*Laurencia* sp.) attached to worm reef. Polypides with *Bugula*-type behavior, though they scan more actively than those of species with large colonies. Hastings (1930) described zooids containing eggs and sperm. The colony collected here was not reproducing.

DISTRIBUTION: Western Atlantic: East coast of Florida and Brazil. Also Galapagos, Southern California, and West Australia. A very inconspicuous species generally associated with algae. Its distribution may be more widespread.

GENUS *CAULIBUGULA* VERRILL, 1900

Caulibugula pearsei Maturo, 1966
Figure 55

Caulibugula sp. Osburn, 1951, p. 137.
Caulibugula pearsei Maturo, 1966, p. 575.

DESCRIPTION: (AMNH 599) Colonies, up to 6 cm. in height, composed of fan-shaped branches of zooids arising from a stalk of kenozooids. Kenozooids forming stalks 1.5–3.6 mm. long and .19–.40 mm. wide, with annulations at proximal end. Branch zooids biserial, turned so that alternating zooids face each other, scoop-shaped, averaging .40 mm. in length by .21 mm. in width, with a U-shaped frontal membrane taking up about three-quarters of the frontal surface. The semicircular distal area around the orifice bearing from one to four spines, depending on the position of the zooid on the branch. Spines very long (those in the specimen illustrated are broken off short), curving over the frontal surface of the branch. Small pedunculate avicularia sometimes present near proximal edge of frontal membrane. Polypides with 12 tentacles and an obliquely truncate lophophore averaging .277 mm. in diameter. No ovicells observed.

OCCURRENCE AND ECOLOGY: Collected at Walton Rocks in May attached to undersurface of beach rock ledge and entangled with *Bowerbankia imbricata* and *Sundanella sibogae.*

DISTRIBUTION: Cape Hatteras to Florida.

FAMILY BEANIIDAE CANU AND BASSLER, 1927

GENUS *BEANIA* JOHNSTON, 1840

Beania hirtissima (Heller), 1867
Figure 56

Diachoris hirtissima Heller, 1867, p. 94.
Beania hirtissima: Marcus, 1937, p. 62. Osburn, 1940, p. 397; 1950, p. 579. Lagaaij, 1963, p. 180. Maturo, 1966, p. 579.

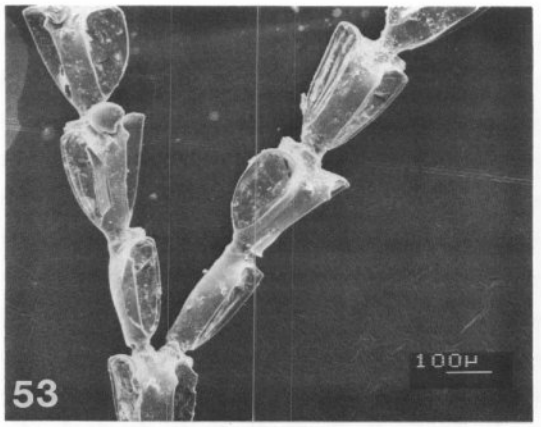
DESCRIPTION: (AMNH 600) Colonies forming spiny brownish mats attached to hydroid stems or encrusting flat surfaces. Zooids shaped like split peanut kernels, averaging .64 × .29 mm. in size. Frontal surface flat, slightly constricted below the operculum and bristling with spines around its margins. Eight to 10 spines radiating out around the orifice, eight to 14 curving over the rest of the frontal membrane, and about 10 more projecting outward from lateral walls below frontal membrane. Zooids closely joined to each other, six tubular processes connecting each one with the six adjacent zooids. Polypides with 18 tentacles and lophophores averaging .520 mm. in diameter. No ovicells or avicularia.

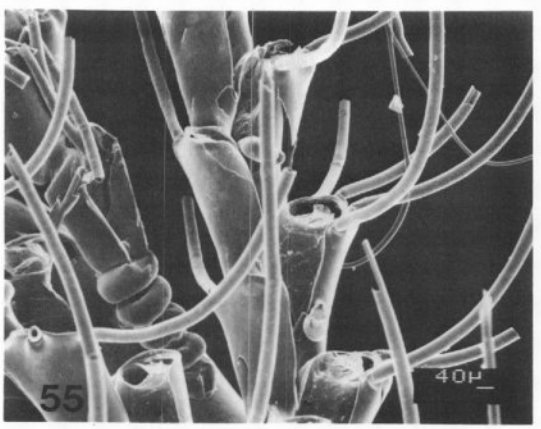
OCCURRENCE AND ECOLOGY: Occurred year-round at Fort Pierce Breakwater, Walton Rocks, and Seminole Shores. An important component of the *Thyroscyphus* stem-and-root-mat fauna. Most plentiful in August when many other species were absent from the actively growing *Thyroscyphus.* Also found at Walton Rock encrusting beach rocks partially buried in sand. Surfaces of these matlike loosely adhering colonies almost completely coated with sand grains, making them difficult to recognize as living organisms. Reproductive season unknown.

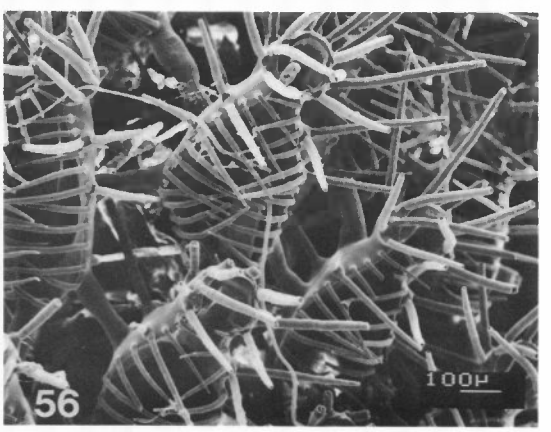
DISTRIBUTION: Widely distributed in warm waters. Western Atlantic: Cape Hatteras to Brazil. Caribbean and Gulf of Mexico.

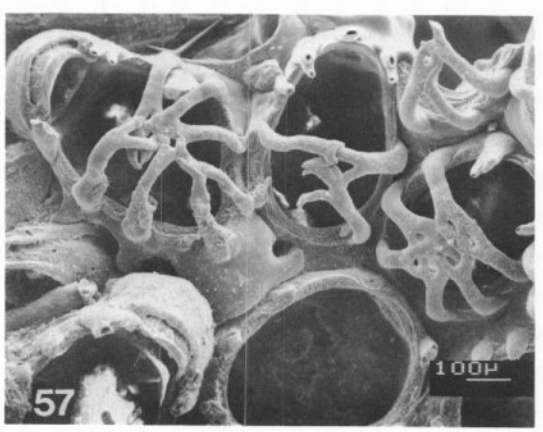
Beania klugei Cook, 1968
Figure 46

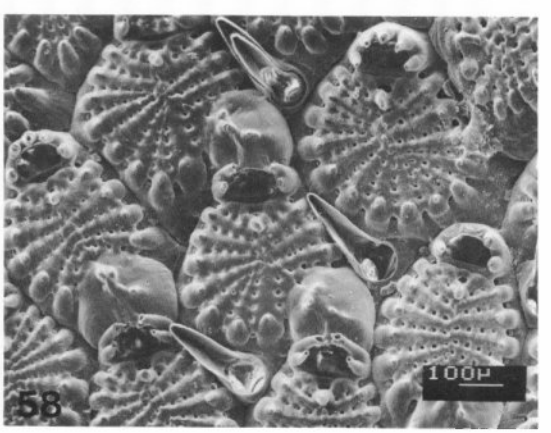
Beania intermedia Osburn, 1914, p. 189; 1940, p. 398. Hastings, 1930, p. 705. Shier, 1964, p. 624. Maturo, 1966, p. 579.
Beania klugei Cook, 1968a, p. 164.











FIGS. 53–58. 53. *Synnotum aegyptiacum*. 54. *Scrupocellaria regularis*. 55. *Caulibugula pearsei*. 56. *Beania hirtissima*. 57. *Membraniporella aragoi*. 58. *Cribrilaria radiata*.

DESCRIPTION: Colonies uniserial, vinelike, or semi-erect. Attached to substratum by radicles. Zooids boat-shaped, thinly calcified, averaging .73 × .30 mm. in size, with flat

frontal membrane and rounded abfrontal surface, proximal end a narrow tube by which the zooid was budded from the zooid proximal to it. Two minute distal projections at distal end above operculum. On either side of operculum usually a stalked "bird's beak" avicularium. Polypides with average lophophore diameter of .657 mm., and 26 tentacles. No spines. No ovicells.

TAXONOMIC DISCUSSION: Cook (1968a) has differentiated this species from *Beania intermedia* which has smaller zooids, distal and lateral spines, larger avicularia, and lateral tubules originating at the mid-zooid level. All the specimens listed in the synonymy above were found to be referable to *B. klugei*. NOTE: Indian River specimens of *B. klugei* have been listed as *B. intermedia* in Winston (1978) and Winston and Eiseman (1980).

OCCURRENCE AND ECOLOGY: Common at both river and coastal stations, where the tiny colonies occurred primarily on hydroid roots and algae. An important component of the *Thyroscyphus* community at the Fort Pierce Breakwater and found entangled with hydroids and algae at the other coastal stations as well. Also common on the drift alga *Soliera tenera* in Indian River seagrass beds, and collected once (in October) at Capron Shoals (10 m.) on dead shell. *B. klugei* occurred year-round. Most abundant in the winter and spring. Degenerating colonies found at Sebastian Inlet in January, however, after a cold spell brought the water temperature below 15° C. Many colonies found between the end of August and December lacked the paired avicularia. The significance of this is not known.

DISTRIBUTION: Probably widely distributed in tropical and subtropical waters. Western Atlantic: Cape Hatteras to Florida. Caribbean and Gulf of Mexico.

Beania mirabilis Johnston, 1840
Figure 45

Beania mirabilis Johnston, 1840, p. 272. Osburn, 1914, p. 189; 1940, p. 398; 1950, p. 170. Hastings, 1930, p. 705. Marcus, 1937, p. 60. Prenant and Bobin, 1966, p. 552. Cook, 1968a, p. 163. Ryland and Hayward, 1978, p. 150.

DESCRIPTION: Colony uniserial, vinelike, irregularly branching, adhering by radicles to hydroids, algae, and other bryozoans. Zooids boat-shaped, lenticular in outline, about .6 by 15 mm., frontal membrane flat. One erect spine on either side of the operculum, plus one or two spines on the distal margin, and five to 11 pairs of lateral spines overarching the frontal membrane. Zooids suberect; each connected to the next by a stolon-like elongation of the basal portion of the zooid. No ovicells. No avicularia. Attachment radicles on abfrontal side of proximal end of zooid.

OCCURRENCE AND ECOLOGY: Collected at Sebastian Inlet, Fort Pierce Breakwater, and Seminole Shores among the hydroid roots. Also collected at Capron Shoals (10 m.) on a dead shell. One degenerating colony was found in August. It probably occurs primarily in fall and winter months, but is a very inconspicuous species and might often be overlooked. Embryos probably develop inside the zooids; there is no information available on its reproduction.

DISTRIBUTION: May be worldwide in warm and temperate waters. Not often recorded. Western Atlantic: Florida to Brazil. Gulf of Mexico and the Caribbean.

FAMILY CRIBRILINIDAE HINCKS, 1880
GENUS *CRIBRILARIA* CANU AND BASSLER, 1928

Cribrilaria radiata (Moll), 1803
Figure 58

Eschara radiata Moll 1803, p. 63.
Cribrilina radiata: Smitt, 1873, p. 22.
Puellina radiata: Canu and Bassler, 1928a, p. 73. Osburn, 1940, p. 406.
Colletosia radiata: Marcus, 1937, p. 73. Maturo, 1957, p. 48. Shier, 1964, p. 625.
Cribrilaria radiata: Cheetham and Sandberg, 1964, p. 1026. Cook, 1967, p. 333; 1968a, p. 172. Long and Rucker, 1970, p. 19.

DESCRIPTION: (AMNH 602) Colonies encrusting, inconspicuous, pink to white in color, but living colonies often fouled green by algae. Zooids irregularly ovoid in shape, separated by deep grooves, about .45 × .35 mm. in size. Frontal surface made of five to 12 pairs of radiating costae separated by rows

of evenly spaced lacunae. Usually a somewhat larger pore just below the orifice. There may be tubercles on the outer ends of the costulae. Orifice semicircular, surrounded by five to seven distal spines and may have a small proximal umbo. Ovicell helmet-shaped, imperforate, with several bumps or a keel on its frontal surface. Embryos rose-pink in color. Interzooecial avicularia with long pointed mandibles in a channeled rostrum may be present.

OCCURRENCE AND ECOLOGY: Collected in September and February at *Gosnold* stations where it was common encrusting shell and *Oculina* rubble. Ovicells contained embryos at the time of collection in February. Ovicelled specimens also collected at Capron Shoals in October.

DISTRIBUTION: Cosmopolitan. Western Atlantic: Cape Hatteras to Brazil. Caribbean and Gulf of Mexico.

GENUS *MEMBRANIPORELLA* SMITT, 1873

Membraniporella aragoi (Audouin), 1826
Figure 57

Flustra aragoi Audouin 1826, p. 240.
Membraniporella aragoi Harmer, 1926, p. 473.
Not *Membraniporella aragoi* Marcus, 1938, p. 30.

DESCRIPTION: (AMNH 601) Colonies encrusting. Zooids about .35 × .50 mm. in size, with a small cryptocyst and gymnocyst and a large oval frontal membrane. Spines (usually three or four per side) arising outside mural rim, curving over frontal membrane, branching once or twice at the tips which interlock like clasped hands over the center of the zooid. Non-ovicelled zooids with two to four hollow straight or branching spines at distal end. Only one pair of spines showing in ovicelled zooids. Ovicells hemispherical and heavily calcified, with lunate inner area and raised lip. No avicularia.

TAXONOMIC NOTE: Cook (1967) has separated *M. aragoi* from *Membraniporella marcusi* on the basis of number and form of the spines. Spines of *M. marcusi* (=*M. aragoi* of Marcus 1938, p. 30) show third or fourth order branching, those of *M. aragoi* have usually only a single branch.

OCCURRENCE AND ECOLOGY: Collected only once at *Gosnold* station 696 encrusting dead shell. Ovicells present at time of collection (September).

DISTRIBUTION: Western Atlantic: Cape Hatteras to Florida. Also reported from the Red Sea and the East Indies.

GENUS *REGINELLA* JULLIEN, 1886

Reginella floridana (Smitt), 1873
Figure 59

Cribrilina figularis var. *floridana* Smitt, p. 1873.
Cribrilina floridana Osburn, 1914, p. 195.
Puellina floridana: Canu and Bassler, 1928a, p. 74.
Pelmatopora (*sensu lato*) *apsata* Shier, 1964, p. 626.
Reginella floridana: Cheetham and Sandberg, 1964, p. 1026.

DESCRIPTION: (AMNH 603) Colony encrusting. Zooids irregularly oval in shape, about .30 × .45 mm. in size, frontal shield made up of five to seven pairs of radially arranged costae with rows of small lumen pores separating them, the outer pores especially may develop into hollow tubules. Orifice semicircular with two erect bifid or trifid distal spines and two flattened lateral spines which arch over the orifice, joining at its center. Ovicell unknown. No avicularia.

DISCUSSION: Shier (1964) described a new species *Pelmatopora* (*sensu lato*) *apsata,* based on material from the Gulf coast of Florida, but his figure shows quite clearly its identity with *Reginella floridana.*

OCCURRENCE AND ECOLOGY: Collected at *Gosnold* station 696 and 702 encrusting dead shell and *Oculina.*

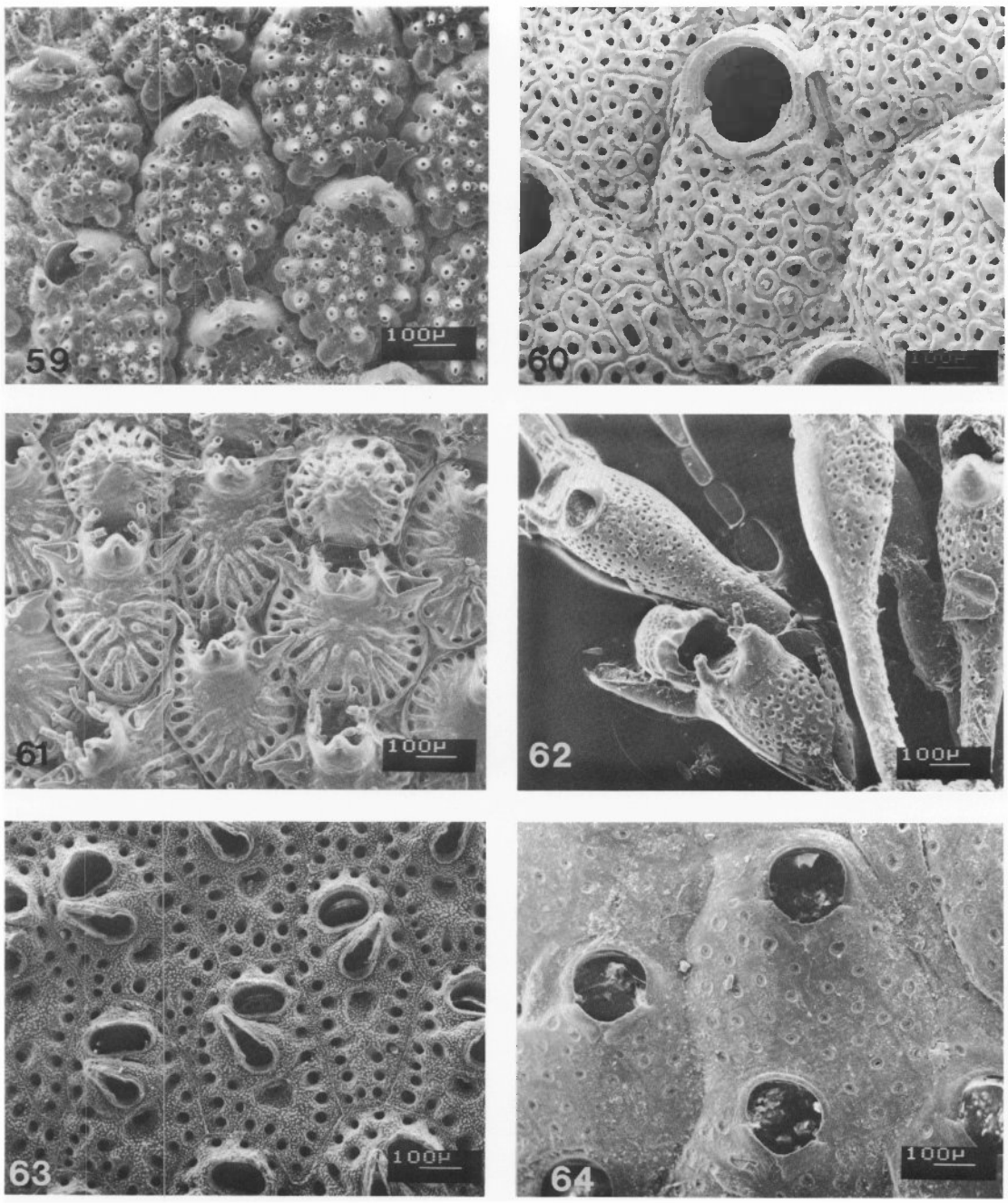
DISTRIBUTION: Cape Hatteras to the Tortugas. Northwest gulf coast of Florida.

GENUS *BELLULOPORA* LAGAAIJ, 1963

Bellulopora bellula (Osburn), 1950

Colletosia bellula Osburn, 1950, p. 188.
Bellulopora bellula: Lagaaij, 1963, p. 183.

DESCRIPTION: Colonies encrusting, only a few millimeters in size. Zooids ovoid, separated by deep grooves, about .35 to .50 mm.



FIGS. 59–64. 59. *Reginella floridana.* 60. *Exechonella antillea.* 61. *Escharoides costifer.* 62. *Savignyella lafontii.* 63. *Reptadeonella costulata.* 64. *Tremoschizodina lata.*

in size, frontal surface covered by six or seven radiating pairs of costae with rows of slitlike lacunae between them. Orifice keyhole-shaped, with a small pedicellate avicularium

on either side. Ovicell small, hemispherical, and carinate.

OCCURRENCE AND ECOLOGY: Collected in September at *Gosnold* station 697 encrusting a shell fragment. Ovicelled at time of collection.

DISTRIBUTION: Western Atlantic: Cape Hatteras to Florida. Gulf of Mexico. Originally described from the Gulf of California and the Galapagos.

FAMILY EXECHONELLIDAE HARMER, 1957
GENUS *EXECHONELLA* CANU AND BASSLER, 1927

Exechonella antillea (Osburn), 1927
Figure 60

Lepralia antillea Osburn, 1927, p. 128.
Exechonella pumicosa Canu and Bassler, 1928a, p. 70.
Exechonella antillea: Osburn, 1940, p. 366; 1950, p. 95. Shier, 1964, p. 616. Cook, 1967, p. 337; 1968a, p. 97.

DESCRIPTION: (AMNH 604) Colony encrusting, unilaminar, grayish yellow in color, attached by dorsal processes. Zooids oval, large, about .80 × .50 mm. in size, separated by a deep groove. Frontal surface covered by large pores, surrounded by a collar, giving the surface of the zooids the texture of terrazzo pavement. Marginal pores smaller and uncollared. Orifice large, shaped like two attached semicircles, the distal one larger than the proximal. Peristome wide-rimmed, rather flat proximally, becoming raised into a collar around distal margin of orifice. Tiny avicularia sometimes occurring near edge of frontal surface. No ovicells.

OCCURRENCE AND ECOLOGY: Encrusting a *Thyroscyphus* stem at Fort Pierce Breakwater in March.

DISTRIBUTION: Western Atlantic: Cape Hatteras to Florida. Caribbean and Gulf of Mexico. Also known from the Gulf of California and from West Africa.

Escharoides costifer (Osburn), 1914
Figure 61

Escharella costifera Osburn, 1914, p. 203.
Escharoides costifera: Marcus, 1938, p. 38.

DESCRIPTION: (AMNH 605) Zooids ovoid, inflated, glassy, about .36 × .27 mm. Row of large pores around margin, with ribs between them, converging toward the center and fading out as they approach. Peristome a short tube with six to eight thick, jointed spines. A pointed mucro with an open area in the center projecting over orifice. Large avicularia on margin of mucronate process. Usually one on each side, occasional zooids with only one. Avicularia with tiny elongate-triangular mandible oriented laterally and projecting upward. Ovicells hyperstomial, round and prominent, also with marginal distal and lateral pores in more than one row, and a raised rim with strong ribs converging on the center. Only four spines showing on ovicelled zooids. Ancestrula about .30 mm. in size, differing in shape from subsequent zooids, with a circle of 12 jointed spines surrounding the orifice. Embryos bright orange.

OCCURRENCE AND ECOLOGY: Found only on algae. Occurred on drift *Sargassum* collected at Seminole Shores in February and also on four species of red, green, and brown algae in collections from the continental shelf (Winston and Eiseman, 1980). All specimens in Florida collections very small, forming circular colonies only a few millimeters in size. Zooids only three generations out from the ancestrula may have ovicells, and almost every zooid was ovicelled in all but the smallest colonies. Polypide with 15 tentacles; lophophore diameter about .350 mm.

DISTRIBUTION: Florida Atlantic coast and continental shelf, Tortugas, Florida, Bahia de Santos, Brazil.

FAMILY SAVIGNYELLIDAE LEVINSEN, 1909
GENUS *SAVIGNYELLA* LEVINSEN, 1909

Savignyella lafontii (Audouin), 1826
Figure 62

Eucratea lafontii Audouin, 1826, p. 242.
Savignyella lafontii: Osburn, 1914, p. 197. Marcus, 1937, p. 78. Cook, 1968, p. 178.
Savignyella lafonti: Osburn, 1927, p. 126; 1952, p. 288.
Catenaria lafontii: Hastings, 1930, p. 732.

DESCRIPTION: (AMNH 606) Colony composed of uniserial jointed branches, brick red

or brownish when living due to coloration of polypides and/or embryos within the zooids. Zooids trumpet-shaped with tubelike proximal portion and inflated distal portion, varying in length between 0.75–1.5 mm. Distal portion with numerous pores penetrating frontal surfaces. Orifice semicircular, surrounded by a raised peristome with four stout spines and a large pointed suboral avicularium with a triangular mandible. Ovicells globular, also perforated by pores. Polypide with 17–19 tentacles (Marcus, 1937).

OCCURRENCE AND ECOLOGY: Found at all coastal stations: Sebastian Inlet, Fort Pierce Breakwater, Walton Rocks, and Seminole Shores, and in the Sebastian grassbed in the Indian River. Most commonly occurred on the roots of *Thyroscyphus* and other hydroids where colonies often intermingled with those of *Vittaticella*. The delicate branching colonies are not usually obvious until substratum material is examined under the microscope. Also found on algae, sponges, and *Zoobotryon*. Occurred year-round, most abundant from September to December, and especially abundant at Fort Pierce Inlet. Reproduction may be year-round in this area. Osburn found colonies reproducing in June in the Tortugas. Colonies collected in the Indian River in January were reproducing.

DISTRIBUTION: Worldwide in warm waters. Western Atlantic: Bermuda, east coast of Florida to Brazil. Caribbean. Gulf of Mexico.

FAMILY ADEONIDAE JULLIEN, 1903
GENUS *REPTADEONELLA* BUSK, 1884

Reptadeonella costulata (Canu and Bassler), 1928
Figure 63

Adeona costulata Canu and Bassler, 1928b, p. 94.
Reptadeonella hastingsae Cheetham and Sandberg, 1964, p. 1039.

DESCRIPTION: (AMNH 607) Colony encrusting. Zooids approximately .50 × .50 mm. in size, irregularly rhomboidal in shape, separated from each other by a distinct threadlike ridge. Characterized by row of circular marginal pores, granular secondary calcification, and crescentic ascopore proximal to center of zooid. Orifice semi-elliptical, proximal margin straight, distal margin rounded, with a low peristome. Avicularium, with a rounded base and a pointed mandible, located between ascopore and orifice and oriented obliquely distally and outwardly from the zooid center, touching the outer margin of the orifice. No ovicells. Embryos brooded in gonozooids, in this species similar in size to the autozooids and differentiated from them only in the more hoodlike development of the peristome.

DISCUSSION: Cheetham and Sandberg (1964) were unaware of Canu and Bassler's introduction of this species when they described it as new (A. H. Cheetham, personal commun.).

OCCURRENCE AND ECOLOGY: Thick encrustations on *Oculina* and shell rubble in continental shelf collections (30–90 m.). Not collected at coastal stations. Colonies have dark brown coloration when live and keep a brown and white speckled appearance even when preserved in alcohol.

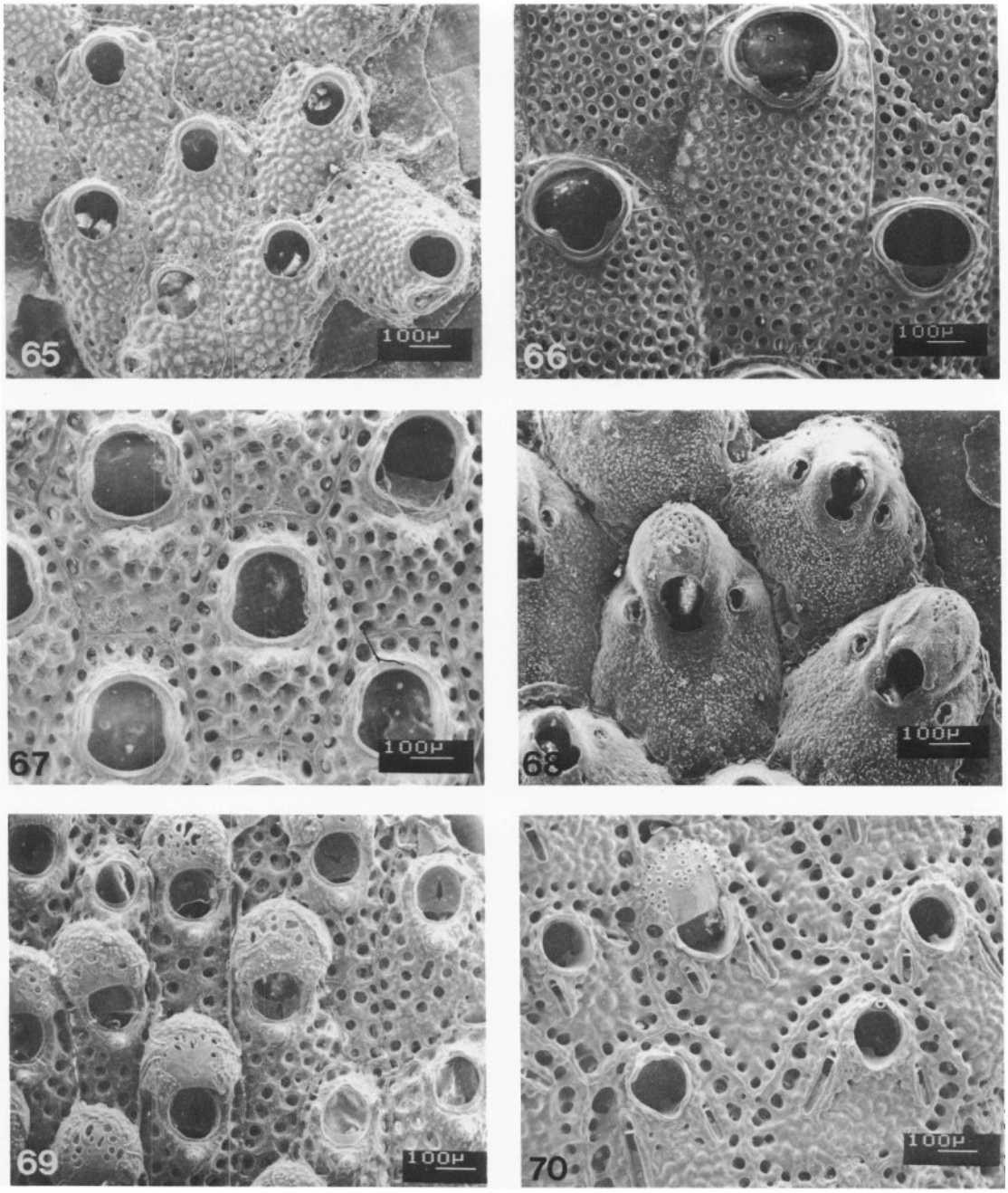
DISTRIBUTION: East and west coasts of Florida, Gulf of Mexico, north coast of Florida, Straits of Florida. This species has been confused with *R. violacea* and *R. plagiopora*, but its identity was clarified by Cheetham and Sandberg, 1964.

FAMILY CHEILOPORINIDAE BASSLER, 1953
GENUS *TREMOSCHIZODINA* DUVERGIER, 1921

Tremoschizodina lata Smitt, 1873
Figure 64

Gemellipora lata Smitt, 1873, p. 36.
Tremoschizodina lata: Canu and Bassler, 1928a, p. 131. Cook, 1968, p. 184.

DESCRIPTION: (AMNH 608) Colony encrusting. Zooids relatively large, about .65 × .55 mm. in size, surfaces covered with shallow regularly shaped pores. Orifice horseshoe-shaped distally, shallowly V-shaped proximally, with very slight lateral indentations. Ovicells endozooidal. Ovicelled zooids distinguished by the larger, more transversely elliptical orifice. Very rare frontal avicularia, not occurring in the colonies examined.



FIGS. 65–70. 65. *Hippaliosina rostrigera.* 66. *Watersipora subovoidea.* 67. *Cryptosula pallasiana.* 68. *Crepidacantha setigera.* 69. *Hippoporina verrilli.* 70. *Parasmittina spathulata.*

OCCURRENCE AND ECOLOGY: Only in continental shelf collections. Colonies collected in September and February did not have ovicelled zooids.

DISTRIBUTION: A tropical species, known from the east coast of Florida, Florida Straits, Gulf of Mexico, and West Africa.

GENUS *HIPPALIOSINA* CANU, 1918

Hippaliosina rostrigera (Smitt), 1873
Figure 65

Escharella rostrigera Smitt, 1873, p. 57.
Lepralia rostrigera: Osburn, 1914, p. 211.
Hippaliosina rostrigera: Canu and Bassler, 1928a, p. 130. Hastings, 1930, p. 729. Osburn, 1940, p. 448; 1952, p. 475. Cheetham and Sandberg, 1964, p. 1044. Shier, 1964, p. 641.

DESCRIPTION: (AMNH 609) Colonies encrusting, orange when live. Zooids variable in shape and size (.35–.60 mm. in length by .25–.30 mm. in width). Frontal surface granular with one or two rows of marginal pores, a distinct threadlike rim between zooids. Orifice horseshoe-shaped distally, arc-shaped proximally, narrow peristome raised distally. Avicularia single or paired, with a rounded base and pointed mandible directed obliquely inward from edge of zooid toward distal margin of orifice. Ovicell endozooidal. Fertile zooids distinguished by wide short orifices.

OCCURRENCE AND ECOLOGY: On *Oculina* and shell rubble in continental shelf collections. Also found at Seminole Shores in October in depressions on loose subtidal beach rock. No colonies in this material had fertile zooids.

DISTRIBUTION: Warm waters of Western Atlantic and east Pacific. Cape Hatteras, Gulf of Mexico, Caribbean, Galapagos, Panama, and Gulf of California.

GENUS *CRYPTOSULA* CANU AND BASSLER, 1925

Cryptosula pallasiana (Moll), 1803
Figure 67

Eschara pallasiana Moll, 1803, p. 57.
Cryptosula pallasiana: Canu and Bassler, 1925, p. 33. Marcus, 1942, p. 58. Osburn, 1952, p. 47. Maturo, 1957, p. 58.

DESCRIPTION: (AMNH 611) Colonies encrusting, or sometimes rising into frills, pink, beige, or white when live. Zooids about .60 × .40 mm. in size, usually regularly hexagonal in shape, the front surface covered by large pores sunk in heavy calcification. Very often zooids with a suboral umbo giving colony surface a beaded appearance to unaided eye. Orifice very large, bell-shaped, anterior part deeper and rounded, posterior a shallow arc, sides parallel, cardelles small. Narrow peristome forming a neat frame around the orifice. No ovicells. Embryos brooded in ovisacs within zooids. No orificial dimorphism. Embryos detected in living specimens by their orange color. Rare small suboral avicularia. None observed on specimens collected in this study.

OCCURRENCE AND ECOLOGY: Occurs on almost any hard substratum: wood, glass, and beachrock. A common and cosmopolitan fouling species, tolerant of reduced salinities. Not found in the Indian River but did occur at coastal stations between April and December. Embryos noted in colonies only in April, but colonies active at all times they were observed.

DISTRIBUTION: Cosmopolitan, but disjunct in many cases. Distribution may be related to proximity to shipping lanes (Marcus, 1942).

GENUS *WATERSIPORA* NEVIANI, 1895

Watersipora subovoidea (d'Orbigny), 1852
Figure 66

Cellepora subovoidea d'Orbigny, 1852, p. 402.
Lepralia cucullata Osburn, 1914, p. 211.
Watersipora cucullata Hastings, 1930, p. 729. Marcus, 1937, p. 118; 1938, p. 46. Osburn, 1940, p. 449.
Dakaria subovoidea: Harmer, 1957, p. 1022.
Watersipora subovoidea: Gautier, 1962, p. 183. Ryland, 1965, p. 68. Cook, 1968a, p. 184.

DESCRIPTION: (AMNH 610) Colonies unilaminar encrusting to bilaminar frilled, brownish orange to black when living. Zooids large, averaging .82 mm. in length by .38 mm. in width, elongate but irregular in shape. Frontal surface slightly curved and evenly perforated all over by large pores. Orifice mushroom-shaped, ovoid anteriorly, with a small semicircular sinus. Operculum dark brown to black. No avicularia. Polypides bright orange-red, average lophophore diameter .66 mm., average tentacle number 21.

No ovicells. Embryos brooded in internal ovisacs.

OCCURRENCE AND ECOLOGY: Most abundant encrusting bryozoan at all coastal stations. A well-known fouling organism, its success attributed to its rapid rate growth (Osburn, 1914) and its ability to grow on almost any surface including copper antifouling paint (Wisely, 1958). Most abundant encrusting the rocks of the breakwaters at about the mean low water level. Only encrusting bryozoan growing on cemented sand tubes of the reef-building sabellariid *Phragmatopoma lapidosa,* attaching both on outer surfaces of the worm reef and in caves and cavities within it. These colonies were subject to the cycle of growth and decay of the worm tubes over the year; by late summer when old worms died and most tubes crumbled, most *Watersipora* died, though colonies on other substrata remained healthy. Present yearround, reproducing from November to April, with maximum production of larvae in November and December. Where the water was calm and/or competition for space with hydroids intense (as at Sebastian), *Watersipora* grew out in bilaminar frills. Also found once attached to algae at the Sebastian Grass Flats.

DISTRIBUTION: Synonymy of this species is very confused, but it appears to be worldwide in warm seas. Western Atlantic: east coast of Florida to Brazil. Caribbean. Gulf of Mexico.

CREPIDACANTHIDAE LEVINSEN, 1909
CREPIDACANTHA LEVINSEN, 1909

Crepidacantha setigera (Smitt), 1873
Figure 68

Escharella setigera Smitt, 1873, p. 58.
Crepidacantha setigera: Canu and Bassler, 1928a, p. 135. Cook, 1968a, p. 186.

DESCRIPTION: (AMNH 612) Colonies encrusting, pinkish when alive. Zooids pyriform, about .40 × .60 mm. in size, surface inflated, faintly granular, separating grooves deep, row of small marginal pores present. Orifice keyhole-shaped, distal portion circular and proximal border broadly arcuate between stout condyles. Avicularia with long setose mandibles located on each side of orifice. In living specimens setose spines occurring between marginal pores, on bleached specimen illustrated only basal joints of these spines remain. Ovicell hyperstomial, closed by operculum, may have a porous central area.

OCCURRENCE AND ECOLOGY: Found only in *Gosnold* collections, on shell fragments, ovicelled in September.

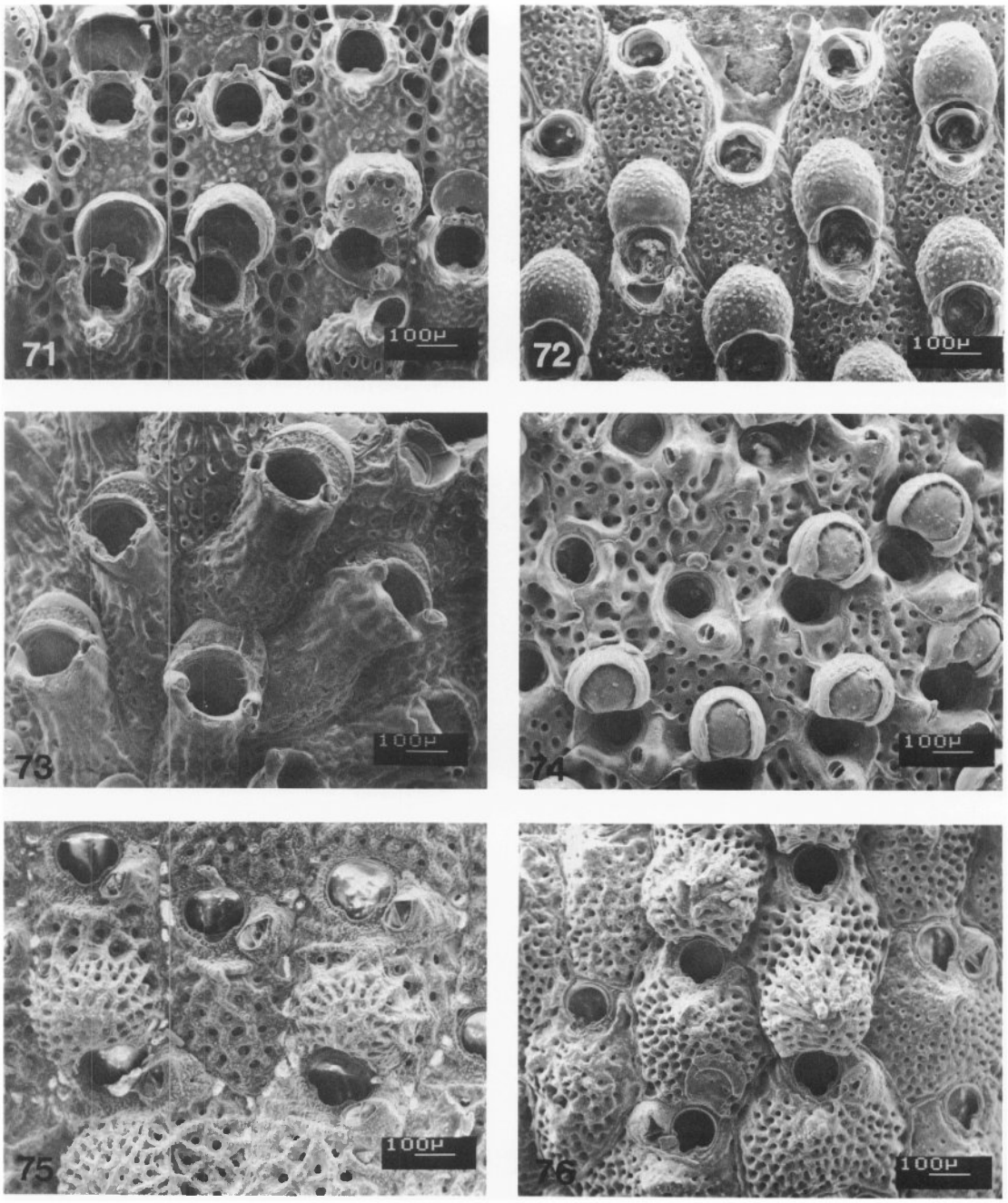
DISTRIBUTION: Circumtropical. Tropical east Pacific, West Africa, Florida, and Caribbean.

FAMILY HIPPOPORINIDAE BASSLER, 1953
GENUS *HIPPOPORINA* NEVIANI, 1895

Hippoporina verrilli Maturo and Schopf, 1968
Figure 69

Escharella pertusa (Esper) Verrill, 1875, p. 41 (part).
Lepralia pertusa (Esper) Osburn, 1912, p. 241 (part).
Hippodiplosia americana (Verrill) Hastings, 1930, p. 725. Marcus, 1937, p. 101. Osburn, 1952, p. 339. Maturo, 1957, p. 51. Lagaaij, 1963, p. 192. Shier, 1964, p. 631 (Not of Verrill, 1875).
Hippoporina americana Cook, 1964b, p. 6; 1968a, p. 188.
Hippoporina verrilli Maturo and Schopf, 1968, p. 56. Powell, 1971, p. 771.

DESCRIPTION: (AMNH 613) Colonies encrusting shell, wood and other hard substrata. Zooids regular in shape, in young colonies measured in this study usually quadrangular, averaging .40 × .29 mm., up to .47 × .39 in old colonies (Maturo and Schopf, 1968). Frontal surface of zooids perforated by about 10–20 medium-sized evenly spaced pores. Zooids separated from each other by slightly raised rims. Orifice rounded distally, with sides almost straight and slightly curved proximal portion behind delicate condyles. Often a prominent umbo just below orifice. Polypide with 12 tentacles. Lophophore diameter .428 mm. Avicularia variable, many colonies lacking them. When present may occur on one or both sides of the orifice and may be narrow, ovoid or have round base and triangular mandible. Narrow ones directed proximolaterally, the other two types may be oriented proximolaterally, laterally,



FIGS. 71–76. 71. *Parasmittina nitida* morphotype B. 72. *Phylactellipora aviculifera.* 73. *Lagenicella marginata.* 74. *Schizoporella cornuta.* 75. *Schizoporella floridana.* 76. *Schizoporella unicornis.*

proximomedially, laterally or distomedially. Ovicells globular, hyperstomial, with rough granular calcification around the outside and a smoother porous central area which may

also become covered by granular secondary calcification. Embryos reddish orange in color.

OCCURRENCE AND ECOLOGY: When living, colonies from the Indian River are ivory to beige in color, but in other areas color may vary from golden yellow to red. Collected at three stations: Capron Shoals, Fort Pierce Breakwater, and on the panels at Link Port in the Indian River. One of the most abundant bryozoans recruited on panels in the river in 1974 and 1975 (Mook, 1976). Eurythermal, but reproduction heaviest in cooler months. Settlement was heaviest in fall (October to January) though colonies settled in bryozoan traps through June.

DISTRIBUTION: This species was confused with *H. americana* until quite recently, but is apparently widely distributed in warm-temperate to tropical waters, especially in seasonally brackish lagoons, harbors, or estuaries. Western Atlantic: Cape Cod to Brazil. Gulf of Mexico. Pacific Coast: Gulf of California to the Galapagos. West Africa.

FAMILY SMITTINIDAE LEVINSEN, 1909
GENUS *PARASMITTINA* OSBURN, 1952

Parasmittina nitida morphotype B
Maturo and Schopf, 1968
Figure 71

Smittina trispinosa (Johnston) Osburn, 1912, p. 246 (part), pl. 27, fig. 65a. Canu and Bassler, 1923, p. 143. Rogick and Croasdale, 1949, p. 67, pl. 10, figs. 68–71. Osburn, 1952, p. 412 (part), pl. 49, fig. 7. Maturo, 1957, p. 55 (part), fig. 62.

Smittina trispinosa var. *nitida* (Verrill) Osburn, 1912, p. 246. Marcus, 1937, p. 104.

Parasmittina nitida morphotype B Maturo and Schopf, 1968, p. 41, fig. 120. Humphries, 1975, p. 20, pl. 4.

DESCRIPTION: (AMNH 614) Colonies encrusting, one or two layers thick, color variable, whitish buff to yellow. Zooids quadrate, averaging .45 × .29 mm. in size, frontal wall solid and coarsely granular in the center with a row of large marginal pores. Primary orifice round with short toothed condyles and a lyrula one-third to one-fourth width of orifice. Two spines on distal edge of primary orifice and an orificial collar raised into lappets on each side. Avicularia variable, one to three per zooid. If two or more are present, they are of different types. Avicularia with pointed mandibles placed lateral to the orifice (usually extending up onto the collar), and on the distal or lateral side of the orifice. Oval avicularia, variously oriented, occurring lateral or proximal to orifice (opposite acute avicularium if both occur). Giant (interzooidal) avicularia may occasionally occur. Ovicell hyperstomial and prominent, upper rim and sides usually covered by granular calcification, front penetrated by two rows of large pores. Embryos pinkish orange. Polypides with 13 tentacles and an average lophophore diameter of .419 mm.

DISCUSSION: Traditionally a whole complex of species have been lumped together under *Smittina trispinosa.* Maturo and Schopf (1968) separated two of these varieties into *Parasmittina nitida* morphotype A and *Parasmittina nitida* morphotype B. Morphotype A is the form figured by Verrill as *Discopora nitida.* Morphotype B has been shown by Maturo (1973) and Humphries (1975) to be genetically distinct and should be recognized as a new species.

OCCURRENCE AND ECOLOGY: Occurred from April to December at Walton Rocks as one of the most common bryozoans on the subtidal beachrock stones. Also found on dead shells at Capron Shoals in April and October. Appeared to reproduce year-round in the Indian River area, and also reported by Humphries (1975) to reproduce year-round in the Gulf of Mexico.

DISTRIBUTION: Distribution not well known due to the problems with taxonomy, but probably occurs in the Western Atlantic from New England to Brazil, in the Gulf of Mexico, and the Caribbean.

Parasmittina spathulata (Smitt), 1873
Figure 70

Escharella jacotini var. *spathulata* Smitt, 1873, p. 60.

Smittina trispinosa var. *spathulata* Osburn, 1914, p. 208; 1927, p. 29.

Smittina trispinosa spathulata Canu and Bassler, 1928a, p. 114.

Smittina trispinosa var. *spathulosa* [*sic*] Osburn, 1940, p. 435.
Parasmittina spathulata: Osburn, 1952, p. 415. Cheetham and Sandberg, 1964, p. 1038. Long and Rucker, 1970, p. 20.

DESCRIPTION: (AMNH 613) Colonies encrusting, often plurilaminar. Zooids about .60 × .40 mm. in size, variable in shape, irregular, but often rounded distally and with sharp proximal edges. Frontal surface flat, coarsely granular with a row of large marginal pores. Orifice subcircular with short condyles, large truncate lyrula and low peristome raised more laterally and usually hiding the condyles. Two to four spines on orifice (usually covered by secondary calcification). Avicularia variable in size, position, and number but usually one with long pointed mandible in the vicinity of the orifice and directed proximally. Ovicells prominent, hyperstomial, top and sides often becoming covered in granular calcification, frontal surface with numerous irregularly spaced collared pores.

OCCURRENCE AND ECOLOGY: Found only in *Gosnold* collections. One specimen ovicelled when collected (September).

DISTRIBUTION: Western Atlantic: Cape Hatteras-Brazil. Gulf of Mexico and Caribbean. Galapagos.

FAMILY PHYLACTELLIPORIDAE BASSLER, 1953
GENUS *PHYLACTELLIPORA,* BASSLER, 1953

Phylactellipora aviculifera (Osburn), 1914
Figure 72

Phylactella collaris var. *aviculifera* Osburn, 1914, p. 213.
Smittina (sensu lato) thrincota Shier, 1964, p. 637.

DESCRIPTION: (AMNH 615) Colony encrusting, white in color. Zooids ovoid to hexagonal, about .45 × .30 mm. in size with a granular, evenly porous, slightly inflated frontal wall, and a depression between zooids. Orifice subcircular, round distally, with a pair of strong cardelles near the proximal end. Distal rim of orifice with slightly bowed proximal margin, orificial collar high and thin laterally and jutting out proximally to form a triangular shelf with a central chamber. This chamber, with a membranous or chitinous covering but no hinge or mandible, resembling an aborted avicularium, thus giving the species its name. Ovicell prominent, helmet-shaped, finely granular in texture with a curving distal flange meeting the lateral processes of the orificial collar of the fertile zooid. Ovicell not closed by the operculum, its opening a low arch (barely visible in upper right zooid of specimen illustrated). Embryos yellowish brown in color.

OCCURRENCE AND ECOLOGY: Collected on dead shells at Capron Shoals in April and October and on the continental shelf pinnacles in February. Colonies were reproducing in October.

DISTRIBUTION: East coast of Florida, Tortugas, northwest Florida.

GENUS *LAGENICELLA* CHEETHAM AND SANDBERG, 1964

Lagenicella marginata (Canu and Bassler), 1930
Figure 73

Lagenipora marginata Canu and Bassler, 1930, p. 36.
Lekythopora longicollis Lagaaij, 1963, p. 199.
Lagenicella marginata: Cheetham and Sandberg, 1964, p. 1041.

DESCRIPTION: (AMNH 616) Colonies encrusting, made up of clusters of small zooids. Zooids flask-shaped, about .40 × .25 mm. in size, including peristome. Frontal wall inflated, surface perforated by small pores which are almost lost beneath thick wavy longitudinally ribbed calcification. Peristome long, smoother, imperforate, zooid constricted at base of peristome and then just slightly flaring. Pair of very small (0.010 mm.) acute avicularia occurring at the top of a tubular chamber extending from the lateral rim of the peristome. Ovicells distal to peristome, opening high up its distal side, with a crescentic densely porous frontal area and smoothly calcified top and sides. Embryo color pinkish red.

OCCURRENCE AND ECOLOGY: Collected once at Seminole Shores encrusting drift *Sargassum* sp. Colonies occurred in the crotches where leaves attached to the main stem of

the alga. Colonies had ovicells with embryos in April. Lagaaij (1963) reported *L. marginata* to be a "fairly common species in the Gulf of Mexico" and "presumably encrusting a perishable substratum." It probably is common on drift and rooted *Sargassum* and other algae. Found on the deep-water alga *Rhodymenia pseudopalmata* off the Florida coast (Winston and Eiseman, 1980).

DISTRIBUTION: East coast of Florida, Gulf of Mexico, Galapagos.

SCHIZOPORELLIDAE JULLIEN (1903)
SCHIZOPORELLA HINCKS, 1877

Schizoporella cornuta (Gabb and Horn), 1862
Figure 74

Reptescharellina cornuta Gabb and Horn, 1862, p. 147.
Schizoporella incrassata Canu and Bassler, 1928a, p. 93. (Not Hincks, 1882).
Schizoporella canui Osburn, 1940, p. 422.
Schizoporella cornuta: Osburn, 1952, p. 320. Maturo, 1957, p. 50. Shier, 1964, p. 628. Cheetham and Sandberg, 1964, p. 1030. Cook, 1968a, p. 192.

DESCRIPTION: Colonies encrusting, pink to salmon in color. Zooids oval to hexagonal in shape, about .35 × .25 mm. in size. Boundaries between zooids often not distinct due to heavy calcification. Frontal surface perforated by numerous pores (.015–.02 mm. in diameter) and becoming increasingly irregular to age due to secondary calcification. Orifice slightly more than semicircular, with two cardelles and a shallow V-shaped sinus proximally. Elliptical avicularia, paired, or, in these specimens, more commonly single, raised on mammillated processes just below and beside the orifice with mandibles directed up at a 45-degree angle and outward toward the sides of the zooid. Ovicell hyperstomial, globular and prominent; differing from the other two described species of *Schizoporella* in not having pores all over ovicell surface, but having an outer rim of heavy calcification and a circular central area radially grooved to a greater or lesser degree, the grooves ending under the rim of the secondary cover in what looks like a row of pores. Embryos orange-red to cherry red.

OCCURRENCE AND ECOLOGY: Found at all three coastal stations and at Capron Shoals. Most abundant on beachrock and dead shell in subtidal pools at Walton Rocks and Seminole Shores. Found from April to December (may be present year-round). Most abundant and reproducing October to December. Colonies collected at Walton Rocks in December had most zooids ovicelled and filled with embryos.

DISTRIBUTION: Range incompletely known as the species has been confused with *Schizoporella biaperta* as well as several other species. Probably occurs from Woods Hole, Massachusetts to Florida, the Gulf of Mexico, and the Caribbean. Also along the Pacific coast of North America and reported from West Africa.

Schizoporella floridana Osburn, 1914
Figure 75

Schizoporella floridana Osburn, 1914, p. 205; 1927, p. 126; 1940, p. 29. Canu and Bassler, 1928a, p. 93. Cheetham and Sandberg, 1964, p. 1030.
Schizoporella unicornis Shier, 1964, p. 629.
Schizoporella unicornis var. *floridana* Shier, 1964, p. 630.

DESCRIPTION: (AMNH 617) Colony encrusting, unilaminar or multilaminar to foliaceous or tubular. Zooids rectangular, averaging .49 × .36 mm. in Indian River specimens, heavily calcified, with a granular texture and numerous large (.02 mm. or more) pores sunk in depressions in the calcification. A heavy suborificial umbo often present. Orifice often situated somewhat at an angle at one side of semicircular distally, with a broad U-shaped sinus; the zooid midline. Avicularia with rounded bases and pointed mandibles occurring singly, or in pairs, beside and just below the orifice, directed upward at about a 30-degree angle on a mammillate process. Polypides pink in color, mean tentacle number 17, mean lophophore diameter .509 mm. Ovicells large, hyperstomial, slightly wider than long, cov-

ered with pores. Embryos pale orange in color.

OCCURRENCE AND ECOLOGY: Found encrusting *Thalassia* in the Link Port grassbeds. Colonies on *Thalassia* blades did not grow large or become multiserial. Ovicelled zooids occurred only a few generations out from the ancestrula and colonies only a few millimeters in size were producing embryos. Colonies recruited on panels at Link Port from January to August, peak settlement (according to Mook, 1976) in late spring to early summer (chiefly April and May). Not collected at any coastal stations and massive coral-like colony forms described from the Gulf coast of Florida and from other areas were not seen.

DISTRIBUTION: Western Atlantic, Beaufort, N.C., Bermuda to Florida Gulf of Mexico, Caribbean. This "species" may actually be a variety of *Schizoporella errata,* a common fouling species in ports and harbors of the Mediterranean and Europe (Ryland, 1965).

Schizoporella unicornis (Johnston), 1847
Figure 76

Lepralia unicornis Johnston, 1847, p. 320.
Schizoporella unicornis: Maturo, 1957, p. 49. Ryland, 1965, p. 65. Cook, 1968a, p. 101. Long and Rucker, 1970, p. 19.

DESCRIPTION: Colony encrusting, unilaminar to plurilaminar, white to pink in color. Zooids regularly rectangular in shape, about .45 × .35 mm. in size, frontal surface perforated by a large number of small pores (.01 mm. or less in diameter). Zooids separated from each other by a sharp depression, frontal wall often raised into umbo below the orifice. Orifice central, slightly more than semicircular with a deep V-shaped sinus. Ovicells hyperstomial, large, globular, porous, with a radial pattern making edge appear fluted and also often with a pointed umbo at the top.

OCCURRENCE AND ECOLOGY: Collected on beachrock stones at Walton Rocks in May. Reproducing at that time.

DISTRIBUTION: The true range of this species in the Western Atlantic is unknown because of its confusion with *S. errata.* Maturo (1968) lists it as ranging extensively north and south of Cape Hatteras. Figure 3, no. 3 of Long and Rucker (1970) is definitely this species. It is one of the principal fouling organisms in many parts of the world.

GENUS *ESCHARINA* MILNE-EDWARDS, 1838

Escharina pesanseris (Smitt), 1873
Figure 77

Hippothoa pesanseris Smitt, 1873, p. 43.
Escharina pesanseris: Osburn, 1914, p. 207.
Mastigophora pesanseris: Osburn, 1927, p. 130; 1940, p. 452; 1952, p. 479. Canu and Bassler, 1928a, p. 133. Hastings, 1930, p. 722. Marcus, 1939, p. 142.
Escharina pesanseris: Cook, 1968a, p. 195. Long and Rucker, 1970, p. 19.

DESCRIPTION: (AMNH 618) Colonies encrusting and small, less than 1 cm. in diameter. Zooids polygonal, usually five-sided about .60 × .55 mm. in size, frontal surface covered with fine pores which may become filled in by secondary calcification, and with distinct grooves between them. Orifice semicircular, proximal border straight with a narrow, deep, notched sinus. Peristome forming a thick rim around the orifice and bearing six to eight spines. Avicularia in pairs on each side of the orifice, directed distally, with a fin-shaped "duck-foot" mandible (this chitinous mandible lacking in Clorox-treated specimen illustrated). Ovicells (not illustrated) thin-walled, globular, small and imperforate.

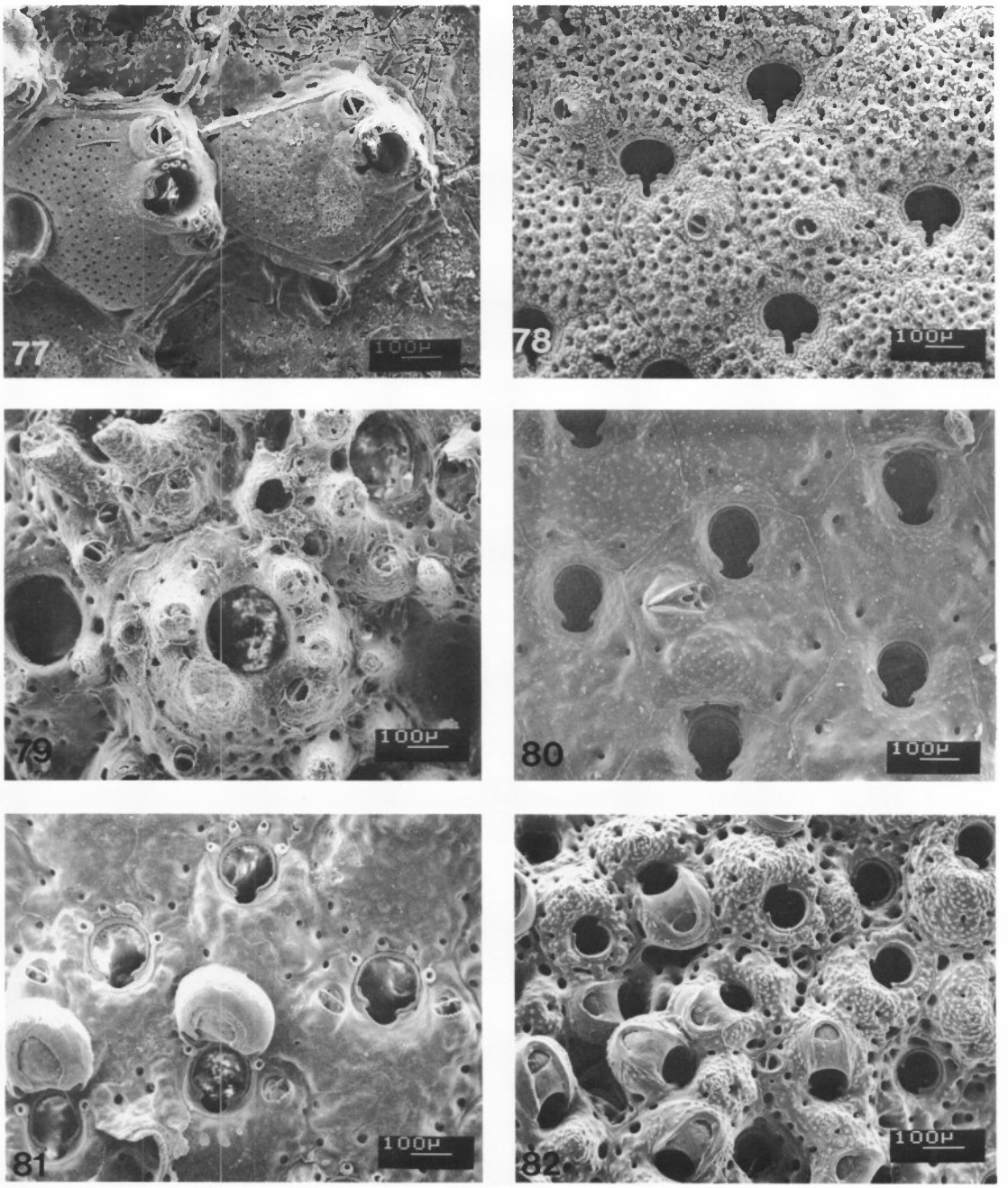
OCCURRENCE AND ECOLOGY: Collected only at offshore stations, February 1975, on dead shells. The small colonies, often fouled and eroded, are easy to overlook, but once noted the fan-shaped avicularia are distinctive.

DISTRIBUTION: Circumtropical. Western Atlantic: Cape Hatteras to Brazil. Caribbean. Gulf of Mexico.

GENUS *STYLOPOMA* LEVINSEN, 1909

Stylopoma spongites (Pallas), 1766
Figure 78

Eschara spongites Pallas, 1766, p. 45 (part).
Hippothoa spongites: Smitt, 1873, p. 42.



FIGS. 77–82. 77. *Escharina pesanseris*. 78. *Stylopoma spongites*. 79. *Cigclisula turrita*. 80. *Cleidochasma porcellanum*. 81. *Cleidochasma contractum*. 82. *Hippoporidra calcarea*.

Schizoporella spongites: Osburn, 1914, p. 207.
Stylopoma spongites: Osburn, 1927, p. 128. Canu and Bassler, 1928a, p. 91. Hastings, 1930, p. 721.
Stylopoma informata Marcus, 1937, p. 91. (*Not* Lonsdale, 1845); 1955, p. 296. Osburn, 1940, p. 424; 1952, p. 336. Shier, 1964, p. 631.
"*Stylopoma spongites*" (Levinsen): Cheetham and Sandberg, 1964, p. 1031.
Stylopoma spongites (Levinsen): Long and Rucker, 1970, p. 19.
Stylopoma spongites (Pallas): Thomas and Hastings, 1967, p. 316.

DESCRIPTION: (AMNH 619) Colony encrusting to tubular, usually plurilaminar, white to orange in color. Zooids usually regularly quadrangular in shape, about .50 × .35 mm. in size, frontal wall perforated by numerous small pores, with intervening calcification becoming increasingly thick and granular with age, sometimes with a low umbo below the orifice (which tends to become buried with increasing calcification). Orifice semicircular, with straight proximal border and deep V-shaped to linear sinus. Peristome low, usually not forming a noticeable ridge except on zooids at the growing edge. Avicularia varying in size and shape. Small avicularia with short triangular mandibles occurring beside the orifice or on the frontal surface of zooids or ovicells. Occasional large spatulate vicarious avicularia also occurring. Ovicell distinctive, huge in comparison with zooids, about .55 mm. in diameter, globular, completely covering the orifice of the mother zooid, covered with pores and usually bearing several small avicularia on its surface.

OCCURRENCE AND ECOLOGY: Found in continental shelf collections in September encrusting dead *Oculina.* Collected twice on beachrock stones at Seminole Shores, in April and October. None of these specimens had ovicells.

DISTRIBUTION: Western Atlantic: Cape Hatteras, Bermuda to Brazil. Gulf of Mexico and Caribbean. Galapagos. A warm water species abundant in the Caribbean and Gulf of Mexico.

FAMILY STOMACHETOSELLIDAE CANU AND BASSLER, 1917

GENUS *CIGCLISULA* CANU AND BASSLER, 1929

Cigclisula turrita (Smitt), 1873
Figure 79

Lepralia turrita Smitt, 1873, p. 65.
Holoporella turrita: Osburn, 1914, p. 217; 1927, p. 131. Canu and Bassler, 1928a, p. 145. Hastings, 1930, p. 732.
Cigclisula turrita: Harmer, 1957, p. 1059.
Trematooecia turrita: Powell, 1971, p. 773.

DESCRIPTION: (AMNH 620) Colony encrusting, plurilaminar, massive peach colored live. Zooids erect, about .50 × .50 mm. in size, orifice central, surrounded by several thick tubercles or projections, thickly calcified, with walls penetrated by small scattered pores. Orifice subcircular proximally, semicircular distally. Tiny ovate avicularia occurring in various positions on the frontal surface and on the tips of the tubercles. Large spatulate avicularia sometimes occurring. Ovicells (according to Harmer, 1957 and Osburn, 1940) spherical, inconspicuous, opening into the distal end of the peristome, with a rounded membranous area when young which becomes heavily calcified and porous with age.

OCCURRENCE AND ECOLOGY: Occurred only in continental shelf collections. Specimens collected in September and February had no ovicells.

DISTRIBUTION: East coast of Florida, Gulf of Mexico, Caribbean. Panama. Also reported from the Mediterranean and the Pacific.

GENUS *CLEIDOCHASMA* HARMER, 1957

Cleidochasma porcellanum (Busk), 1860
Figure 80

Lepralia porcellana Busk, 1860, p. 283.
Lepralia cleidostoma Smitt, 1873, p. 62.
Hippoporina cleidostoma Canu and Bassler, 1928a, p. 104.
Hippoporina porcellana: Hastings, 1930, p. 721. Marcus, 1937, p. 96. Osburn, 1940, p. 428; 1952, p. 344. Shier, 1964, p. 633.

Cheidochasma porcellanum: Cheetham and Sandberg, 1964, p. 1032. Cook, 1964b, p. 11; 1968a, p. 198. Long and Rucker, 1970, p. 19. Powell, 1971, p. 771.

DESCRIPTION: (AMNH 621) Colonies encrusting, white to beige or peach in color, unilaminar to plurilaminar. Zooids hexagonal in shape, .60 × .45 mm. in size, slightly inflated, calcification thick and sparsely granular, with three to five marginal pores, a faint line of calcification marking edges. Orifice keyhole-shaped, round proximally, with cardelles directed backward and a deep and broad sinus below that. Avicularia varying in size and position, in these specimens rare, when present located below the aperture, directed laterally, and with a long pointed mandible. Ovicell hyperstomial, imperforate, granular. Near the growing edge ovicells prominent and showing longitudinal striations. In older areas of the colony ovicells embedded in calcification of distal zooids and almost invisible except for slight swelling of the distal zooids and squared-off lines above the aperture of the fertile zooid marking their openings. Embryos reddish pink.

OCCURRENCE AND ECOLOGY: Colonies with ovicells containing embryos present encrusting *Oculina* in *Gosnold* collections of February 1975.

DISTRIBUTION: Probably circumtropical. Western Atlantic: Cape Hatteras to Brazil. Gulf of Mexico and Caribbean.

Cleidochasma contractum (Waters), 1899
Figure 81

Lepralia contracta Waters, 1899, p. 11.
Perigastrella contracta: Hastings, 1930, p. 722. Marcus, 1937, p. 98.
Hippoporina contracta: Osburn, 1940, p. 428; 1952, p. 346. Marcus, 1955, p. 298. Shier, 1964, p. 632.
Cleidochasma contractum: Cook, 1964b, p. 14; 1968a, p. 198. Cheetham and Sandberg, 1964, p. 1032.

DESCRIPTION: (AMNH 622) Colonies encrusting, unilaminar to plurilaminar, white in color. Zooids about .43 × .36 mm. in size, oval to hexagonal in shape, with rough, thick and uneven calcification and a row of marginal pores. Edges of zooids indistinct except for pores. Orifice rounded distally and beaded at edge, with strong cardelles and rounded sinus proximally. Four to eight hollow spines around orifice. Avicularia variable, sometimes entirely lacking near edge. Small ovoid avicularia may be present on either side of orifice, having serrated mandibles, raised at an angle, and proximolaterally directed. Spatulate distolaterally directed avicularia may also occur beside orifice. Ovicell hyperstomial, usually broader than long, imperforate, with an outer heavily calcified front having faint radial striations, and a less calcified central area. Ovicells covering all but two spines of fertile zooids. According to Marcus (1937) polypides have 12 tentacles and are dark yellow in color.

OCCURRENCE AND ECOLOGY: One of the most common species in the *Gosnold* collections, often forming massive encrustations on dead *Oculina*. Specimens collected in September had ovicells.

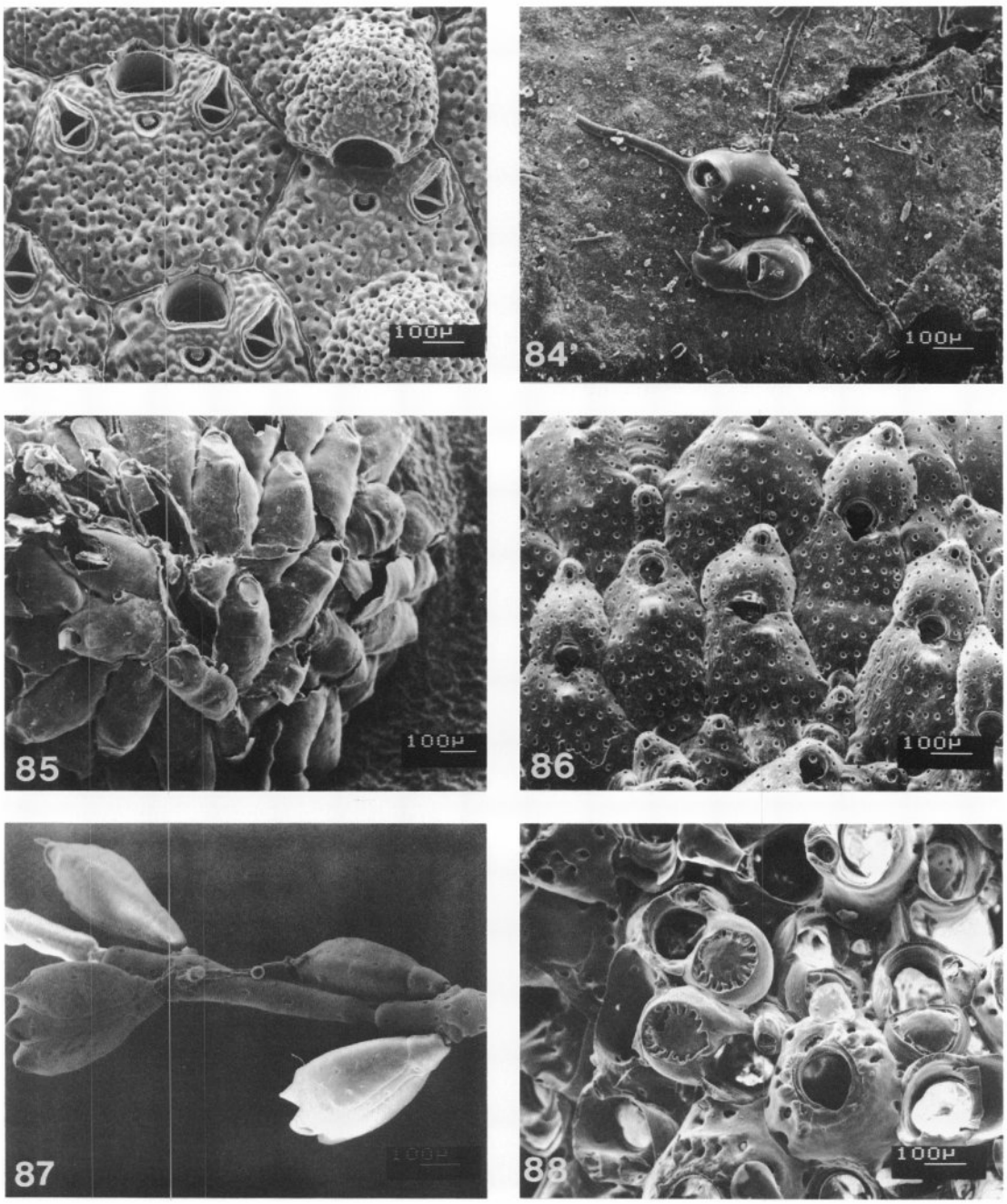
DISTRIBUTION: Western Atlantic: Cape Cod to Brazil. Caribbean and Gulf of Mexico. Eastern Pacific, Madeira, and West Africa.

GENUS *HIPPOPORIDRA* CANU AND BASSLER, 1927

Hippoporidra calcarea (Smitt), 1873
Figure 82

Lepralia edax (forma calcarea) Smitt, 1873, p. 63.
Lepralia edax Osburn, 1914, p. 212.
Hippoporidra calcarea: Canu and Bassler, 1928a, p. 140.

DESCRIPTION: (AMNH 623) Colonies encrusting gastropod shells occupied by hermit crabs. Massive, often developing nodules, long prominences or cylindrical branches, commonly one on either side of the shell. Two basic kinds of zooids. Small autozooids forming the bases of branches and prominences (only ones illustrated in fig. 82) and large cortical zooids with reduced orifices. Autozooids about .30 × .30–.40 mm. in size, with a suborificial umbo, their frontal surface very granular. There with a row of marginal pores and more irregular inner row of pores. Depressions between zooids; in some areas



FIGS. 83–88. 83. *Microporella umbracula.* 84. *Hippothoa flagellum.* 85. *Celleporella carolinensis.* 86. *Trypostega venusta.* 87. *Pasythea tulipifera.* 88. *Celleporina hassalli.*

zooids set off from each other by a thin calcareous rim, in other areas zooids backed together so closely and at such differing levels and angles that boundaries become hard to

distinguish. Small avicularia with blunt mandibles present on the frontal surface of many zooids, and large avicularia with long pointed mandibles found between zooids. Ovicell hyperstomial and hooded with a raised smooth rim and an inverted U-shaped frontal area that may be membranous or become partly covered by calcification.

OCCURRENCE AND ECOLOGY: Collected in 7 m. of water on the subtidal worm reef off Pepper Park, Fort Pierce in April. Also dredged in 67–70 m. offshore in September. Buge (1957) and Cook (1964b) studied the association of *Hippoporidra* spp. with gastropod shells inhabited by hermit crabs and concluded that it was primarily between the bryozoan and the hermit crab, as they are not found on shells that contain living gastropods. Usually the colony is formed by a larva which settles near the orifice of the shell (out of range of the chelae of the crab). Colonies in this genus appear to be sexually dimorphic. Ovicelled zooids are female. According to Cook's studies (1968b), cortical zooids have very small polypides with only six non-ciliated tentacles and may be male zooids.

DISTRIBUTION: Florida, Gulf of Mexico.

FAMILY MICROPORELLIDAE HINCKS, 1880

GENUS *MICROPORELLA* HINCKS, 1877

Microporella umbracula (Audouin), 1826

Figure 83

Flustra umbracula Audouin, 1826, p. 239.
Microporella ciliata var. *coronata* Hastings, 1930, p. 727.
Microporella coronata Osburn, 1952, p. 386.
Microporella umbracula: Harmer, 1957, p. 964. Powell, 1971, p. 772.

DESCRIPTION: (AMNH 624) Colony encrusting, unilaminar, pink to orange when alive, showing a great deal of variation in size and shape of zooids, position of avicularia, etc. Zooids about .60 × .60 mm. in size, surface inflated with smooth or roughened calcification perforated by small pores. Zooids separated by a depression. Orifice semicircular. Below it a crescent-shaped ascopore edged with a row of fine teeth, usually four spines, and often dark green in color, occurring around proximal rim of orifice but often broken off. Avicularia with very pointed mandibles on one or both sides of ascopore, directed distolaterally. Ovicell large, globular, porous, closed by zooidal operculum. Embryos reddish pink in color.

OCCURRENCE AND ECOLOGY: Occurs yearround in the Indian River area, reproductive in fall and winter. Colonies with ovicells and embryos occurred in late October at Capron Shoals, in December at Walton Rocks and ovicelled specimens taken in the *Gosnold* collection in September.

DISTRIBUTION: Circumtropical. Western Atlantic: Florida.

GENUS *HIPPOTHOA* LAMOUROUX, 1821

Hippothoa flagellum Manzoni, 1870

Figure 84

Hippothoa flagellum Manzoni, 1870, p. 6. Hincks, 1880, p. 293. Osburn, 1952, p. 278. Gautier, 1962, p. 118. Cook, 1968a, p. 176.

DESCRIPTION: (AMNH 625) Colony uniserial, composed of straggling networks of zooids. Autozooids smooth-walled, ovoid or teardrop-shaped, the proximal parts elongated into narrow tubular connections. Autozooid orifices rounded distally, with proximal sinus. Female zooids shorter than autozooids, to which they are usually attached by a short tubular process, and having a smooth and helmet-shaped ovicell with a single central pore. The orifice which closes the ovicell, is semicircular, slightly curved proximally, but without a sinus.

DISCUSSION: I follow Cook (1968a) in keeping *H. flagellum* separate from *H. distans* as described by Harmer (1957), as his material from the East Indian region differs with respect to the shape of the orifice of ovicelled zooids.

OCCURRENCE AND ECOLOGY: Found only in continental shelf collections. One of the most common species on dead shell and *Oculina* rubble in 40–90 m. depth. Ovicelled zooids observed at the time of collection in September.

DISTRIBUTION: Probably cosmopolitan in warm seas. Western Atlantic: Cape Hatteras to Florida (Maturo, 1968, p. 278). If Osburn's

Hippothoa distans is really this species, then it has also been recorded from the Tortugas.

GENUS *CELLEPORELLA* GRAY, 1848

Celleporella carolinensis Ryland, 1979
Figure 85

Hippothoa hyalina Smitt: Verrill, 1878, p. 305.
(?) *Hippothoa hyalina* (Linnaeus) Osburn, 1932, p. 443.
(Probably) *Hippothoa hyalina* (L.) Marcus, 1937, p. 79, pl. 17, fig. 42.
Hippothoa hyalina (L.) (in part) Marcus, 1938, p. 74–77, 119, pl. 20, fig. 54 (not 56), pl. 21, fig. 55.
(?) *Hippothoa hyalina* (L.) Osburn, 1944, p. 42, fig. 26.
Hippothoa hyalina (Linnaeus) Maturo 1957, p. 48, fig. 51.
Celleporella carolinensis Ryland, 1979, p. 612, fig. 1.

DESCRIPTION: (AMNH 626) Colony unilaminar, a transparent glistening layer of encrusting zooids. Zooids polymorphic, of three types: autozooids, very small male zooids, and female zooids bearing ovicells. Autozooids oblong-elongate, averaging .36 × .18 mm. in size and having polypides with 11 tentacles, mean lophophore diameter .253 mm. Male zooids about one-quarter the size of autozooids, female zooids (with ovicells) about half autozooid size. All zooids smooth surfaced with faint transverse growth ridges. Opecula of male zooids about one-third the size of that of the autozooid, but similar in shape, both are horseshoe-shaped distally, with a rounded proximal sinus. Orifice of female zooid (which closes the ovicell) lunate and with a barely apparent sinus. Ovicell globular and prominent, with only a few scattered pores and a ridge along the orifice margin that develops into a slight keel. Early stages of embryos yellow, late stages white. Larva whitish, subspherical, without pigment spots (Ryland, 1979).

DISCUSSION: This species was recently described by Ryland (1979) who separated it from *Celleporella hyalina* on the basis of zooid size, early astogeny, unilaminar growth form, and ovicell characters. *Celleporella hyalina* has larger zooids (autozooids .45–0.5 mm. in length in Atlantic material), ovicells with many evenly sized regularly spaced pores, and a colony which is whitish and calcified except at the edges and able to form several layers of zooids.

OCCURRENCE AND ECOLOGY: Found encrusting *Sargassum* in beach drift at Seminole Shores in February and July. Colony collected in February had white embryos.

DISTRIBUTION: The previous identification of this species with *Celleporella hyalina* makes its exact range difficult to determine, but *Celleporella carolinensis* probably occurs from Cape Cod to Brazil. Ryland collected it at Woods Hole and at Beaufort, N.C. It is here reported from Florida. Its normal habitat appears to be the brown alga *Sargassum filipendulum*, on which the colonies may be abundant and yet unnoticed because their transparency renders them almost invisible.

GENUS *TRYPOSTEGA* LEVINSEN, 1909

Trypostega venusta (Norman), 1864
Figure 86

Lepralia venusta Norman, 1864, p. 84.
Gemellipora glabra forma *striatula* Smitt, 1873, p. 37.
Trypostega venusta: Osburn, 1914, p. 198; 1940, p. 409; 1952, p. 280. Canu and Bassler, 1928a, p. 77. Marcus, 1938, p. 35. Shier, 1964, p. 627. Cook, 1968a, p. 177.

DESCRIPTION: (AMNH 627) Colony encrusting, surface smooth and glassy when young, becoming whitish with age. Zooids rhomboidal, numerous pores evenly distributed over the surface. Faint longitudinal striations and transverse growth lines, sometimes with a small umbo proximal to the orifice. Zooids measuring about .45 × .30 mm. Orifice pyriform: rounded distally, two cardelles and a V-shaped sinus proximally. Rectangular zooeciules or dwarf zooids located at the distal end of each autozooid. Ovicells deeply embedded, porous, and covering the proximal part of the zooeciule, which then appears to be part of the ovicell.

OCCURRENCE AND ECOLOGY: Abundant in shelf waters on shell and *Oculina* rubble. Also occurred subtidally in 10 m. of water at Capron Shoals. Ovicells present on specimens

collected in September. The zooeciules of this species have been found to contain a polypide, but no gonads and thus seem not to be male zooids (as in *Hippothoa*) but they do have a large opercular muscle and so, according to Marcus (1938), should be considered to be avicularia. Although zooeciules ordinarily are located at the distal ends of zooids they are occasionally found inside the opercula of autozooids, apparently replacing dead autozooids. *Trypostega* colonies when alive are often so fouled by algae that the colonies themselves resemble greenish and yellowish patches of algae. The pores become darkened by this accumulation of algae, giving the colony surface a speckled appearance.

DISTRIBUTION: Atlantic, Pacific, and Indian oceans but with greatest distribution in warm water. Not known from the Mediterranean. Western Atlantic: Cape Hatteras to Brazil. Caribbean and Gulf of Mexico.

PASYTHEIDAE DAVIS, 1934
PASYTHEA LAMOUROUX, 1812

Pasythea tulipifera
(Ellis and Solander), 1786
Figure 87

Cellaria tulipifera Ellis and Solander, 1786, p. 27. *Pasythea tulipifera:* Marcus, 1938, p. 37. Osburn, 1940, p. 462. Cook, 1968a, p. 186.

DESCRIPTION: (AMNH 628) Colony composed of erect jointed branches rising from a creeping stolon. Axis of branch consisting of tubular kenozooids separated by chitinous joints, triads of zooids arising from the distal ends of these on opposite sides. Middle zooid of triad connected by another joint to the kenozooid and facing away from the stalk. Other two zooids budded off the central zooid and facing toward the stalk. Joints movable. When colony is alive, triads can be drawn up parallel to the kenozooid stalk or held out almost perpendicular to it. Distal tips of zooids sometimes elongated into spines. Both zooids and kenozooids with scattered pores on their surfaces. Orifice with an orbicular top portion and a sinuate bottom portion. Zooids averaging .40 mm. in length by .10 mm. wide. Polypides with 10 tentacles, average lophophore diameter .167 mm. No ovicells or avicularia.

OCCURRENCE AND ECOLOGY: Found at only one station: Fort Pierce Breakwater, but sometimes quite abundant there. Its distribution is tropical and colonies found in winter months (December and January) were fouled with diatoms and appeared senescent, although still having some functional polypides. Most common in summer on *Thyroscyphus* roots and stems and on the breakwater rocks just below the *Watersipora* zone. Young colonies noted in October.

DISTRIBUTION: Florida, Caribbean, Brazil, West Africa.

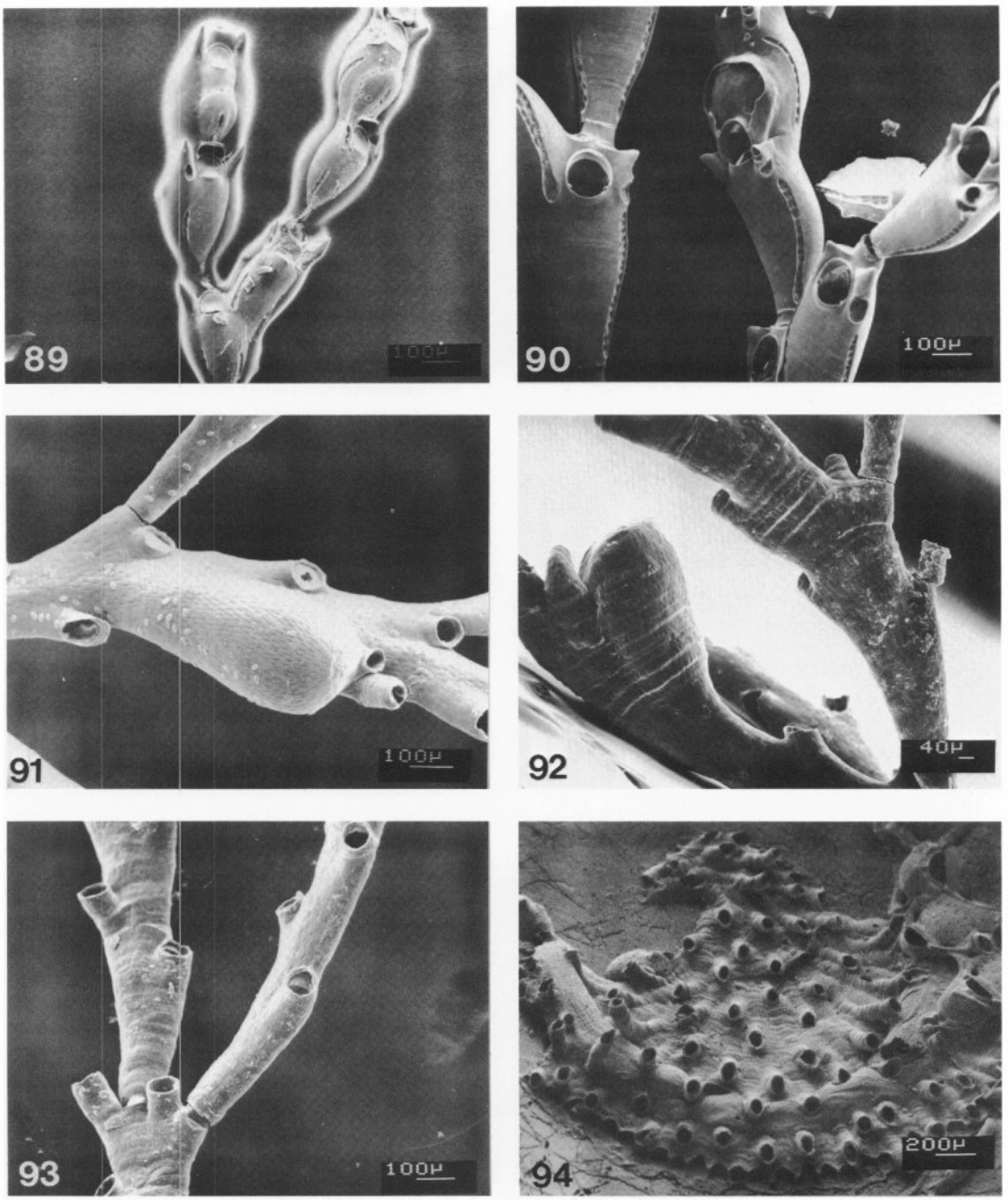
VITTATICELLIDAE HARMER, 1957
GENUS *VITTATICELLA* MAPLESTONE, 1901

Vittaticella uberrima Harmer, 1957
Figure 90

?*Vittaticella elegans* (Busk) Osburn, 1940, p. 464 (Not *Catenicella elegans* Busk, 1852, p. 361). *Vittaticella uberrima* Harmer, 1957, p. 772. Lagaaij, 1963, p. 202. Cook, 1968a, p. 179.

DESCRIPTION: (AMNH 629) Colony, erect, jointed, branching, up to 5–8 cm. in length. Zooids arranged in a single series, all facing the same way, tubular at the base and broadening toward the orifice, characterized by vittae (longitudinal grooves with pores) extending down either side of the frontal surface and by a triangular lateral process on either side of the orifice, bearing an avicularium with a triangular mandible. Zooids about .20 × .50 mm. in size. Ovicells embedded in base of distal zooid, often several in sequence on an internode. Frontal surface of ovicell flat, indented, surrounded by a beaded border. Embryos brownish, larvae dark brown in color.

OCCURRENCE AND ECOLOGY: Large colonies collected at Walton Rocks in April and Fort Pierce Breakwater in December. Ovicells with embryos present in both instances. Osburn noted reproduction occurring in Puerto Rican specimens in February, but not in mid-summer.



FIGS. 89–94. 89. *Vittaticella contei.* 90. *Vittaticella uberrima.* 91. *Crisia eburnea,* branch with gonozooid, showing position of oeciopore. 92. *Crisia elongata,* gonozooid in side view. 93. *Crisia elongata* zooids. 94. *Plagioecia dispar,* view of colony, showing arc-shaped brood chamber.

DISTRIBUTION: Cosmopolitan in warm water. Western Atlantic: East coast of Florida, Bermuda. Caribbean and Gulf of Mexico.

Vittaticella contei (Audouin), 1826
Figure 89

Eucratea contei Audouin, 1826, p. 242.
Catenicella contei: Marcus, 1937, p. 76; 1938, p. 31.
Vittaticella contei: Osburn, 1940, p. 465.

DESCRIPTION: (AMNH 630) Small, delicate, translucent white colonies, with branches only a few millimeters in length. Zooids short, wide distally and smoothly tapering proximally, averaging .33 × .14 mm. in size, fertile zooids often shorter. Vittae usually only down the proximal half of the zooids. Avicularia lacking, replaced by a long pointed process on either side of the orifice (which may have a central membranous area). Orifice semicircular. Polypides with 12 tentacles; lophophore diameter averaging .253 mm. Ovicells large, embedded in the distal zooid, outlined by a beaded border, and with a longitudinal groove down the front, having a transversely elongate orifice separate from and just above the orifice of the fertile zooid. Embryos pinkish red.

OCCURRENCE AND ECOLOGY: Found yearround at all coastal stations, but more abundant at Fort Pierce Inlet and Seminole Shores. Colonies, like those of *Savignyella,* small in size and generally cryptic in habit. Occurred chiefly in the roots of *Thyroscyphus* and *Endendrium,* but also found on sponges, beach rock or breakwater rock surfaces, and *Sargassum.*

DISTRIBUTION: Western Atlantic: Cape Hatteras to Brazil. Gulf of Mexico and Caribbean. Widely distributed in warm waters, but noted only rarely due to small size and cryptic habit.

FAMILY CELLEPORINIDAE HARMER, 1957
GENUS *CELLEPORINA* GRAY, 1848

Celleporina hassalli (Johnston), 1847
Figure 88

Lepralia hassalli Johnston, 1847, p. 30.
Celleporina hassalli: Hayward and Ryland, 1979, p. 276.

DESCRIPTION: (AMNH 631) Colony plurilaminar, forming small nodular masses around hydroid stems, etc. Zooids erect, averaging .40 × .30 mm. across exposed frontal surfaces, piled together irregularly so orifices are at several levels and zooids at various angles to each other. Surface inflated, with a row of marginal pores and often some pores toward the orifice as well. Orifice round with a shallow V-shaped sinus. Peristome high with a transversely elongated secondary orifice. Polypides with mean tentacle number of 13, mean lophophore diameter .373 mm. Peristomial avicularia, often paired, directed distally, and usually tilted at a 45-degree angle to the orifice. Large spatulate avicularia sometimes occurring. Ovicells prominent, with a circular membranous or lightly calcified frontal area edged by radiating ridges of calcification. Embryo pinkish red, larvae, pink.

OCCURRENCE AND ECOLOGY: Living colonies pink in color, due to pale pink or polypides and pinkish red of brooded embryos showing through translucent calcification. Encrusted *Thyroscyphus* at the North Beach Breakwater, abundant from October–April, but disappeared in the summer months. Reproducing from November–February.

DISTRIBUTION: Western Atlantic: Cape Hatteras to Florida. May be cosmopolitan but identity has been confused, especially with *Celleporina costazii.*

ORDER CYCLOSTOMATA
DIVISION ARTICULATA BUSK, 1852
FAMILY CRISIIDAE JOHNSTON, 1838
GENUS *CRISIA* LAMOUROUX, 1812

Crisia elongata Milne Edwards, 1838
Figures 92, 93

Crisia elongata Milne-Edwards, 1838, p. 203. Osburn, 1940, p. 328; 1953, p. 684. Shier, 1964, p. 647.
Crisia eburnea form *denticulata* Smitt, 1872, p. 4.
?*Crisia denticulata* Osburn, 1914, p. 185.
Crisia denticulata Canu and Bassler, 1928a, p. 156.

DESCRIPTION: (AMNH 633) Colonies bushy white tufts found attached to undersides of rock overhangs, hydroids, and algae, or embedded in sponges. Zooids tubular, averaging .07 × .60 mm, and punctate, sometimes with faint annular striations. Short peristome turned outward and sometimes with a small denticle on its distal border. Internodes of branches formed by alternating series of zooids, about 14–16 per internode (though variable), connected by brown or black chitinous joints. Polypides with eight tentacles and a campylonemidan lophophore averaging .266 mm. in diameter. Gonozooid short, broadly inflated, widest at distal end, generally with a faintly annulated surface. Oeciopore a transverse slit located back of the distal end of the gonozooid where it rests against branch zooids. Mature larvae ovoid, solid, and ciliated, greenish white in color, with no pigment spots. Gonozooids containing embryos and developing larvae yellowish brown in color.

OCCURRENCE AND ECOLOGY: Collected year-round at three coastal stations, Sebastian Inlet, Fort Pierce Breakwater, and Seminole Shores. A dominant species in the lower intertidal at Fort Pierce Breakwater during winter and early spring on *Thyroscyphus* and *Eudendrium,* as well as in association with sponges. Colonies grew vegetatively during the fall and gonozooids started developing in early December. Gonozooids with embryos were present in January and February. Although these large mature colonies were often fouled by fungi and diatoms they contained functional and active polypides. The species was less abundant in summer, but young colonies did occur. However, these colonies did not appear to contain functional polypides. Many zooids had peristomes extended and openings closed off by diaphragms and appeared to be dormant or oversummering at the time.

DISTRIBUTION: Circumtropical. Western Atlantic: Florida. Gulf of Mexico and the Caribbean.

Crisia eburnea (Linnaeus), 1758
Figure 91

Sertularia eburnea Linnaeus, 1758, p. 810.

Crisia eburnea: Maturo, 1957, p. 30. Cook, 1968a, p. 235.

DESCRIPTION: (AMNH 632) Colonies forming delicate white tufts on stems of algae. Branches curving slightly inward; joints yellowish in color. Zooids tubular, punctate, about .10 × .25 mm. in size, orifices usually pointed distally. Internodes short, but variable in number of zooids, usually with five to seven. Gonozooid usually occurring between the fourth and fifth zooid of a fertile internode, elongate, club-shaped and rounded distally. Oeciopore a short tube with a transversely ovoid opening (fig. 91).

OCCURRENCE AND ECOLOGY: Found only once in these collections, at the Sebastian Grassbed on the red alga *Solieria tenera.* Colonies small, but with gonozooids containing ripe embryos and larvae. Larvae which emerged from the oeciopore while the colony was being examined under the microscope remained for a moment or two on the colony and then took off for the water surface like tiny bees.

DISTRIBUTION: Common in the cold waters of Europe and America. Western Atlantic: Labrador to Florida. Also found in West Africa.

DIVISION TUBULIPORINA HAGENOW, 1851
FAMILY DIASTOPORIDAE GREGORY, 1899
GENUS *PLAGIOECIA* CANU, 1918

Plagioecia dispar Canu and Bassler, 1928
Figure 94

Plagioecia dispar Canu and Bassler, 1928a, p. 159.

DESCRIPTION: (AMNH 634) Colonies encrusting on dead shell and coral, fan-shaped when young, becoming subcircular with growth. Zooids tubular, embedded for most of their length, and separated from each other by furrows. Peristomes short (about .10 mm. or less) and semi-erect with oval orifices, not arranged in series. Brood chamber a prominent swelling, making an arcuate band well inside the growing edge of the colony, and normally surrounding a number of peristomes (12 in the specimen illustrated).

DISCUSSION: This species closely resembles *Plagioecia patina* and may, in fact be syn-

TABLE 1
Indian River
(All Collections)

HAULOVER CANAL
1. *Bowerbankia gracilis*
2. *Bowerbankia maxima*
3. *Sundanella sibogae*
4. *Zoobotryon verticillatum*
5. *Bugula neritina*
6. *Bugula stolonifera*
7. *Conopeum tenuissimum*

BANANA RIVER
1. *Bowerbankia gracilis*
2. *Bugula neritina*
3. *Conopeum tenuissimum*

SEBASTIAN GRASSBED
1. *Crisia eburnea*
2. *Amathia alternata*
3. *Amathia vidovici*
4. *Bowerbankia maxima*
5. *Bowerbankia gracilis*
6. *Bowerbankia imbricata*
7. *Zoobotryon verticillatum*
8. *Beania klugei*
9. *Bugula turrita*
10. *Bugula neritina*
11. *Conopeum tenuissimum*
12. *Membranipora savartii*
13. *Scrupocellaria regularis*
14. *Savignyella lafontii*
15. *Watersipora subovoidea*

LINK PORT GRASSBED
1. *Amathia distans*
2. *Bowerbankia gracilis*
3. *Bowerbankia maxima*
4. *Nolella stipata*
5. *Beania klugei*
6. *Bugula neritina*
7. *Conopeum tenuissimum*
8. *Electra bellula*
9. *Schizoporella floridana*

ST. LUCIE INLET
1. *Bowerbankia gracilis*
2. *Zoobotryon verticillatum*
3. *Bugula stolonifera*
4. *Bugula neritina*
5. *Conopeum tenuissimum*
6. *Electra bellula*

onymous with it. According to Canu and Bassler (1928) it differs from *Diastopora lactea* (Calvert, 1903) in the lack of concentric wrinkles on the colony and in slightly smaller micrometric measurements. Faint concentric wrinkles can be seen in the colony illustrated here, however.

OCCURRENCE AND ECOLOGY: Found at *Gosnold* stations encrusting shell and *Oculina* rubble. Brood chambers present on colonies collected in February.

DISTRIBUTION: Cape Hatteras to Straits of Florida.

DISTRIBUTION AND ECOLOGICAL FACTORS

The factors influencing bryozoan distribution have been discussed by many authors. Most factors are interrelated and difficult to assess separately, as, for example, the relationships between turbulence, rate of deposition, temperature, and water depth (see Cook, 1968a).

SALINITY

The factor known to most critically *restrict* the distribution of marine bryozoans is salinity. Only about 6 percent of living species are able to survive in waters of reduced salinity (under 30‰) (Winston, 1977).

At coastal and offshore stations (Walton Rocks, Seminole Shores, Capron Shoals, and *Gosnold* stations) in the Indian River area salinities remained at normal marine levels (35 to 37‰) throughout the survey. Within the Indian River lagoon salinities varied both with location and with time. The total range measured in 1974–1975 by the Indian River Coastal Zone Survey was from 14 to 34‰, whereas at the inlets (Fort Pierce, Sebastian, St. Lucie) salinity ranges between 30 and 35‰ were recorded (Young, 1975).

Eighteen species of bryozoans were found in the Indian River (table 1). Twelve species (three ctenostomes): *Bowerbankia gracilis, Bowerbankia maxima, Zoobotryon verticillatum*: and (nine cheilostomes): *Conopeum seurati, Conopeum tenuissimum, Electra bellula, Beania klugei, Bugula neritina, Bugula stolonifera, Hippoporina verrilli, Schizoporella floridana,* and *Watersipora subovoidea*) occurred in waters of less than 30‰

salinity. Other species, e.g., *Nolella stipata, Amathia alternata, Membranipora savartii,* were collected at stations within the river, but not at times when the salinity was under 30‰.

Of the species that occurred in brackish (30‰) water only three: *Conopeum tenuissimum, Conopeum seurati,* and *Bowerbankia gracilis* are truly brackish water species (having their chief abundances in brackish water and only occurring occasionally in fully marine water). The other species are euryhaline species characteristic of areas (like harbors) in which sudden strong variations in salinity and temperature may occur, but on a short-term basis, and in which conditions are generally marine (Gautier, 1962; Winston, 1977).

TABLE 2
Link Port—Barge and Piling Bryozoan Traps
(Glass Slides)

SPECIES
CTENOSTOMES
1. *Alcyonidium polyoum*
2. *Bowerbankia gracilis*
3. *Victorella pavida*
ANASCAN CHEILOSTOMES
1. *Bugula neritina*
2. *Bugula stolonifera*
3. *Conopeum seurati*
4. *Conopeum tenuissimum*
5. *Scrupocellaria regularis*
ASCOPHORAN CHEILOSTOMES
1. *Hippoporina verrilli*
2. *Schizoporella floridana*
3. *Watersipora subovoidea*

SUBSTRATUM

The presence of a suitable surface for larval settlement and colony growth and the associated category of variety of microhabitats available (on or including different substrata) at any locality are among the most important environmental controls of bryozoan distribution, as students of both living and fossil populations have pointed out (e.g., Cheetham, 1963; Cook, 1968a; Voigt, 1973; Thomsen, 1977). Many studies have shown the preference of bryozoan larvae of various species for a certain substratum (Ryland, 1959, 1962, 1976; Ryland and Stebbing, 1971; Stebbing, 1972), or the association of colonies of a species with a substratum (Hayward, 1973; Hayward and Ryland, 1975; Moore, 1973; Rogick and Croasdale, 1949; Stebbing 1971; Winston and Eiseman, 1980) or with a particular microhabitat or portion of a substratum (Hayward and Harvey, 1974). As the station descriptions show, localities sampled varied considerably with respect to type and number of substrata available.

In the Indian River (table 1) the chief substrata sampled were three species of seagrasses, *Halodule wrightii, Syringodium filiforme,* and *Thalassia testudinum.* All are relatively short-lived. In addition, seagrasses offer minimal surface area for somatic growth of colonies. As would be expected the bryozoan species most successful on this type of substratum were those with short life-spans, small zooid and colony size, and high reproductive rates such as the *Bowerbankia* spp., and two species of *Conopeum,* of which *Conopeum tenuissimum* (able to reproduce in three weeks or less [Dudley, 1973a]) appeared to be dominant. These species were present during most of the year and could apparently survive considerable fluctuations in temperature and salinity. Of the other common species, two, *Bugula neritina* and *Bugula stolonifera,* are common fouling species. Their distribution appears to be limited to temperature rather than by substratum preference as they were abundant only during the winter months (see also Mook, 1976). Another species, *Schizoporella floridana,* is known to form massive encrustations around *Thalassia* in localities farther south in Florida Bay (Multer, 1975). In the Indian River area the colonies of *S. floridana* on *Thalassia* never reach more than a few millimeters in size, yet these tiny colonies were often completely mature, containing many ovicells. The bryozoan traps set out at Link Port (table 2) supported a fauna similar to that found on seagrasses, with the major exception of *Hippoporina verrilli.* This encrusting cheilostome, common in tropical estuarine envi-

TABLE 3
Sebastian Inlet—Inner Breakwater—Sebastian, Florida

SPECIES
CYCLOSTOMES
1. *Crisia elongata*
CTENOSTOMES
1. *Aeverrillia armata*
2. *Amathia alternata*
3. *Amathia vidovici*
4. *Anguinella palmata*
5. *Bowerbankia maxima*
6. *Bowerbankia gracilis*
7. *Nolella stipata*
8. *Zoobotryon verticillatum*
ANASCAN CHEILOSTOMES
1. *Aetea sica*
2. *Aetea truncata*
3. *Antropora leucocypha*
4. *Beania klugei*
5. *Bugula neritina*
6. *Bugula stolonifera*
7. *Membranipora savartii*
8. *Synnotum aegyptiacum*
9. *Thalamoporella floridana*
ASCOPHORAN CHEILOSTOMES
1. *Savignyella lafontii*
2. *Watersipora subovoidea*
3. *Vittaticella contei*
4. *Schizoporella cornuta*
5. *Cryptosula pallasiana*

ronments was collected on oyster shells in the Indian River, as well as on panels and slides, but was not found on seagrasses.

The four coastal localities studied were alike in containing a large number of microhabitats, but at each locality the environmental conditions were somewhat different, and these differences were reflected in the bryozoan fauna each locality supported. At the Sebastian Inlet inner breakwater 23 species of bryozoans were collected (table 3) including one cyclostome, eight ctenostomes and 14 cheilostomes. The breakwater, which offered sheltered conditions and a range of hard substrata, supported a great many sessile organisms: sponges, hydroids, soft corals, tunicates, as well as bryozoans. On the tide-flat side of the breakwater, fine-grained sediment smothered colonies of encrusting forms growing directly on the surface of the rocks. Two normally sheetlike encrusting forms, *Watersipora subovoidea* and *Thalamoporella floridana,* there assumed an eschariform growth habit by producing ruffled bilaminate fronds from an encrusting base. Many of the bryozoans found on the Sebastian Breakwater were arborescent types which required very little attachment surface. One of the dominant species was the ctenostome *Anguinella palmata,* whose pendant colonies resembled mud-covered seaweed. *Zoobotryon,* another ctenostome, was also common hanging from the undersides of the jetty rocks. The other species found at Sebastian were mostly the delicate erect or encrusting forms that were characteristically associated with the bases and stems of hydroids.

Thirty-one species were collected from the North Beach Breakwater, Fort Pierce Inlet (table 4), including one cyclostome, nine ctenostomes and 21 cheilostomes. More collections were made at the North Beach Breakwater than at any other locality, as it was the closest site to gather material for morphological and behavioral studies (Winston, 1978), but the high number of species from this locality probably reflected chiefly the number of available microhabitats. Variously oriented rock surfaces and the surfaces of caves and crevices between the rocks, pieces of wood wedged between the rocks and holes, and hollows in the sabellariid mounds that encrusted many rocks, all provided substrata. The North Beach Breakwater is exposed to strong wave and tidal action, but very few bryozoans lived in the most exposed situations. One species that did is *Watersipora subovoidea* which formed a blackish crust on the rocks at the upper intertidal level. The channels receiving the strongest wave surges from the ocean to the inlet were commonly lined with colonial tunicates and sponges; among these were found the bushy white colonies of *Crisia elongata,* which reached maximum development in association with certain sponges. Below the upper intertidal level the rocks (especially in channels and crevices) were covered by various

TABLE 4
North Beach Breakwater—Fort Pierce Inlet—Fort Pierce, Florida

SPECIES
CYCLOSTOMES
1. *Crisia elongata*
CTENOSTOMES
1. *Aeverrillia armata*
2. *Amathia distans*
3. *Amathia vidovici*
4. *Anguinella palmata*
5. *Bowerbankia maxima*
6. *Bowerbankia imbricata*
7. *Nolella stipata*
8. *Valkeria atlantica*
9. *Zoobotryon verticillatum*
ANASCAN CHEILOSTOMES
1. *Aetea sica*
2. *Antropora leucocypha*
3. *Beania hirtissima*
4. *Beania klugei*
5. *Beania mirabilis*
6. *Bugula turrita*
7. *Bugula minima*
8. *Membranipora tuberculata*
9. *Scrupocellaria regularis*
10. *Synnotum aegyptiacum*
11. *Thalamoporella floridana*
ASCOPHORAN CHEILOSTOMES
1. *Celleporina hassalli*
2. *Cryptosula pallasiana*
3. *Exechonella antillea*
4. *Hippoporina verrilli*
5. *Pasythea tulipifera*
6. *Savignyella lafontii*
7. *Schizoporella cornuta*
8. *Vittaticella contei*
9. *Vittaticella uberrima*
10. *Watersipora subovoidea*

TABLE 5
Walton Rocks—Hutchinson Island, Florida

SPECIES
CYCLOSTOMES
1. *Crisia elongata*
CTENOSTOMES
1. *Alcyonidium polypylum*
2. *Amathia alternata*
3. *Amathia distans*
4. *Anguinella palmata*
5. *Bowerbankia maxima*
6. *Bowerbankia gracilis*
7. *Bowerbankia imbricata*
8. *Nolella stipata*
9. *Sundanella sibogae*
10. *Zoobotryon verticillatum*
ANASCAN CHEILOSTOMES
1. *Aetea sica*
2. *Antropora leucocypha*
3. *Beania hirtissima*
4. *Beania klugei*
5. *Bugula neritina*
6. *Bugula stolonifera*
7. *Bugula turrita*
8. *Bugula uniserialis*
9. *Caulibugula pearsei*
10. *Electra bellula*
11. *Membranipora savartii*
12. *Membranipora tuberculata*
13. *Scrupocellaria regularis*
14. *Synnotum aegyptiacum*
15. *Thalamoporella floridana*
ASCOPHORAN CHEILOSTOMES
1. *Cryptosula pallasiana*
2. *Celleporella carolinensis*
3. *Microporella umbracula*
4. *Parasmittina nitida* morphotype B
5. *Savignyella lafontii*
6. *Schizoporella cornuta*
7. *Schizoporella unicornis*
8. *Vittaticella contei*
9. *Vittaticella uberrima*
10. *Watersipora subovoidea*

hydroids, of which the largest and most abundant was *Thyroscyphus ramosus.* It was among the stems and roots of *T. ramosus* that most of the bryozoan species occurred. *Thalamoporella floridana* did not form foliaceous colonies as at Sebastian but instead grew in tubular fashion around the bases of the hydroid stems, the colonies only occasionally rose into a bilaminate frill. The characteristically hydroid-associated bryozoans were *Beania hirtissima, Beania klugei, Pasythea tulipifera, Synnotum aegyptiacum, Vittaticella contei,* and *Savignyella lafontii* all of which occurred year-round. *Thalamoporella floridana, Crisia elongata,* and *Celleporina hassalli* flourished during the winter months, whereas the stoloniferous cteno-

TABLE 6
Seminole Shores—Hutchinson Island, Florida

SPECIES
CYCLOSTOMES
1. *Crisia elongata*
CTENOSTOMES
1. *Aeverrillia armata*
2. *Alcyonidium polypylum*
3. *Amathia alternata*
4. *Amathia distans*
5. *Amathia vidovici*
6. *Anguinella palmata*
7. *Bowerbankia maxima*
8. *Bowerbankia gracilis*
9. *Sundanella sibogae*
10. *Zoobotryon verticillatum*
ANASCAN CHEILOSTOMES
1. *Aetea sica*
2. *Antropora leucocypha*
3. *Beania hirtissima*
4. *Beania klugei*
5. *Beania mirabilis*
6. *Bugula minima*
7. *Bugula uniserialis*
8. *Membranipora savartii*
9. *Membranipora tuberculata*
10. *Scrupocellaria regularis*
11. *Synnotum aegyptiacum*
ASCOPHORAN CHEILOSTOMES
1. *Celleporina hassalli*
2. *Cryptosula pallasiana*
3. *Hippaliosina rostrigera*
4. *Savignyella lafontii*
5. *Schizoporella cornuta*
6. *Parasmittina nitida* morphotype B
7. *Stylopoma spongites*
8. *Vittaticella contei*
9. *Watersipora subovoidea*

stomes were more common in summer and early fall.

At Walton Rocks 36 species including one cyclostome, 10 ctenostomes and 25 cheilostomes were found, making it the richest locality in terms of total number of species (table 5).

Two distinct subhabitats were available for colonization by bryozoans at Walton Rocks; the coquinoid ledge and the loose beachrock stones and boulders resting on and in the sandy trough between the ledge and the beach. These subhabitats differed considerably with respect to physical stability. The coquinoid ledge substratum was relatively stable, though environmental conditions varied seasonally (see section on temporal variation). Erect bryozoans attached directly to the undersurfaces of beachrock ledges, while other forms encrusted or attached to co-occurring hydroids and algae.

The other subhabitat, that of smaller stones, shells, and boulders lying in the sand channel between the ledge and the beach was a most unstable one as the substrata were constantly being covered and uncovered by shifting sand. During a one-month period, the level of sand in this area could change by 30 cm. or more. Colonies on stones that were completely buried were destroyed by being abraded off. Yet the stones, when only partially covered with sand or other stones, supported a diverse fauna of encrusting bryozoans, notably the ctenostome *Alcyonidium polypylum,* the cheilostomes *Parasmittina nitida* morphotype B, *Schizoporella cornuta, Schizoporella unicornis, Cryptosula pallasiana, Membranipora savartii,* and the ubiquitous *Watersipora subovoidea.* Often colonies on the underside of the stones were lying directly on the sand, but apparently the sand was porous enough and the water action sufficient so that feeding and respiration could occur, and only long-term burial killed the colonies.

At Seminole Shores (table 6) 31 bryozoans were collected including one cyclostome, 10 ctenostomes, and 20 cheilostomes. The areas exposed at low water at Seminole Shores consisted mostly of sabellariid reef on coquinoid rock base.

The dominant substrata for attachment, were the worm tubes themselves, the beachrock stones and ledges, and the algae and hydroids (especially *Eudendrium carneum*) attached to the rocks. *Watersipora subovoidea* was the only bryozoan commonly found on worm tubes. As the beachrock at Seminole Shores is more scoured than at Walton Rocks and contains fewer crevices for the attachment of algae and hydroids, the total number of bryozoan species was smaller than at Wal-

TABLE 7
Capron Shoals—Buoy 10A off Hutchinson Island, Florida

SPECIES
CTENOSTOMES
1. *Alcyonidium polypylum*
2. *Bowerbankia gracilis*
ANASCAN CHEILOSTOMES
1. *Aetea sica*
2. *Beania intermedia*
3. *Beania mirabilis*
4. *Bugula neritina*
5. *Bugula stolonifera*
6. *Cribrilaria radiata*
7. *Discoporella umbellata depressa*
8. *Floridinella typica*
9. *Membranipora arborescens*
10. *Membranipora savartii*
11. *Scrupocellaria regularis*
12. *Synnotum aegyptiacum*
ASCOPHORAN CHEILOSTOMES
1. *Hippoporina verrilli*
2. *Microporella umbracula*
3. *Parasmittina nitida* morphotype B
4. *Phylactellipora aviculifera*
5. *Schizoporella cornuta*
6. *Trypostega venusta*
7. *Watersipora subovoidea*

TABLE 8
***Gosnold* Collections (*Oculina* pinnacles and sand bottoms) Species Found on *Oculina* and on Gastropod Shells, Oyster or other Bivalve Shells Stations 696-698, 700-702; 734, 735, 737, 738, 757, 758, 759**

SPECIES
CYCLOSTOMES
1. *Plagioecia dispar*
ANASCAN CHEILOSTOMES
1. *Antropora leucocypha*
2. *Aplousina gigantea*
3. *Bellulopora bellula*
4. *Cleidochasma contractum*
5. *Cleidochasma porcellanum*
6. *Crepidacantha setigera*
7. *Cribrilaria radiata*
8. *Cigclisula turrita*
9. *Floridina antiqua*
10. *Floridinella typica*
ASCOPHORAN CHEILOSTOMES
1. *Escharina pesanseris*
2. *Hippaliosina rostrigera*
3. *Hippoporidra calcarea*
4. *Hippothoa flagellum*
5. *Membraniporella aragoi*
6. *Micropora coriacea*
7. *Microporella umbracula*
8. *Parasmittina spathulata*
9. *Parellisina latirostris*
10. *Phylactellipora aviculifera*
11. *Reginella floridana*
12. *Reptadeonella costulata*
13. *Stylopoma spongites*
14. *Tremoschizodina lata*
15. *Trypostega venusta*
Species found in sand from Station 766
ANASCAN CHEILOSTOMES
1. *Discoporella umbellata depressa*
2. *Cupuladria doma*

ton Rocks. Arborescent ctenostomes, *Amathia* spp., *Bowerbankia* spp., and *Zoobotryon verticillatum,* and the cheilostomes, *Bugula* spp., and *Scrupocellaria regularis* were abundant. The bottom surfaces of loose beachrocks in pools in the ledge were often completely covered by encrusting cheilostomes.

Two ctenostomes and 19 cheilostomes occurred at Capron Shoals (table 7) where patches of broken shells alternated with areas of sand bottom. *Discoporella umbellata depressa,* a free-living form, with a tiny conical colony that maintains itself on the shifting surface of the sand by means of long moveable spinelike vibracula, was present in samples taken in July. This was the only living species taken from the sand substratum (though dead colonies of another lunulitiform species, *Cupuladria doma,* were collected there). The main substrata available to bryozoan settlement were dead shells and shell fragments, hence the dominant forms were encrusting. Most common were *Alcyonidium polypylum, Microporella umbracula, Trypostega venusta, Cribrilaria radiata,* and *Phylactellipora aviculifera.* Panels which had been exposed at Capron Shoals for six months were examined in January. Four species (all common fouling species) oc-

TABLE 9
Association of Bryozoan Species with Various Substrata

WOOD (Sticks and Boards)
Bowerbankia gracilis
Crisia elongata
Cryptosula pallasiana
Hippoporina verrilli
Membranipora tenella
Membranipora sp.
Schizoporella cornuta
Schizoporella floridana
Scrupocellaria regularis
Thalamoporella floridana

LIVE GASTROPOD SHELLS
Antropora leucocypha

GASTROPOD SHELLS OCCUPIED BY HERMIT CRABS
Antropora leucocypha
Hippoporidra calcarea

PLASTIC AND METAL
Conopeum tenuissimum
Membranipora arborescens
Membranipora tenella
Membranipora sp.

OTHER BRYOZOANS (*Zoobotryon, Bugula neritina, Amathia* spp.)
Aetea sica
Aeverrillia armata
Bowerbankia gracilis
Bugula minima
Nolella stipata
Savignyella lafontii
Vittaticella contei

SPONGES
Bugula minima
Crisia elongata
Savignyella lafontii

SABELLARIID TUBES
Amathia distans
Bowerbankia imbricata
Crisia elongata
Watersipora subovoidea

FREE LIVING
Cupuladria doma
Discoporella umbellata depressa

HYDROIDS (*Thyroscyphus* and *Eudendrium*)
Aetea truncata
Aeverrillia armata
Amathia distans

TABLE 9—(*Continued*)

Anguinella palmata
Beania hirtissima
Beania klugei
Beania mirabilis
Bowerbankia maxima
Bugula stolonifera
Bugula minima
Bugula uniserialis
Celleporina hassalli
Crisia elongata
Exechonella antillea
Pasythea tulipifera
Savignyella lafontii
Scrupocellaria regularis
Sundanella sibogae
Synnotum aegyptiacum
Thalamoporella floridana
Valkeria atlantica
Vittaticella contei
Watersipora subovoidea

ALGAE
Amathia alternata
Amathia distans
Amathia vidovici
Aetea sica
Beania hirtissima
Beania klugei
Bowerbankia gracilis
Bowerbankia imbricata
Bowerbankia maxima
Bugula neritina
Bugula minima
Bugula stolonifera
Bugula uniserialis
Celleporella carolinensis
Crisia eburnea
Electra bellula
Escharoides costifer
Lagenicella marginata
Membranipora tuberculata
Microporella umbracula
Nolella stipata
Pasythea tulipifera
Savignyella lafontii
Scrupocellaria regularis
Synnotum aegyptiacum
Thalamoporella falcifera
Thalamoporella gothica
Vittaticella contei
Watersipora subovoidea
Zoobotryon verticillatum

TABLE 9—(*Continued*)

SEAGRASSES (*Syringodium, Halodule, Thalassia*)
Aetea
Amathia distans
Beania klugei
Bowerbankia gracilis
Bowerbankia maxima
Bugula neritina
Bugula stolonifera
Conopeum tenuissimum
Electra bellula
Membranipora savartii
Nolella stipata
Schizoporella floridana
Sundanella sibogae
Watersipora subovoidea

ROCK, SHELL AND CORAL
Aetea sica
Alcyonidium polypylum
Amathia alternata
Amathia distans
Antropora leucocypha
Aplousina gigantea
Beania hirtissima
Beania klugei
Beania mirabilis
Bellulopora bellula
Bowerbankia gracilis
Bowerbankia imbricata
Bowerbankia maxima
Bugula neritina
Bugula stolonifera
Bugula turrita
Caulibugula pearsei
Cleidochasma contractum
Cleidochasma porcellanum
Crepidacantha setigera
Crisia elongata
Cribrilaria radiata
Cryptosula pallasiana
Cigclisula turrita
Escharina pesanseris
Floridina antiqua
Floridinella typica
Hippaliosina rostrigera
Hippoporidra calcarea
Hippoporina verrilli
Hippothoa flagellum
Membranipora savartii
Membraniporella aragoi
Micropora coriacea
Microporella umbracula
Nolella stipata
Parasmittina nitida morphotype B
Parasmittina spathulata
Parellisina latirostris
Pasythea tulipifera
Plagioecia dispar
Phylactellipora aviculifera
Reginella floridana
Reptadeonella costulata
Scrupocellaria regularis
Schizoporella cornuta
Schizoporella unicornis
Stylopoma spongites
Synnotum aegyptiacum
Thalamoporella floridana
Tremoschizodina lata
Trypostega venusta
Vittaticella uberrima

curred: *Bugula neritina, Bugula stolonifera, Hippoporina verrilli,* and *Watersipora subovoidea.* There are similarities between the Capron Shoals fauna and those of the two intertidal stations, Walton Rocks and Seminole Shores, which have the most similar substrata. Only two ctenostomes were found at Capron Shoals, but one of these, *Alcyonidium polypylum* was a dominant form at Seminole and Walton rocks. Only four species of the encrusting cheilostomes, *Membranipora arborescens, Floridinella typica, Phylactellipora aviculifera,* and *Trypostega venusta,* were not found farther inshore. The last three, however, were collected from the deeper water *Gosnold* stations. An indication of the primary importance of substratum over other factors is that of the cheilostomes collected during the *Gosnold* cruise one-third (nine species) occurred also in very shallow subtidal to intertidal inshore stations.

Both lunulitiform species, *Cupuladria doma* and *Discoporella umbellata depressa* were also taken from sand bottoms of Fort Pierce Inlet and farther offshore. Twenty-eight species of cheilostomes were obtained from samples taken on the fossil *Oculina* reefs (table 8).

Table 9 summarizes the association of

bryozoan species found in Indian River area collections with various substrata: algae, seagrasses, wood, hydroids, other bryozoans, rock and dead shell, gastropod shells, sponges, and sabellariid tubes.

TEMPORAL VARIATION

Even with collections made over the course of a year it is only for the more abundant species that any reasonable idea of seasonality of occurrence and reproduction can be gained, but since few studies of bryozoans from warm water regions have covered even this length of time all the information obtained has been included in table 10. Offshore collections (*Gosnold* stations) were made only in September and February so not much information can be gained from species which were present only at those stations. What is obvious for coastal and river dwelling species is that more than half of them were present year-round (34 out of 64 species collected at inshore stations). This number might be expected to rise with more intensive collection, as so many of these species are small and cryptic. Abundance and condition during the course of the year varied from species to species, however. Certain species appeared to be chiefly restricted by summer temperatures. *Bugula neritina, Thalamoporella floridana, Crisia elongata,* and *Amathia alternata* achieved their maximum distribution and abundance in winter. Colonies collected in summer had a senescent "oversummering" appearance, e.g., the loss of pigment and degeneration of polypides in *Bugula neritina,* the fouled appearance and calcification of diaphragms in *Crisia elongata.* Other species: *Pasythea tulipifera, Synnotum aegyptiacum, Beania hirtissima,* were most abundant in summer months and colonies were few or had a degenerated appearance in winter collections. A third group: *Alcyonidium polypylum, Bowerbankia maxima,* and *Thalamoporella falcifera* had peak abundances in fall. This last category, and the patterns of occurrence of remaining species cannot be related to times or minimum or maximum water temperatures. Variation in their occurrence and abundance over time is probably related to seasonal changes in other physical conditions, or to appearance or disappearance of ephemeral substrata (e.g., algae and certain hydroids). All habitats studied in detail showed such changes.

At Sebastian Inlet January collections were marked by the occurrence of *Watersipora subovoidea* in foliaceous sheets at upper low-water level, and by the presence of brittle, flower-like clusters of *Thalamoporella floridana* on the undersides of rocks in protected crevices. A cold spell in January in which the water temperature dropped below 15° C. killed some species (e.g., *Bugula neritina,* but did not affect others e.g., *Bugula stolonifera*). In April breakwater rocks were noticeably coated with mud, and the most abundant bryozoan was the ctenostome *Anguinella palmata,* whose colonies became coated with sediment. September collections showed the area dominated by hydroids (including *Pennaria tiarella, Thyroscyphus ramosus,* and *Eudendrium carneum*), while colonies of soft corals (*Telesto* sp.) covered the bases of the rocks along with masses of anemones and sabellid worms. Ruffled colonies of *Watersipora* were again present, but ctenostomes were still dominant, in the form of large mud-covered masses of *Zoobotryon* and *Bowerbankia maxima* hanging from rock undersurfaces below the *Watersipora* level. Bryozoans here grew more actively in the fall than in the spring and summer months; the fauna was most diverse in the month of November when 16 species were collected. Although substrata were still muddy, more encrusting species (*Schizoporella cornuta, Antropora leucocypha, Cryptosula pallasiana, Membranipora savartii,* and *Watersipora subovoidea*) were present on shells, glass, and stones in crevices among the breakwater rocks than at other times. Masses of *Amathia* spp. were most common a month later in December.

At the North Beach Breakwater, Fort Pierce Inlet, the hydroid *Thyroscyphus ramosus* was abundant year-round. In January this hydroid was dormant (with no feeding hydranths), but its perennial roots, stalks, and branches provided an important substratum for bryozoans, especially *Crisia elon-*

gata, Thalamoporella floridana, and *Watersipora subovoidea.* In this high energy environment the *Watersipora* and *Thalamoporella* colonies on hydroid roots remained chiefly encrusting, only occasionally forming bilaminar frills. *Vittaticella contei* and *Savignyella lafontii* were common on *Thyroscyphus* and among massive sponge colonies. *Antropora leucocypha* was common on the shells of snails (mainly *Thais haemostoma floridana*) living on the breakwater rocks. In February *Crisia elongata* was most abundant and reproducing actively. *Thalamoporella* and *Watersipora* were still flourishing and were joined on the hydroid stems by *Celleporina hassalli* which was also reproducing. March was the month showing greatest diversity of the *Thyroscyphus* fauna: *Thalamoporella, Crisia, Celleporina, Synnotum aegyptiacum, Vittaticella contei, Savignyella, Pasythea tulipifera, Bugula minima, Beania hirtissima,* and *Beania klugei* were all present *Scrupocellaria regularis* was common both on hydroid stems and breakwater rocks. In April five days of very rough seas resulted in many of the sabellariid masses being smashed and overturned; the holes inside these structures were exposed and the worms themselves were killed. The storm also caused shifts in levels of sand in the crevices, burying many of the hydroids and scouring rock surfaces. On *Thyroscyphus* in the low to mid-intertidal level *Thalamoporella, Crisia, Beania hirtissima,* and *Celleporina* were the most common species. *Watersipora* was abundant on worm tubes and in holes in the worm reef, whereas *Amathia vidovici* formed clumps on undersurfaces of rocks and in the holes in the worm reef exposed by the storms. April marked the first new growth of *Thyroscyphus.* By June and July *Thyroscyphus* colonies were flourishing and the hydroid *Eudendrium carneum* was also plentiful, whereas the sabellariid mounds were collapsing. Noticeably fewer bryozoans occurred on *Thyroscyphus* in summer months when the hydroid was growing actively and producing stinging nematocysts. *Thalamoporella* and *Celleporina* were lacking and *Crisia* was less abundant, though young colonies were present. *Pasythea tulipifera* was very common both on *Thyroscyphus* and on the undersurfaces of rock crevices just below the *Watersipora* level. *Bowerbankia maxima* was abundant. By August the worm mounds were worn and broken. There were fewer sponges and tunicates and few anemones, but *Thyroscyphus* and *Eudendrium* were still thriving; on them the most abundant bryozoan was *Beania hirtissima.* Very little *Watersipora* was present in comparison with winter months. Some colonies encrusting the rocks were alive; most of the colonies on the worm reef were dead. Fall (October) brought a return of the cooler water fauna. At this time *Watersipora* colonies began growing rapidly and on the *Thyroscyphus* (which was still active) *Pasythea, Synnotum,* and particularly *Savignella* were abundant. Young colonies of *Crisia* (without gonozooids) occurred, and *Thalamoporella* colonies were actively budding again. By December when the water temperature reached 20° C. crevices under rocks were crowded with masses of bushy bryozoans: *Crisia* (with gonozooids developing), *Amathia distans* and *Vittaticella uberrima* (colonies five to eight cm. in size with gonozooids containing embryos). On the *Thyroscyphus, Thalamoporella, Amathia distans, Synnotum,* and *Crisia* were dominant; *Pasythea* still occurred, but colonies were fouled and senescent in appearance.

High tides and strong surf made it almost impossible to collect at Walton Rocks in winter months as the coquinoid ledge remained underwater. *Watersipora* occurred on the ledge itself. Species of *Bugula* were attached to the undersides of the ledge, whereas *Vittaticella contei, Amathia convoluta, Bowerbankia gracilis, Beania klugei, Synnotum aegyptiacum,* and *Sundanella sibogae* occurred on hydroids attached to the ledge. By April environmental conditions had ameliorated. There was rapid growth of algae on the ledges and also of *Zoobotryon verticillatum. Bowerbankia gracilis* occurred on *Zoobotryon* and algae, *Electra bellula* on the algae, whereas *Scrupocellaria regularis, Bugula turrita,* and *Vittaticella* hung from the ledges. The sandy channel between the surf line and the ledges was deeply scoured. Loose beach-

rocks lying on the sand had undersurfaces covered by encrusting bryozoans: *Alcyonidium polypylum, Membranipora savartii, Beania hirtissima, Parasmittina nitida* morphotype B, *Schizoporella cornuta,* and *Schizoporella unicornis.* In June the beach profile had flattened, the channel had filled in (to 30 to 60 cm. above its winter depth) and sand had buried most beachrocks, boulders, and dead shells. *Zoobotryon, Amathia distans,* and *Bugula turrita* were attached to the ledges. *Bugula neritina* was present in the form of faded brown senescent colonies in which only the distalmost zooids had functional polypides. *Bowerbankia maxima, Thalamoporella,* and *Watersipora* occurred on red algae, and *A. polypylum, Schizoporella cornuta,* and *Parasmittina* had survived on a few beachrocks (on most beachrocks there were only dead and abraded colonies). At the July collection the sand level in the channel had returned to the level of winter months. Many dead *Watersipora* colonies were noted on the ledges (where they had been killed by the previous high sand level), but live colonies were abundant in the pockets in the worm reef mounds caused by their seasonal degeneration. *Cryposula* and *Microporella umbracula* encrusted dead shell. *Zoobotryon* was less luxuriant than in June. In September sand had again filled in around the rocks so that only the upper surface of the ledges was exposed. *Zoobotryon* persisted on the ledges, though colonies were fouled with filamentous algae. Large branching masses of *Bowerbankia maxima* were attached directly to the rock surface. *Alcyonidium polypylum, Watersipora, Parasmittina,* and *S. cornuta* were present as small colonies (young or regenerated) on beachrocks. Fall (October) brought high tides, surf, and winds. Most algae, hydroids, and bryozoans had disappeared from undersides of ledges, the channel area was scoured out again and full of loose stones on which encrusting species, especially *Schizoporella unicornis, Schizoporella cornuta,* and *Membranipora savartii,* were abundant. *Bugula turrita, Bugula neritina,* and *Scrupocellaria regularis* were collected from the ledges in November. In December surf covered the ledges making it impossible to collect there. The channel area was still scoured out and beachrock stones were abundant. Encrusting species had large colonies. *Parasmittina, S. cornuta,* and *Microporella* were reproducing; *A. polypylum, S. unicornis,* and *Cryptosula* occurred as large colonies, but were not reproducing.

At Seminole Shores in January the worm reef was vigorously growing. *Watersipora* occurred directly on worm tubes. Other bryozoans were found only on hydroid stems and algae attached to worm reef or rock surfaces. Although the number of species was similar to that at the other coastal stations colony numbers were low and colonies found were small in size and very cryptic, adhering closely to the rare beachrock stones or almost invisible among the hydroid roots. In January species from hydroid-algal habitats included *Beania hirtissima, Beania mirabilis, Synnotum, Sundanella, Crisia, Amathia vidovici,* and *Bugula minima.* As at Walton strong surf and high seas hampered collection. In February the reef was completely covered and only uprooted *Sargassum filipendulum* and drift *Sargassum* spp. could be collected. June found much of the worm reef eroded and dying, and sand had covered most loose beachrock and shell material in ledge pools, the quantities of hydroids and algae had diminished. *Zoobotryon* specimens collected contained sperm. *Aetea sica, Bowerbankia gracilis, Beania klugei, Crisia, Amathia distans, Bugula minima,* and *Vittaticella contei* occurred on hydroids or algae. Only two encrusting species were found in June: *Membranipora savartii* and *Schizoporella cornuta,* but in July six encrusting species were collected from beachrock stones in back-ledge pools: *A. polypylum, Parasmittina, Cryptosula, S. cornuta,* and *Stylopoma spongites.* In September young colonies of *A. polypylum, Watersipora, Beania klugei,* and *Amathia alternata* were found on beach rock. Masses of *Zoobotryon* and *Bowerbankia maxima* were tangled among the green algae attached to the worm reef. In October the worm reef mounds were still degenerated, though there had been some new settlement

TABLE 10
Seasonal Occurrence and Breeding in Bryozoans of the Indian River Area

Species	Species Collected (most abundant)	Colonies with Embryos and/or Young Settled Colonies Observed
Bowerbankia gracilis	Year-round	December–June
Bowerbankia imbricata	March–September	—
Bowerbankia maxima	March–November (September)	March (young colonies)
Zoobotryon verticillatum	April to October	June
Amathia alternata	Year-round (Winter)	—
Amathia distans	Year-round (December)	—
Amathia vidovici	Year-round	—
Valkeria atlantica	August	—
Aeverrillia armata	Year-round (Fall)	—
Alcyonidium polyoum	April	April
Alcyonidium polypylum	Year-round	September–November
Victorella pavida	December	December
Sundanella sibogae	Year-round	—
Nolella stipata	Year-round	—
Anguinella palmata	January–April	—
Aetea truncata	November	—
Aetea sica	February–October (Sept.–Oct.?)	—
Membranipora arborescens	February–April (+?)	—
Membranipora savartii	Year-round (April & October)	—
Membranipora tuberculata	Year-round	—
Membranipora tenella	Year-round (?)	—
Membranipora sp.	Year-round (?)	—
Conopeum seurati	December–May	Dec.–May (Late Winter–Spring)
Conopeum tenuissimum	Year-round	Spring and Fall (December)
Electra bellula	Year-round	—
Cupuladria doma	Year-round (?)	—
Discoporella umbellata depressa	Year-round (?)	—
Aplousina gigantea	February	February
Parellisina latirostris	February	February
Antropora leucocypha	Year-round	—
Floridina antiqua	February	—
Micropora coriacea	February	February (?)[a]
Floridinella typica	October, February	—
Thalamoporella floridana	Year-round (Winter)	January
Thalamoporella falcifera	Year-round (Fall)	—
Synnotum aegyptiacum	Year-round (Summer)	—
Scrupocellaria regularis	Year-round	January–April
Bugula neritina	Year-round (Winter)	Jan.–June (late winter/early spring)
Bugula stolonifera	December–May	December–April
Bugula turrita	November–April	April
Bugula minima	January–June	—
Bugula uniserialis	October	—
Caulibugula pearsei	May	—
Beania hirtissima	Year-round (August)	—
Beania klugei	Year-round (Winter & Spring)	—
Beania mirabilis	Fall and Winter	—
Membraniporella aragoi	February	February (?)
Cribrilaria radiata	October, February	October & February
Bellulopora bellula	February	(?)

TABLE 10—(*Continued*)

Species	Species Collected (most abundant)	Colonies with Embryos and/or Young Settled Colonies Observed
Reginella floridana	February	–
Exochonella antillea	March	–
Escharoides costifer	February	February
Savignyella lafontii	Year-round (September–December)	Year-round (?)
Reptadeonella costulata	February	–
Tremoschizodina lata	February	–
Hippaliosina rostrigera	October & February	–
Plagioecia dispar	February	February (?)
Parasmittina spathulata	February	February (?)
Parasmittina nitida morphotype B	Year-round	Year-round
Phylactellipora aviculifera	Year-round (?)	October
Lagenicella marginata	April	April
Schizoporella cornuta	Year-round (October–December)	October–December
Schizoporella floridana	January–August	January–August (April–May)
Schizoporella unicornis	May and October	May
Escharina pesanseris	February	–
Stylopoma spongites	February, April, October	–
Cigclisula turrita	February	–
Cleidochasma porcellanum	February	February (?)
Cleidochasma contractum	February	February (?)
Hippoporidra calcarea	April, September	–
Microporella umbracula	Year-round	Late Fall and Winter
Hippothoa flagellum	February	February (?)
Celleporella carolinensis	February, July	February
Trypostega venusta	April, October, February	–
Pasythea tulipifera	Year-round (Summer)	October
Vittaticella uberrima	April, December	April, December
Vittaticella contei	Year-round	Year-round (?)
Celleporina hassalli	October–April	November–February
Crisia eburnea	March	March
Crisia elongata	Year-round (Winter)	January–February

[a] (?) = Colonies ovicelled only.

of worms. There was very little algae on the ledges except for one red alga, *Lawrencia* sp.; the hydroid *Eudendrium* was thriving. On *Lawrencia* were *Bugula uniserialis, Vittaticella contei, Aetea sica,* and *Synnotum,* whereas *Beania klugei, Vittaticella, Sundanella, B. uniserialis, Synnotum,* and *Scrupocellaria* occurred on *Eudendrium.* Beachrock stones were well scoured, and most bryozoan colonies were abraded and dead. *Membranipora savartii* was fairly abundant in depressions in the rocks, living (though partially abraded) colonies of *Stylopoma spongites* and *Hippaliosina rostrigera* also found. No collections could be made in November or December as the combination of poor tides, strong winds and high surf conditions again prevailed.

Reproduction

Information on reproduction (the presence of colonies with embryos) has been included in table 10. In temperate regions a few bryozoan species (chiefly those with boreal distributions) reproduce in winter, but reproduction and settlement of the majority of

species occurs in late summer and early fall (Ryland, 1970). In tropical regions like West Africa (Cook, 1968a) on the other hand, settlement occurs from November through April with the period of heaviest settlement from late January through April. In the Indian River area some bryozoan reproduction occurs year-round, but peaks of reproductive activity occurred in winter–spring and fall–winter. *Bugula neritina* reproduces in summer in Swansea, Wales, and from April to December in Beaufort, N.C. (Ryland, 1970). This species in Florida reproduced from January to June with peak settlement in late winter and early spring. *Conopeum tenuissimum* reproduces between April and November in Chesapeake Bay (Dudley, 1973a), between March and October in Beaufort (Maturo, 1959). Peak reproduction in Chesapeake Bay occurred in summer. Indian River populations reproduced from fall to spring with peak reproduction in December. *Conopeum seurati* which co-occurred with *C. tenuissimum,* started reproducing later and had its peak of reproduction later in late winter and early spring.

Biogeography

It is difficult to assess the affinities of this fauna as many species are probably more widespread than has been recognized, but would not be identified or reported in general surveys because of the small size of their colonies and the cryptic nature of their habitats. Only one new species *Bowerbankia maxima* is described here. Although its distribution is here listed as Florida and Jamaica (where I have also collected it), the range of measurements given for *Bowerbankia gracilis* from subtropical and tropical localities by other authors suggests that some of their material might be referable to *B. maxima.*

One species, *Conopeum seurati,* has not previously been recorded from the Western Atlantic. Seven species: *Victorella pavida, Alcyonidium polypylum, Crisia eburnea, Bugula uniserialis, Celleporella carolinensis, Pasythea tulipifera,* and *Lagenicella marginata* have not previously been recorded from Florida. *Reptadeonella costulata* and *Reginella floridana* have not been recorded from the east coast of Florida, although both occur in the Gulf of Mexico. *Phylactellipora avicularifera* has not been recorded north of the Tortugas. One species, *Membranipora tenella,* was recorded only once before from Florida (the original description by Hincks, 1880) and once from Brazil (Marcus) 1937, but may actually be quite common on floating objects. Another species found on floating substrata, *Membranipora* sp., may also be common.

In general, most species found in the river and at coastal stations (intertidal to subtidal) are cosmopolitan or circumtropical in their distribution, although *Bugula turrita, Bugula stolonifera, Aeverrillia armata, Membranipora savartii, Conopeum tenuissimum, Caulibugula pearsei,* and *Plagioeocia dispar* have Western Atlantic or Western Atlantic plus Caribbean and Gulf of Mexico distributions. The affinities of the species collected from the continental shelf *Oculina* reefs are generally tropical.

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