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BRYOZOANS FROM BELIZE

BY

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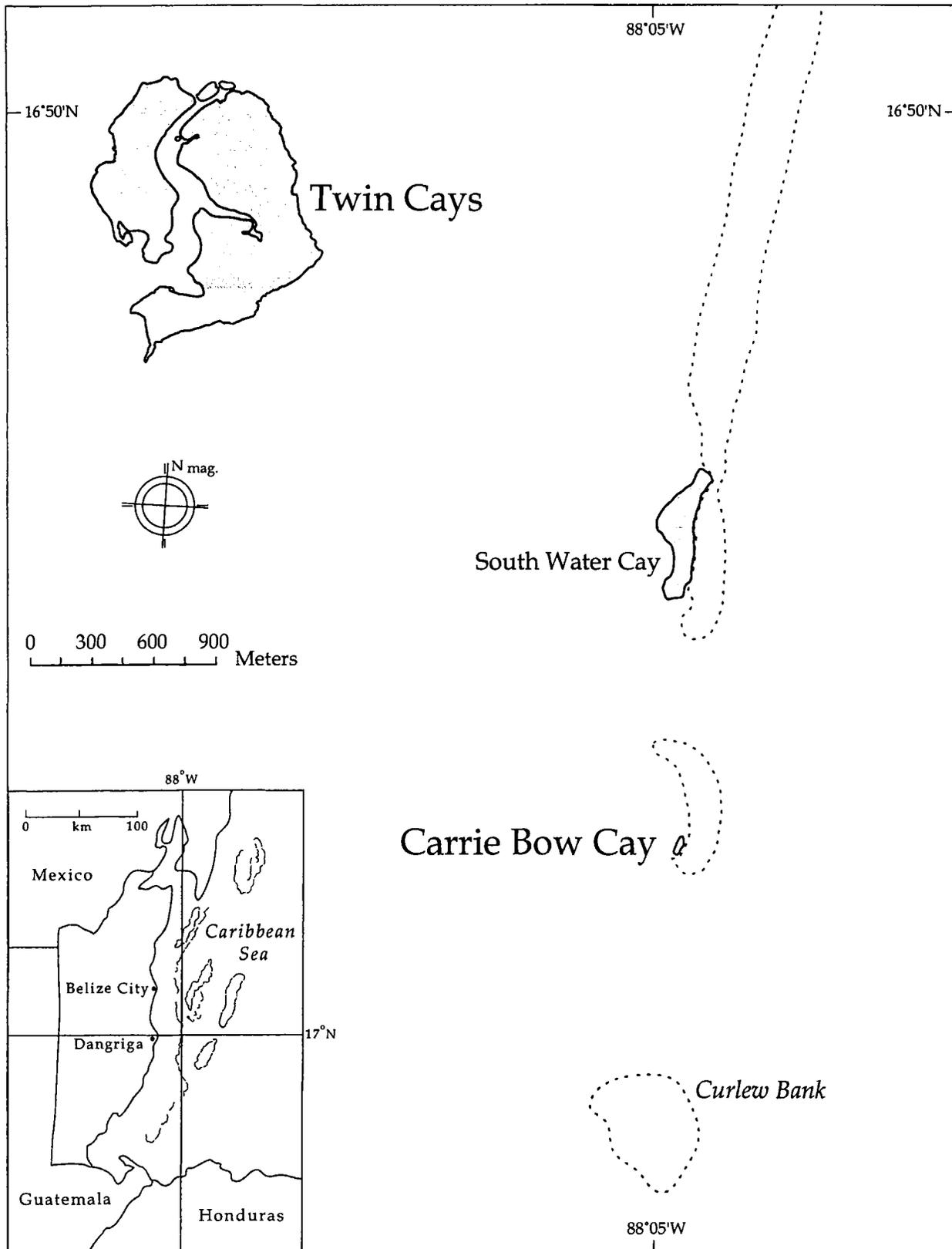


Figure 1. Index map showing locations of Twin Cays and Carrie Bow Cay.

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ABSTRACT

The two studies carried out at Carrie Bow Cay and Twin Cays on bryozoans from reef and mangrove habitats have focused on ecology, behavior, and basic taxonomic description. The first visit by the author in November 1980 was primarily for the purpose of carrying out a preliminary survey of the bryozoans from the vicinity. Thirty-six species of bryozoans, including one new genus and four new species, were found in this survey. During the 1980 visit, pilot studies of avicularian behavior of reef-dwelling species were also made.

A second visit was made in October-November 1984 in order to carry out further observations on avicularia, as well as to study the distribution of bryozoans in the Twin Cays mangrove ecosystem, and to make additional observations on living colonies of reef bryozoans at Carrie Bow Cay. One unusual new cheilostome species, *Synnotum circinatum*, was also discovered at Twin Cays during this trip and is described here.

INTRODUCTION

With increasing human pressure on coastal environments, including mangroves and reefs, documentation of coastal faunas becomes ever more vital. Bryozoans are components of coral-reef and mangrove communities world-wide, but the taxonomic composition of such bryozoan faunas is well known in only a very few areas. A 1980 visit to Carrie Bow Cay resulted in a descriptive taxonomic publication on the shallow water (20 m or less) bryozoan fauna of the reef off Carrie Bow Cay and in mangrove habitats at Twin Cays (Winston, 1984). Thirty-six species of bryozoans, including one new genus and four new species, were collected and described. It was the first report on marine bryozoans from Belize waters, the nearest published bryozoan collections previous to that having been made in deep water off the Yucatan Peninsula in the 19th century by the U.S. Fisheries Commission steamer *Albatross* (Canu and Bassler, 1928). Preliminary studies of the behavior of bryozoan avicularia of the common reef-dwelling species were also carried out during this first visit. A return two week visit to Carrie Bow Cay in 1984 to carry out additional studies on behavior of bryozoan avicularia also allowed opportunities for more collections in the area as well as observations on living colonies from reef and mangrove habitats. One new species, *Synnotum circinatum*, found at Twin Cays is described in this paper.

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STUDY AREA AND METHODS

Description of Sites

Carrie Bow Cay, located on the barrier reef of Belize, has been the site of studies by scientists from the Smithsonian National Museum of Natural History for about 30 years (Fig. 1). The small cay which houses the field station is surrounded by five types of reef habitat: lagoon, back reef, reef crest, inner fore-reef and outer fore-reef (Rützler and Macintyre, 1982). Most of the bryozoans studied came from the "Outer Ridge" on the outer fore-reef where masses of broken *Acropora cervicornis* accumulated following a 1964 hurricane.

Twin Cays (16°48.6'N, 88°08.9'W) are a pair of mangrove islands located northwest of Carrie Bow Cay (Fig. 1). The site is characterized by winding channels and embayments, areas of sea grass, and a diversity of organisms encrusting the red mangrove stilt roots that, in this location, stay mostly submerged rather than being exposed by tidal fluctuations as in some other areas.

General Methods

Bryozoans were collected by scuba diving and snorkeling and taken to the lab where they were maintained for up to six hours in aerated-seawater holding tanks for observation, avicularia experiments and photography. Photographs were taken on a Wild M-5 microscope equipped with an adapter for a Nikon 35 mm camera and strobe setup. Voucher specimens were fixed in formalin and either wet-preserved in 70% ethanol, or washed in fresh water and air-dried for identification and taxonomic study. Specimens for SEM were later ultrasonically cleaned and allowed to dry, or bleached with Clorox® to remove all tissue, leaving the details of the calcareous zooid skeleton visible. They were then coated with gold or palladium and studied and photographed using SEM.

Avicularian Behavior

Bryozoans are a phylum of colonial invertebrates with three living marine orders: Ctenostomata, Cyclostomata and Cheilostomata. Their colonies are made up of several to several thousands of physically connected microscopic individuals (**zooids**). The basic feeding zooid (**autozooid**) of a cheilostome colony is a box-like structure filled with body fluids, cells, muscles and internal organs belonging to the **polypide**. The polypide consists of a funnel of ciliated tentacles called a **lophophore**, a mouth, and a U-shaped gut, all of which are retracted into the protective zooid box when not in use. In cheilostome bryozoans, the dominant group in most marine habitats, zooid walls are variously reinforced with chitin and calcium carbonate, but all zooids retain some membranous frontal wall area either on the frontal surface, or in some form of in-pocketing from the frontal surface, which allows the zooid hydrostatic system to operate. Toward the distal end of the frontal wall is a hinged and chitinized trap door called the

operculum. Muscles contract and increase fluid pressure inside the zooid, slowly pushing the compressed lophophore and introvert region of the polypide out of the zooid through the opening operculum, so that the ciliated tentacles of the lophophore can expand to feed. Disturbance, a sudden water current or the movement of a trespassing organism on the colony surface, for example, results in the polypide's rapid retraction back into the zooid.

Avicularia are polymorphic zooids found in many species of cheilostome bryozoans. The most primitive type of avicularia have been usually considered to be the **B zooids** found in some species, which may be larger than **A zooids** (autozooids), and have a feeding polypide like those of A zooids, but have an enlarged or thickened operculum. Most avicularia are smaller than zooids, and may either replace them in budding sequence in the colony (**vicarious** or **interzoecial avicularia**) or be budded from the frontal wall of a supporting autozooid (**frontal avicularia**). Avicularian zooids have an modified operculum called a **mandible**. It is enlarged compared to an autozooid operculum, often covering most of the frontal wall of the avicularium, and is usually more rigidly chitinized, strengthened, and modified, sometimes edged with a sharp pointed tip (e.g, Fig. 2), rows of chitinous teeth, or shaped into a bristle or paddle form. The avicularium zooid may have enlarged muscles to operate the heavy mandible and retains some membranous frontal wall area, but most of it is essentially a reinforced socket for the closed mandible. There is no functional polypide, although sometime a **polypide rudiment** tipped with sensory cilia is present (Fig. 2), especially in the **bird's head** or **pedunculate** avicularia that are usually considered the most derived type.



Figure 2. Pedunculate avicularium of *Synnotum circinatum* with open mandible. PR= opening of polypide rudiment. SC=cluster of sensory cilia.

For the avicularian behavior experiments (Table 1) the goal for each species was to have a timed period for general observation of one or more to determine if avicularia had a species-specific behavior pattern, whether any innate rhythm of activity could be detected in an undisturbed colony. When possible

this period was followed by testing for response to mechanical disturbances, by jarring the dish or colony, probing the avicularia directly (with fine insect pin or pig's eyelash tipped probe), and by producing a rapid current of seawater with a syringe. If time permitted, further testing of the colony was carried out by introducing a chemical or particle-based stimuli: crab juice, oyster juice, a solution of mixed amino acid powder dissolved in seawater (from health food store capsules), milk, Spirulina (dried blue-green algae) powder in seawater, mud in seawater, and tiny plastic beads in seawater.

Table 1. Observations on avicularia of Belize bryozoans

Species [Type of avicularia]	Innate behavior *# of avicularia in 6X view shutting in timed observation on undisturbed colony	Response to mechanical stimuli	Response to chemical stimuli
<i>Synnotum circinatum</i> [pedunculate]	avicularia open *2/15"	Almost any current makes branches coil; avicularia do not respond	Possible response to amino acid solution
<i>Hippopodina feegeensis</i> [frontal]	0/10"	Hard to trigger closure Had to probe at hinge line No response to current jet	_____
<i>Reptadeonella costulata</i> [frontal]	1/10", 0/10"	When lophophores retracted all avicularia closed and reopened Brushing causes closure and reopening; jarring caused a few to close	No response to amino acid solution Polychaete caught by colony, remained shut several hours. 2 more syllid polychaetes caught by 2d colony
<i>Rhynchozoon verruculatum</i> [frontal]	avic. open almost immediately open when auto- zooids shut	Probing mandibles>shut, but immediately reopen Jarring> no reaction	No response to chemical cues or to salinity change
<i>Celleporaria albirostris</i> [interzoecial]	1/15", palate surface sticky ¹	Will close on direct mech. stimulation by probe, esp. at hinge line. Did not close On small polychaete making Slow exploratory movement	Oyster juice caused closure, trapped polychaete still trapped (dead) 11 hrs later. Jet of water caused closure
<i>Stylopoma spongites</i> [interzoecial]	1/10"	Close at jarring or strong current application, reopen immediately No response to sediment, lie open under mud	Possible response to Amino acid solution
<i>Smittipora levinseni</i> [interzoecial]	0/10"	Current > closure No response to mud No response to exploratory Movement by polychaete Sharp vibration> closure	Amino acid solution causes partial closure

¹Sediment sticks to palate surface, but not to frontal surface of autozooids.

Table 1 (cont'd)

<i>Cribrilaria flabellifera</i> [interzoecial]	Mandibles paddle-shaped	Jet of water>flip direction Prodding> flip from one direction to other rather than open/shut rx	Amino acid solution consistently causes reversal of direction Not just particles, as neither Micronic beads or Spirulina had that effect
<i>Labioporella granulosa</i> [interzoecial]	0/10" most shut 25" before most open 2d colony, avic Opened sooner	Jarring, some opened Probing on hinge caused Slow closure and Reopening Jet of water> closure	No response to amino acid solution and crab juice
<i>Crassimarginatella tuberosa</i> [B zooids]	Gape open in testing position like A-zooids	Don't react like avicularia. Polypide scans with 1 tentacle = male zooid?	No rx to amino acid solution by B zooids A zooids try to feed on it
<i>Steginoporella magnilabris</i> [B zooids]	Bs open before As., open wide	Jet of water causes closure. Closure can affect all Bs in area	Jet of crab juice, Bs opened wide, or open and shut without affecting A zooids Amino acid solution > open wide or open, then shut. Nematode caught by A-zooid operculum
<i>Trematoeocia aviculifera</i> [frontal and interzoecial]	Small frontal immed.open Large interzoo- ecial slow to open, after 30" most open.	Jet of water makes them open	Possible response to amino acid solution

RESULTS

Avicularian Behavior

The 1980 visit to Carrie Bow Cay had shown that species with diverse types of avicularia, including B zooids, and pedunculate avicularia were abundant there. It had also shown that it was possible to maintain the colonies in good condition in the lab long enough for behavioral studies to take place. However, compared to studying other aspects of bryozoan biology like feeding, working with avicularia proved challenging for two reasons. One reason was the small size (less than 50 μm) of the avicularia of many species. The other was the long periods of inactivity characteristic of all but the bird's

head type, resulting in many periods of observation in which no activity was detected. In a freshly collected bryozoan colony, brought into the lab and observed in a dish of seawater under the microscope, there will be periods of feeding. At those times autozooid opercula first open to a testing position, then, if no threat is detected, polypides protrude lophophores completely and expand them to feed, only retracting if jarred or disturbed by sharp currents or activities of other animals in the dish. At other times autozooid opercula remain closed and the colony quiescent. The mandibles of avicularia, on the other hand, open almost immediately and remain open even when autozooid opercula are shut unless they are provoked to close by some stimulus. In only a few species did there appear to be an innate pattern of movement in unstimulated colonies.

Table 1 summarizes the results of observations of avicularia of bryozoans from Carrie Bow and Twin Cays. Although, due to limited numbers of specimens and inadequate time for experimental work (microscope lighting in the field lab at that time depended upon a generator being run for electricity and was limited in duration) the experiments were not complete for each species, results were still valuable. Most striking was the clear demonstration that avicularia of both the larger interzoecial (*Celleporaria*) and smaller frontal (*Reptadeonella*) types had the ability to capture small predators like syllid polychaetes (Winston, 1986). Capture often resulted in damage to avicularia and both the damage and the remains of animals caught were visible on colonies for some time. Slow exploratory movements by colony trespassers did not generate avicularian closure; rapid or violent movements were triggers.

It was also clear that avicularia otherwise responded primarily to mechanical stimuli, such as quick or jarring movements of the colony substratum, or a rapid and intense water current.

There were some indications that chemical stimuli might sometimes be involved in triggering closure or opening. Although the substances used in testing were not very sophisticated, responses by several species suggested that proteinaceous substances (amino acids or body fluids from other invertebrates) were possible triggers for avicularia movements.

Twin Cays Bryozoan Community

At Twin Cays bryozoans were found living attached to *Thalassia* blades, as drift in the seagrass beds adjacent to the mangrove stands and on the mangrove roots themselves (Fig. 3). Three of the most common species belonged to the Ctenostomatida. These soft-bodied forms, tolerant of lowered or changing salinities, often dominate bryozoan communities in harbors and estuaries in temperate and tropical waters.

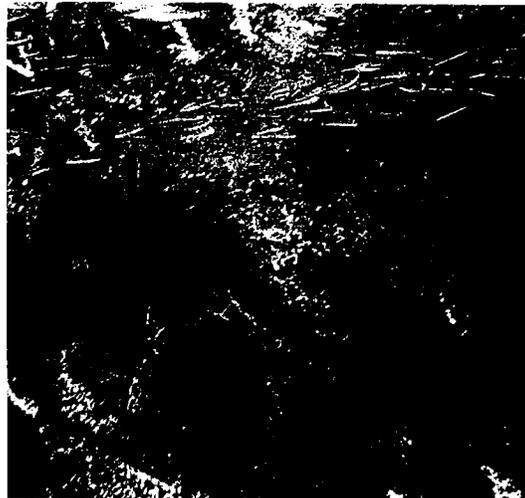


Figure 3. *Zoobotryon verticillatum* in Twin Cays seagrass bed

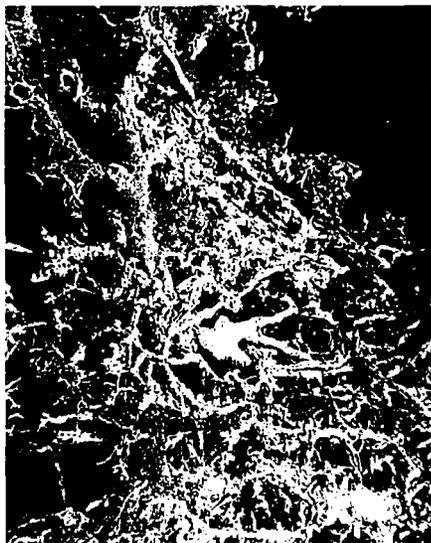


Figure 4. *Zoobotryon* clumps attached to mangrove roots.

Zoobotryon verticillatum (Delle Chiaje, 1828) (Fig. 3 &4). This massive stoloniferan ctenostome, whose colonies resemble dirty strands of cellophane noodles, was the most common bryozoan at Twin Cays. It was found both attached to mangrove roots and freely drifting or attached to grass blades in the seagrass beds. The species is now found world-wide in warm seas, but was originally described from Trinidad (as an alga); perhaps it is actually native to the Caribbean.

Amathia vidovici (Fig. 5). Colonies of *Amathia vidovici* (Heller, 1867) were common at Twin Cays. This species has been reported from fouling and mangrove communities at a number of sites around the world, including the Indian River Lagoon in Florida.

Bowerbankia maxima (Fig. 6). *Bowerbankia maxima* Winston, 1982 is a robust white pigmented ctenostome whose colonies formed festoons of stolons and clustered zooids on bare space on submerged roots. Described from the Atlantic coast of Florida, it has so far been found in Jamaica and South Carolina as well as Belize.

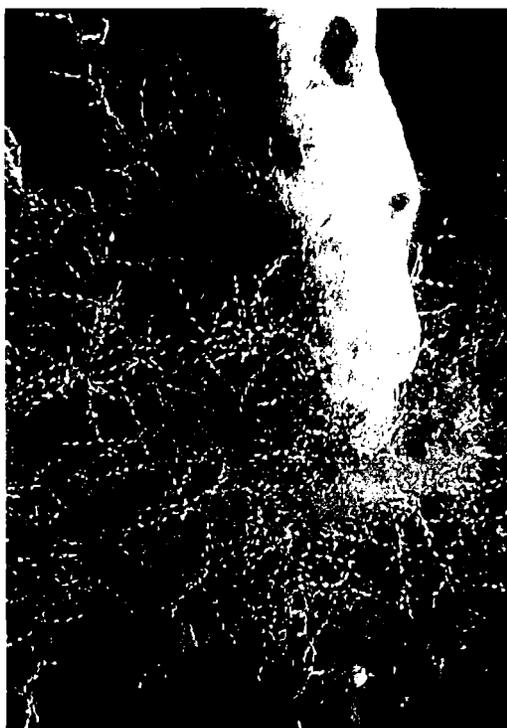


Figure 5. *Amathia vidovici*, colonies growing on mangrove root.

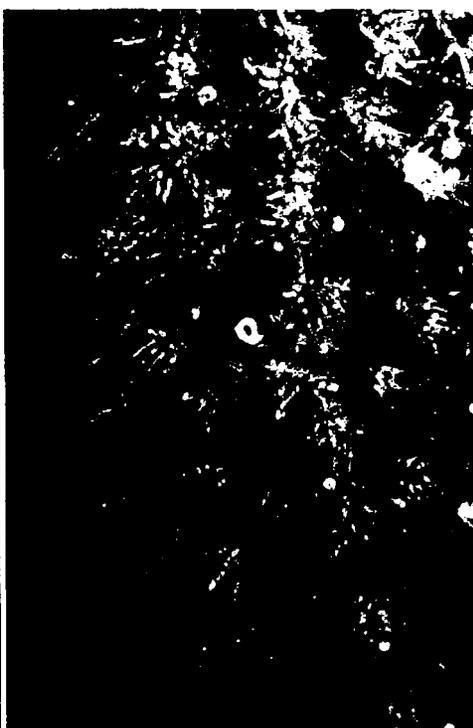


Figure 6. *Bowerbankia maxima*, colonies attached to mangrove root.

The other two common bryozoans at Twin Cays are members of the order Cheilostomatida.

Schizoporella pungens (Canu and Bassler, 1928) (Fig. 7). *Schizoporella pungens* was the most common encrusting cheilostome bryozoan. It formed massive iridescent purple crusts with orange-rimmed growing edges. Where large tube worms were attached to the roots, the *Schizoporella* colonies often developed tubular branches around their tubes. This species was identified in Winston (1984) as *Schizoporella ?serialis* Heller 1867, following Banta and Carson (1977). At that time bryozoan workers understood



Figure 7. *Schizoporella pungens* encrusting mangrove root at Twin Cays. Fuzziness of picture is due to expanded lophophores of zooids.

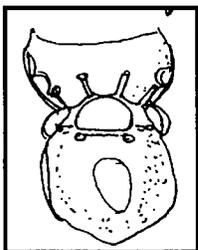


Figure 8. *Schizoporella pungens*, sketch of ancestrula from colony recruited at Twin Cays.

that there were a least two species complexes of fouling or ecologically opportunistic *Schizoporella*, a *unicornis* group and an *errata* group, and *serialis* was considered to be the oldest name for the *errata*-like species. Later SEM studies of material from the Adriatic, W. Africa, Caribbean and Brazil by various authors have clarified the situation further. Caribbean *errata*-like material appears to be morphologically distinct from E. Atlantic, Mediterranean, and W. African “*violacea*-*serialis*”, a cluster which may also include Brazilian material (d’Orbigny’s *S. isabelleana* from Rio de Janeiro). The Caribbean and E. Pacific (e.g. Costa Rican and Hawaiian specimens) material differs slightly in characters of avicularia and orifice. The Caribbean name, *Schizoporella pungens*, should probably be used for Belize and other Caribbean specimens, at least until molecular studies are completed for the entire *errata* complex.

The morphology of the ancestrula (the initial zooid developed from the settled and metamorphosed larva) and the pattern of budding leading from it, may also be useful in distinguishing bryozoan species. Therefore, during the two-week 1984 visit, bryozoan “traps” consisting of screened microscope slide arrays were wired in several spots among mangrove roots near potential parent colonies of *Schizoporella*. Although the time period for recruitment was short (<13 days), a few *S. pungens* larvae did settle, of which the largest had an ancestrula and 7 zooids at the time of collection. A sketch of the ancestrula of *S. pungens* is shown in Figure 8. It has 8 oral spines, a semi-circular operculum and a frontal wall with an ovoid membranous area. The ancestrular polypide has 14 tentacles and a yellow orange color. The growth rate of *Schizoporella* is much greater than that of reef species from the area. The 1980 study had shown that colonies 6 X 6 cm in diameter grew on panels deployed for 6 months. In contrast, reef panels placed out for the same time period had no bryozoan colonies larger than 1 cm².

The most interesting discovery at Twin Cays was of a new species of *Synnotum* (Fig. 9) attached to mangrove roots among ascidians and sponges. Morphologically this delicate branching species is similar to the wide-spread tropical species *Synnotum*

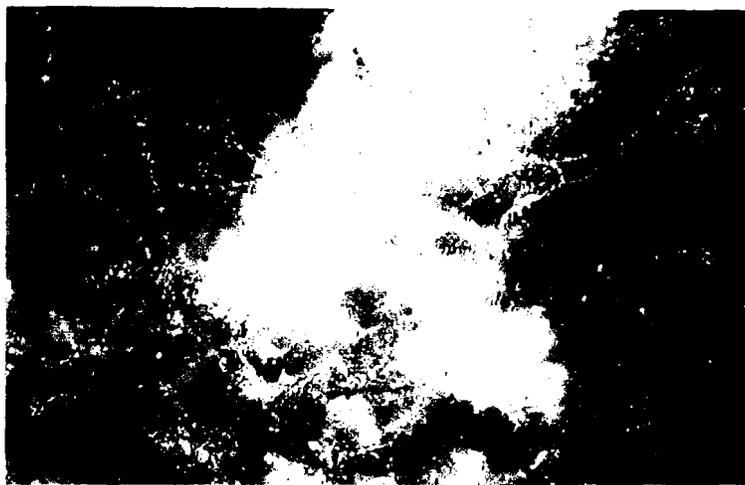


Figure 9. *Synnotum circinatum*, new species. Erect branching colonies attached to mangrove root.

aegypticum, but the free ends of the branches of the new species writhe and twist into knots when touched, with a mobility that is completely lacking in its congener. Movements by zooids and branches of colonies are not unknown in bryozoans but most have been reported from ctenostomes, e.g., *Bowerbankia*, *Mimosella*, *Triticella*. The stalks of the avicularia of members of the cheilostome genus

Camptoplites are in almost constant motion (Winston 1991), but this report may be the first record of whole branch movements in a cheilostome. A formal description of the new species is given below.

Order Cheilostomatida
Family Epistomiidae Gregory, 1893
Genus *Synnotum* Pieper, 1881

***Synnotum circinatum*, New Species**
Figures 2, 9-11.

Diagnosis: *Synnotum* with evenly bifurcating branches spaced along a delicate stolon. Branches perform coiling motion when disturbed. Zooids about 1/3 larger than those of *Synnotum aegyptiacum* and more triangular in shape; their avicularia larger and with a more clearly demarcated peduncle than those of *aegyptiacum*.

Etymology: *circinatus* (Latin) = coiled, curled away from an apex.

Type Material: Holotype, USNM no. 1026612, Paratype VMNH nos. 3173 and 3174.

Description: Colony is erect, glassy white in color, consisting of evenly bifurcating candalabra-like branches attached along a delicate transparent stolon. Each uniserial branch has two faces, made up of back-to-back chains of zooids (Fig. 10). Zooids are elongate (about .30 mm L X .12 mm W), broader distally and narrowing

proximally, with a membranous walled ovoid opesia taking up most of the frontal wall (about 27L X .10 mm W) and with lateral walls delicately calcified. In partially decalcified specimens, a tubular chitinous joint-like region is visible at the proximal end of each zooid, each zooid back-to-back pair thus forming an internode. The operculum is semicircular, about 0.5 mm H by 0.10 mm W, and large relative to zooid size (Fig. 11). On one side of the distal wall of the zooid is a short-stalked cat's ear-shaped pedunculate avicularium with a hooked triangular mandible (Figs. 2, 11). On each face of the branch these avicularia oppose each other so that at a low magnification (Fig. 10), a zooid appears to have two. Polypides are transparent white, with 10 asymmetrical, slightly campylonemidan tentacles. Ovoid white embryos with large apical tufts and a dark-red C-shape of pigmented cells surrounding them, are brooded in enlarged gonozooids which they grow to fill almost entirely, leaving only space for the tiny brown body, remains of the degenerated polypide.

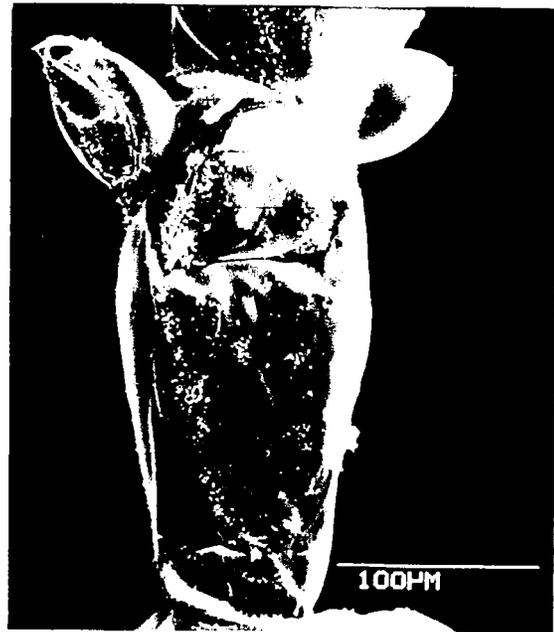
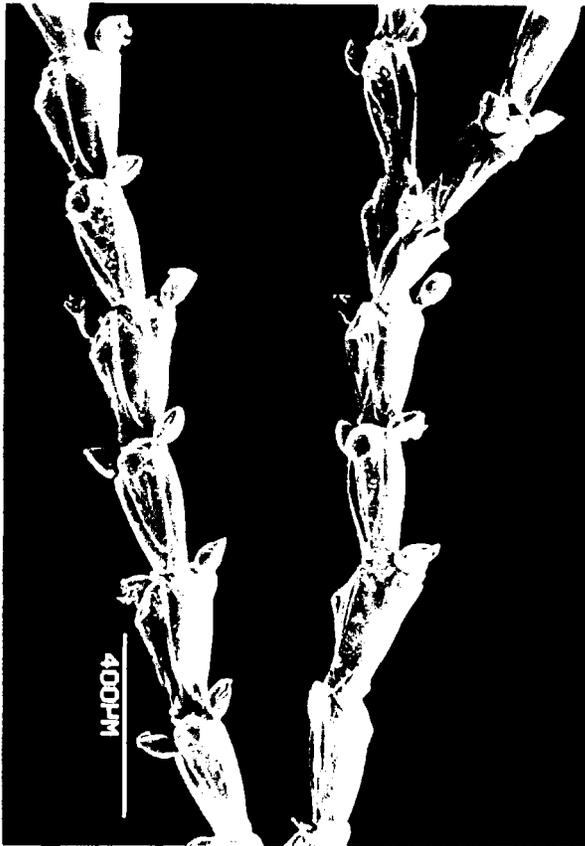


Figure 10. [left] *Synnotum circinatum*, SEM of colony branches.

Figure 11. [right] *Synnotum circinatum*, close up of zooid and avicularia..

Discussion: Unlike those of the very similar *Synnotum aegyptiacum*, the branches of *Synnotum circinatum* respond to a touch of forceps or a strong current of water, by coiling and writhing from their free ends. The uncalcified joints between each zooid may provide the means for this movement, although it has not been observed in Florida colonies of *Synnotum aegyptiacum* which have a similar structure. Marcus (1941) studied colony development and reproduction in *Synnotum aegyptiacum*. He found that zooids with functional polypides occur only near the growing tips of branches. Those

further down the branch contain embryos and proximal-most zooids with only brown bodies. This seems to be the case also in *Synnotum circinatum*. However, Marcus also noted that in *S. aegyptiacum* rootlets produced from proximal zooids were able to regenerate new zooids and branches. He pointed out that, although the lack of ability to regenerate polypides might be disadvantageous, the ability of *Synnotum* colonies to regenerate new branches from rootlets might actually provide an ecological advantage — enhanced dispersal by fragmentation and regeneration. The ability of *Synnotum circinatum* branches to wrap around narrow objects might also be advantageous for dispersal. Colony fragments could be carried to new sites on crustacean legs for example, or if transported by currents, can readily attach themselves to substrata in a new location.

Distribution: So far known only from Twin Cays, Belize.

Observations on Carrie Bow Cay Reef Species

During the 1984 visit, additional collections were made on various parts of the reef, and a number of species were observed alive so that colony color, embryo color, and polypide morphology could be noted. Most reef-dwelling bryozoans are found in cryptic situations: caves, crevices or under surfaces of corals and rubble. As had been noted previously, the most diverse bryozoan assemblages occurred in *Acropora* coral rubble areas on the Outer Ridge. Bryozoans did encrust the interstices of the leafy *Agaricia* coral that dominates the spur-and-groove zone. Species found there included *Cribrilaria flabellifera*, *Hippopodina feegeensis*, *Labioporella granulosa*, *Puellina* sp., *Rhynchozoon verruculatum*, *Stylopoma spongites*, *Trematooecia aviculifera*, and *Steginoporella* sp. Since collecting bryozoans in this zone usually necessitated destroying live coral substrata, most collecting for behavioral work was done in the outer-ridge rubble. In the shallow back-reef area only *Hippopodina feegeensis*, *Trematooecia aviculifera*, and *Steginoporella* sp. were noted.

***Gemelliporida belikina* Winston, 1984.** Living colonies of this small mound-shaped species had not been seen alive in the first study, but were collected from the outer ridge in 1984. They had a glassy translucent calcification and an transparent orange coloration of polypides.

***Trematooecia aviculifera* (Canu and Bassler, 1923).** *Trematooecia aviculifera* (Fig. 12) was the only bryozoan able to grow exposed on vertical and upper surfaces of reef substrata at Carrie Bow Cay and one of the few Caribbean reef bryozoans large and brightly colored enough to be noticed by nonbryozoologist divers. Underwater, living colonies look fluorescent green but they are salmon pink at the surface. The embryos in their ovicells are a shiny maraschino cherry red. The tentacles, 18-19 in number, are translucent pink. Unlike some bryozoans, in *Trematooecia* ovicelled zooids brooding embryos retain feeding polypide.



Figure 12. *Trematoeocia aviculifera* colony growing on side of coral head, Carrie Bow reef.

***Crassimarginatella tuberosa* (Canu and Bassler, 1928).** *Crassimarginatella tuberosa* (Fig. 13) colonies were collected for observations of their B zooids. While examining these colonies, it was noted that fouled frontal membranes in this bryozoan species, like those of cupuladriid bryozoans (Winston and Håkansson, 1989) and many others, underwent a molting process. The frontal walls of many zooids in older colony regions had become fouled with calcareous algae and algal films. Yet in patches, even in old regions, there were areas with clean greenish yellow walls. It was noticed during the avicularia observations that frontal walls of some fouled zooids had peeled partly off, and new frontal walls, transparent and shiny, lay beneath them. Other zooids had swollen frontal walls such as had been observed in molting cupuladriids. Peeling away the old frontal membrane exposed a new frontal wall, complete with new operculum, that had formed beneath the old one.

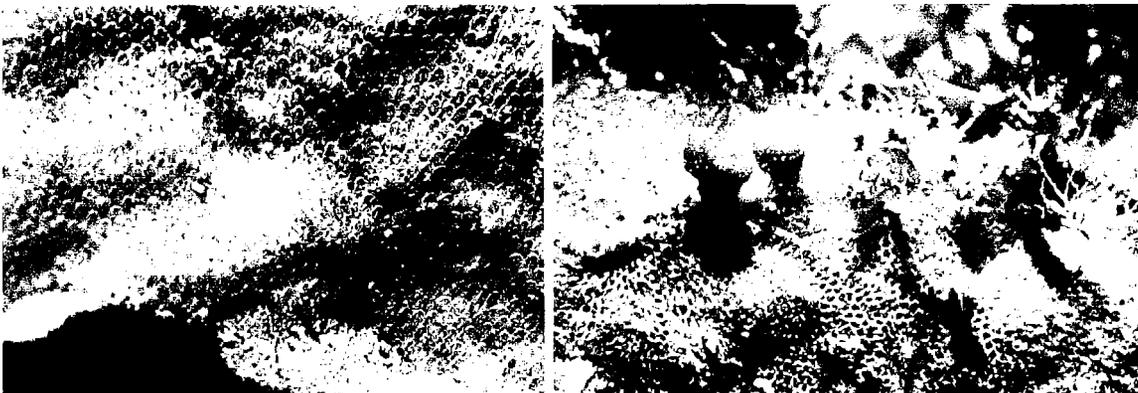


Figure 13. Colony of *Crassimarginatella tuberosa*, Carrie Bow reef, fouled and clean areas of colony.

DISCUSSION

Avicularian Behavior Studies

The function of avicularia in cheilostome bryozoan colonies has been a mystery fascinating biologists since Darwin's time. Recent observations and video studies at Carrie Bow Cay (e.g., Winston, 1984, 1986, 1991) suggest that one function may be to clean colony surfaces. Avicularia may also be the "ears" of the colony in sensing the movement of water and of trespassing organisms. Another function may be to act as defenders of the colony by capturing trespassers and potential predators. Through their ability to hold decaying remains of captures indefinitely, they may even provide a supplementary food source. More sophisticated experiments would help to clarify their response to physical and chemical stimuli. Although time-consuming and difficult, comparative studies would aid in determining the amount of predation on colonies in different habitats and depths. One avenue of research along these lines would be to quantify the damage to avicularia or the remains of trespassers still caught by them.

Taxonomic Studies

Considering that 2 brief surveys, a small amount of collecting by just one person, resulted in 5 new species being described, the 37 species described so far from the Carrie Bow and Twin Cays probably represent only a small fraction of the actual bryozoan diversity of this world's second largest barrier-reef system. A larger survey, carried out at a number of sites along the barrier reef and in other mangrove areas, would easily triple the number of bryozoans known from Belize.

ACKNOWLEDGMENTS

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