Marine Invertebrate Survey of Guana Island, BVI

Report for the 2000 Field and Research Season

Guana Island Marine Science Month

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General Introduction to the Project

The Marine Invertebrate Survey of Guana Island began as a three-year project funded jointly by the U.S. National Science Foundation and the Falconwood Corporation. The primary goals of the project are to document and photograph as many as possible of the small, cryptic invertebrates -- especially crustaceans, polychaete worms, echinoderms, and selected mollusks -- found in and around the various marine habitats on Guana Island. To achieve these goals, a small team of scientists from the Natural History Museum of Los Angeles County (LACM), led by Todd L. Zimmerman and Joel W. Martin, as well as two marine scientists not affiliated with LACM (Rick Ware, Don Cadien), visit the island each summer during Marine Science Month. The team consists of 8 members, although visits to the island are staggered such that only 6 team members are on the island at any given time. Specimens are collected, photographed, assigned preliminary identifications where possible, and preserved in 70% ethyl alcohol for later genetic analysis. In order to survey these small invertebrates, we use a variety of collecting methods including hand collecting, SCUBA diving and snorkeling, yabby pumps and other suction devices, sediment vacuum air lifts, and, most notably, the construction of Artificial Reef Matrices (ARMs) made of concrete and PVC pipe. These ARMs are placed at different depths around the reef and in other underwater habitats, usually at a depth of 30 feet (10 m). The purpose of the ARMs is to attract reef invertebrates that we can study without touching or damaging the actual reefs, where most of these species live. After returning to Los Angeles, we spend most of the remainder of the year identifying and describing the specimens and preparing our findings for publication. Products of the Survey will include scientific publications (some of which are included in this report) and, at the project's conclusion, a CD ROM disk containing color photographs of a large number of marine invertebrates found in the waters of Guana Island, many of which are proving to be new to science.

Summary of Education Activities in 2000

Our project has a strong Education component. We are training or involving graduate students, undergraduate students, high school students, and elementary school students in various aspects of our work. During 2000, the following students benefited from our project.

Todd L. Zimmerman (Ph. D. candidate at UCLA / LACM, using data and specimens from Guana Island to augment his dissertation research on island biogeography of crabs).

Todd A. Haney (a doctoral student at UCLA / LACM, collecting leptostracan ("sea flea") specimens as part of his dissertation research on the Crustacea Leptostraca).

Sandra Trautwein (a doctoral student at UCLA / LACM, benefiting from freshly collected xanthoid crabs that will form the basis of her dissertation research on crab phylogeny).

Barbara Hajduczek (MS student at UC Berkley, beginning fall 2001, trained on photography and electronic publications techniques).

Peter Marko (postdoctoral scholar at LACM, benefiting from ethanol-preserved bivalve shells, which will be part of his study of the molecular phylogeny of the molluscan family Arciidae)

Sarah Boyce (MS student at Florida State University, using some of our calappid crab material as part of her thesis research).

Lianna Jarecki (a doctoral student [as well as an instructor at H. Lavity Stoutt Community College, Tortola, BVI] working on the ecology of salt ponds in the British Virgin Islands; benefiting indirectly from an ongoing exchange of information about copepods and other salt pond crustaceans).

Simone Lettsome (an undergraduate student of Lianna Jarecki, above, who solicited our help for her talk for the Worldwide-Young-Researchers-of-the-Environment meetings in Germany, where she has been invited to present her student research as the sole student representing the BVI).

Nadia Primus (former undergraduate student of Lianna Jarecki, now preparing for entering the University of South Florida, Tampa; worked with us during the harvesting of the ARM off of White's Beach).

David Adolfis and the Seventh Day Adventist Church "Pathfinders" group (approximately 30 students ranging in age from 5 to 15, plus 12 adults, took part in a hands-on demonstration of coral-associated invertebrates on, July 26, 2000, near the airport site on Beef Island).

Summary of Research Activities in 2000

The most significant activity during the 2000 season was the "harvesting" of the concrete and PVC ARMs that we had deployed in the summer of 1999. Collecting and processing these arrays was a time-consuming task involving usually four divers and approximately half a day per ARM. Each ARM was placed in a nylon bag while still underwater (at 10 m depth); the nylon bag was sealed, and the entire ARM was airlifted to the surface, where it was hoisted aboard the boat. The same procedure was applied to the PVC and mesh "basket" underneath each ARM; these were also sealed underwater and then airlifted to the boat. After we had returned to Whites Beach, the plates were carefully separated, with each plate photographed and the associated animals stored and labeled as to where on the ARM they had been found. Rubble from the basket was also carefully sorted, then rinsed, and sorted again, to search for any invertebrates. Selected specimens from both the ARM and from the underlying rubble baskets were taken to the "lab" (the Anegada house) where they were further studied, photographed, and labeled.

After returning to Los Angeles, we spent much of the remainder of the year identifying and describing the specimens and preparing our findings for publication. What follows are some of the completed research reports. A more complete account of the research activities can be seen in Appendices I and II, which list the talks and scientific publications, respectively, that have stemmed from this project to date.

Individual Research Reports

Report on the Crustaceans

Collected at or near Guana Island during 2000

Todd L. Zimmerman

The number of crustacean species collected on and near Guana Island in 2000 increased substantially from that of 1998 and 1999. In addition, the species composition from certain areas has seemingly changed from year to year. These two observations can be attributed to several factors. The first is the use of novel collecting techniques such as artificial reef matrix structures (or A.R.M.S) for nondestructive collecting in reef areas, hand net dredging by divers on sand bottoms in the deeper water at the base of the reef wall, and the use of light traps in various areas. The second factor may be the presence of slightly colder waters around the island in the first half of 2000, which could have influenced recruitment of larvae from the plankton, or distribution of adults. The third factor may simply be the natural variation in recruitment from year to year combined with the relatively low number of sites that can be sampled (e.g. because natural processes around the island tend to cement rocks together in the intertidal zone, the number of rocks that can be turned to uncover specimens is relatively small. Each year the species found under these few rocks changes). A fourth factor may be that our familiarity with the island gained during previous years allows us concentrate our sampling on areas and microhabitats that have proven to be productive in the past.

The most substantial increase in numbers of species found has been for the various shrimp groups, which were nearly lacking in collections from previous years. This increase can be attributed directly to the ARMS. The ARMS replicate many of the microhabitats found in association with a medium-small coral head. By allowing this concrete and plastic structure to sit on the ocean bottom for a full year, a somewhat natural invertebrate community had time to colonize and develop. Careful removal of these structures from the water allowed us to capture not only those larger fast moving species normally hidden in the rock, but also the smallest, most transparent and delicate of species. This would never have been possible using traditional diver or shipboard methods (hand collecting, pulled nets/dredges, etc).

Representatives of the infraorder Stenopodidea serve to illustrate the amount of taxonomic work needed for Caribbean invertebrates. *Stenopus hispidus*, the barber pole cleaner shrimp, is one of the most common and brightly colored reef inhabitants. The group to which it belongs has few species, and most of the representatives are, like *S. hispidus*, brightly colored inhabitants of shallow tropical waters. The ARMS yielded several species from this group, each striking enough to be immediately set aside for photography. Anticipating easy identification of these specimens, Joel Martin decided to work on this group during a visit to the US National Museum, Smithsonian Institution, where most of the world's Caribbean material is held. *Stenopus hispidus* was the only one of the species collected that did not yield some type of new scientific information (please see included report on Stenopodidean shrimps, and copies of two submitted manuscripts).

The number of porcelain crabs and related anomurans found in 2000 increased substantially over that of previous years due directly to the use of ARMS. These animals are not only fast moving, but also very delicate. Surprisingly, although the number of brachyurans (true crabs) found in association with the ARMS did increase, it was nowhere near what was expected based upon our experience collecting at islands in the tropical eastern Pacific. This could be due to the high number of stomatopods (mantis shrimp) found in those same samples. Mantis shrimp, especially species of *Neogonodactylus,* prey aggressively on hard-shelled invertebrates such as crabs. One interesting observation pertains to the crab *Uhlias limbatus*, a small (~5 mm across) species that resembles a large grain of sand. Because of its small size and appearance it is quite rare in collections. After examining all specimens held in the major museums of the world, Rathbun, in her 1937 monograph, could report on only four specimens (one each from four scattered Caribbean locations). The rubble baskets from each of the 8 ARMS placed around Guana yielded from 4 to 8 specimens of *Uhlias*. Each rubble basket represents an area of seafloor ¼ m^2, making this one of the most common crabs inhabiting the reef.

The crustaceans found on the deep (55-75 ft) sand bottom at the base of the reef wall consisted mainly of brachyuran crabs and hermit crabs. By running a flat edged dip net through the top layer of this sediment, sieving out fine particles and bagging up the remainder to be floated to the surface, we were able to find many small species not normally collected. These include several bizarre-looking species of elbow crabs (family Parthenopidae) and purse crabs (family Leucosiidae), as well as miniature (adults ~3 mm across) species of pebble crabs (families Xanthidae and Pilumnidae). Of the many small species of hermit crabs found in these samples, several may turn out to be new species (Rafael Lemaitre, U.S. National Museum, personal communication). One of these, a species of *Iridopagurus,* was observed to throw off the snail shell it inhabited and actively swim away from the perceived threat caused by our actions. This behavior has never before been reported, and will be investigated further in 2001.

Light traps were used in several locations to collect emergent invertebrates. Many species hide in the sand or crevices in the reef during the day, but swim into the water column at night to feed, search out mates, or release eggs. Just as moths are drawn to porch lights, these marine creatures are drawn into the funnel-mouthed light traps. Of the crustaceans collected this way, most belong to the groups Ostracodaand Peracarida. Of the peracarids, cumaceans made up the bulk of the samples both in terms of numbers and species. Cumaceans are not well known so it was easy to recognize undescribed species, and in fact many of the light trap samples contained more undescribed species than described species. These were generally males that enter the water column at night to seek females, who tend to stay on the bottom. The rubble baskets of the ARMS are also yielding a number of cumaceans, and it is hoped that many of these are females so that they can be paired to the males and proper species descriptions can be produced. Two easily recognized cumaceans in Guana Island samples were *Cubanocuma gutzui* and *Stephanomma goesii*. *Cubanocuma gutzii* has only been positively identified in the literature from its type locality in Cuba, its presence on Guana Island has sparked communication with other scientists and we now know that it occurs throughout the

Caribbean. The existence of *Stephanomma goesii* was last (and first) reported in 1871 from Saint Martin.

One group of small crustaceans, the Leptostracans, has shown up in a wide diversity of samples (from algae collected off the shallow finger reefs in White Bay, from deeper water on the opposite side of the island (Grand Ghut ARM), and from a light trap sample from Muskmelon Bay. Leptostracans have a body segmentation pattern different from any other crustacean group and so are often referred to as "living fossils." One handful of algae casually collected while snorkeling in White Bay the day before the team left the island in 2000 by itself made Guana Island the most diverse location for leptostracans in the world (please see full report by Todd Haney).

North Bay, revisited in 2000, yielded many new finds. This was due to sampling a slightly different microhabitat in the same exact area that had been heavily visited the two previous years (North Bay). The shallow waters of North Bay just northwest of the wooden deck are easily accessible and contain a large amount of large rocks and rubble that can be turned over to reveal specimens. In 2000 instead of simply looking under the rocks we began to strip off the algal mat that covered them, and to break up the large pieces of coraline rubble as well. In addition to many snapping shrimp species (family Alpheidae) several pebble crab species (family Xanthidae) turned up that either had not been seen before, or had been found only one or two times. One of these species, which turned up in abundance, was the clown crab, *Platypodiella spectabilis*. The numerous specimens showed a wide range of colors and color patterns; photographs of these will eventually enable us to publish on this information. One of these individuals, an egg-bearing female, released larvae while being held in the laboratory. These larvae, which had not been described, lead to a collaborative paper with a group of Brazillian scientists (see included reprint).

A group of species first found in the North Bay shallows, spider crabs in the genus *Epialtus*, have proven to be taxonomically frustrating. At least six types (four species and two forms or subspecies) could conceivably occur at Guana. Over the past three years, specimens definitely fitting the description of *Epialtus bituberculatus* have been found, along with a miniature form of uncertain identity (possibly a new species). In 2000, specimens identifiable as *Epialtus kingsleyi* were collected both by scuba divers and from ARMS. *Epialtus kingsleyi* is only known in the literature from a single specimen collected prior to 1923 from an unrecorded location in Florida. Subsequent study of variation in the specimens at the US National Museum has done little more than raise questions as to the validity of species designations and relationships. The only descriptions and key to the group currently available (Rathbun, 1925) was based upon very few specimens. In order to help clarify this problematic group, digital microphotography of the USNM and Guana Island specimens will continue in order to define intraspecific variation and to complete an interactive electronic identification guide.

The beach fauna at White Bay changed markedly between 1999 and 2000, possibly due to the presence of cold water in 2000. In 1999 a total of five species of swimming crabs (family Portunidae) were collected from water that was waist deep (or less) in the area extending from the boat dock past the beach house. At this same time, White Bay was filled with swarms of the purple moon jelly *Aurelia* sp. Many dead and dying jellyfish washed up on the beach and provided an abundant food supply for the crabs, possibly facilitating the abundance and diversity of these crabs at the time. In 2000 the jellyfish were found in much lower densities, and only three portunid species were found. Numbers of these were very low. However, two species of sand crab, *Hippa* sp. and *Albunea* sp. (infraorder Anomura), normally considered to be prey items of the aggressive swimming crabs, were found in abundance near the boat dock.

One portunid species of note, found each of the past three years, is *Charybdis helleri*. This species is indigenous to the Indo–western Pacific. It was first found in both Cuba and Brazil in 1987, and was probably introduced to the Caribbean via ships from the Mediterranean. It invaded the Mediterranean from the Red Sea and Indian Ocean via the Suez Canal through natural immigration (Lemaitre, 1995). This is the first report of it in the northern Lesser Antilles. It is not known if eastern Caribbean populations were established by island hopping north from Brazil, or if they came east from the Greater Antilles. This aggressive predator is found mainly in mangrove areas. Its effect on the community structure in that habitat, so important to local fisheries, is unknown but should be monitored.

Our work on Guana often includes looking for specific target taxa needed for either ongoing or planned projects. In 2000 one of these target species was the queen crab, *Carpilius coralinus*, needed for a planned study of genetic relationships within the genus. Night dives were conducted to find this animal, and two were collected. R. Wetzer et al. have completed the study and a manuscript has been drafted. One of the interesting findings of this study was that the two individuals collected at Guana Island showed greater genetic diversity for one of the genes studied than did all individuals of Hawaiian *Carpilius convexus* tested (the ten individuals tested were randomly taken from a sample of 100 collected from throughout the Hawaiian islands). The conclusion of the study is that even though the Caribbean species, *C. coralinus*, looks similar to the Pacific C. convexus, the Caribbean species is from a lineage ancestral to the more genetically similar Pacific species, *C. convexus* and *C. maculatus*.

Literature Cited

Lemaitre, R. 1995. *Charybdis helleri* (Milne Edwards, 1867) a nonindigenous portunid crab (Crustacea: Decapoda: Brachyura) discovered in the Indian River lagoon system of Florida. Proceedings of the Biological Society of Washington 108(4): 643-648.

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Report on the Non-Decapod Arthropods
Collected at or near Guana Island during 2000

Donald B. Cadien

In all of the habitats so far investigated at Guana small arthropods of various groups have proven very numerous and quite diverse. This is not a surprise. In other areas, both tropical and temperate, these small animals form a conspicuous and species-rich portion of the biota. While a number of different types have been taken in collections to date, including barnacles, copepods, ostracods, tanaids, isopods, amphipods, cumaceans, mysids, stomatopods, and leptostracans, my efforts have been concentrated on the cumaceans. Stomatopods have been partially addressed by Todd Zimmerman and Jody Martin, and leptostracans by Todd Haney. Richard Heard has begun to examine one of the isopod groups that have been particularly conspicuous, the stenetriids. The rich amphipod and ostracod collections are still in the process of sorting and initial evaluation.

Cumaceans are typically inhabitants of soft bottom substrates, living among the grains of sand and on or between the small fragments of coral rubble. They all share a basic similarity in form, and pose variations on the theme of a ball with a tail. The "ball" is the carapace of the animal within which all of the organs are located, and on which most of the sensory apparatus is concentrated. The mouthparts are located near the front of the animal and slightly ventrally. The top of the "ball" is a shield protecting the vulnerable organs, and serving as a base for the location of the eyes and antennae. To the rear of this shield a muscular tail is attached which propels the animal forward in the sediments, or is used – spadelike- to reposition the animal within the sediments. All along the underside of the shield, and for the first part of the tail, appendages are located. There are mouthparts (several maxillipeds, and mandibles), and usually five pairs of legs. In some forms this number of pairs is reduced. The end of the tail is a fork formed by two uropods that consist of a basal joint attached to the sixth abdominal segment, and two terminal branches (rami) which consist of several segments. In some families of cumaceans a telson is present between the uropodal bases, while in others this is completely lacking.

In Guana the cumaceans have proven very abundant. They have been found not only in bottom sediments taken with cores, in the air-lift sediment samples, and in washings from the Artificial Reef Matrices (ARMS), but also in samples of both broad-leaved and filamentous algae taken from the reef surface in several areas, and from reef rubble inshore at North Beach. They have also been found associated with seagrasses, both rooted and drift. The animals undoubtedly form a significant portion of the diet of smaller reef fishes with "picker" mouth structure. Given their generally small size they may be of particular importance to juveniles. Avoiding this trophic link is a preoccupation of the cumaceans, who have no defense against predation. Their behavior is designed to minimize their exposure to fish predation to the extent possible.

Reproductive biology of cumaceans strongly affects their exposure to predation. Sexual dimorphism is usually (but not invariantly) strong in these small animals. Females, who carry eggs (and later young) in a marsupium or brood pouch on the underside of their body, are larger than the males of their species in nearly all cases. In a few cases where broods are small and dimorphism is reduced, the two sexes may be virtually the same size. The young are brooded in the marsupium until they are tinier versions of the adult, at which point they exit the pouch and take up residence nearby in the adult habitat. Unlike the decapod crustaceans and the copepods that pass through numerous juvenile stages in the plankton, the entire life cycle of the cumaceans is passed on or very near the bottom.

The animals can, and do, swim from one part of the bottom to another. Males engage in much more active and persistent swimming than females, performing mating forays into the water column to move for considerable distances (given the small size of the animal) of tens or hundreds of meters in search of available females ready to mate. These forays out of the bottom and into the water column are all under cover of darkness to reduce the likelihood of predation by visual predators. Different species of cumaceans swim at different times in response to diurnal rhythms of light and darkness, and to monthly differences in the intensity of moonlight.

One of the major challenges of working on the taxonomy of this group is that many species live together in the sediments sharing the trophic resources of organic detritus and attached benthic diatoms (which they scrape from sand grains and rubble fragments and consume). This cohabitation of similar species, combined with strong sexual dimorphism, makes it difficult to determine which females belong with which males. Descriptions of new taxa need to unravel this knot so that males and females of each species can be fully described. In benthic collections females (and juvenile males, which usually resemble them as much or more than they do adult males) are relatively common, while adult males are uncommon to rare.

To help increase the availability of adult males of the various species, samples of plankton taken on Beef Island by ICLARM were examined in 1999. This yielded males of several species for which females were already known from benthic collections, but also a variety of other males for which the females were unknown, a result both gratifying and frustrating. Subsequently in 1999 additional benthic sediment collections were made around the plankton collectors ICLARM has positioned over the shallow sands near their facility (and also near a mangrove stand), but these did not yield females of most of the species of males taken in the plankton. Just before departure from Guana two deployments of light-traps to catch planktonic organisms were made under the pier at White Beach. These were left out all night, and provided an interesting variety of organisms in the morning – but few cumaceans. Instead we found the remnants of many cumaceans, which had apparently been eaten like popsicles (held by the tail and the "ball" carapace totally consumed). Since several varieties of relatively large predacious isopods were present in these samples they were presumed to have been the culprits. Subsequent observations have suggested that the more likely villains are the exceedingly active and equally predaceous (if somewhat smaller) ostracods (most of the genus *Vargula*) which swarm near these light traps

Last year we deployed additional light-traps for shorter periods in several different locations. Deployments were held to between one and two hours duration, and used a different light source than that tried in 1999. Rather than the battery operated flashlight (producing a mostly white beam) used for the initial attempts, dimmer light sources were used. Cyalume light sticks were activated and placed within the traps as "bait" to attract swimming organisms that swarm towards light in the hours of darkness. As these light sticks come in several different colors we had the opportunity to examine experimentally the sensory biology of the animals, comparing the attractant power of different wavelengths of light, timing of exposure, deployment location [over sediment, on coral head, under dock, etc.] and exposure duration on catch composition. We found significant variation in catch between samples, and we will be pursuing a more rigorous experimental design in 2001 with the aim of publishing these results. Our initial experiments, while promising and providing good collections of organisms for taxonomic purposes, were not sufficiently controlled to serve as good data for publication.

These shorter deployments did provide the cumacean males sought initially, although once again some predation within the traps was evident. The various deployments also sampled species that were not otherwise taken, including large numbers of one species of *Oxyurostylis* (probably described – 5 species are known from the region), a relatively large diastylid cumacean not taken previously. Additional species of *Cyclaspis*, a bodotriid cumacean important in the local fauna, were also taken, complicating the interpretation of benthic data.

Bodotriids are conspicuous in the local fauna. There are at least eight different types of males represented in the collections. These include specimens of *Cyclaspis unicornis*, a related species that is possibly the one for which the genus *Stephanomma* was erected by Sars at the end of the 19th century, *Cyclaspis striata* [a single male specimen was taken in one of the 2000 light traps], and five species that appear to be undescribed. Females and males are known for at least three of these species. Several of these species have very indurate tests (heavily calcified carapaces), while several others are poorly calcified. Those in the former group tend to have relatively short, tall carapaces, while those in the later are more fusiform. These differences should signal differences in life-style, or microhabitat, but this has yet to be determined. Scanning electron micrographs of details of carapace morphology have been taken of several of these animals, and description is in progress.

Nannastacids are even more abundant and diverse than are the bodotriids at Guana. They are the preeminent group among the tropical West Atlantic cumaceans, and have been extensively examined in the last few decades by workers from Romania. Prominent among these was Dr. Mihai Bacescu, sadly recently deceased, whose work is being continued by Dr. Iorgu Petrescu, his student. Although a large number of taxa have already been described (see table), a significant number of the forms taken at Guana and in the ICLARM samples from Beef Island [most of which are also present in Guana samples] are not. The majority fit into the traditional concept of the genus *Cumella*, but recent work on the group has tended to increasingly restrict the broad concept of the genus, establishing new genera split from it. Other nannastacid genera represented in the collections from Guana include a single species [seemingly undescribed] of *Campylaspis*, and the broadly distributed *Cubanocuma gutzui*.

Little has been published on the latter species to date aside from the brief original description, and a mention (and illustration) of specimens from Bermuda. The genus is, so far, monotypic; Dr. Petrescu has examined material from Bermuda and finds it not to differ from the type material in any significant way. The species is very small, looking like a tiny pink stepped-on table-tennis ball [the top is flattened and a bit rugose, while the sides and base of the carapace are very smooth and evenly rounded]. It is often found in Guana samples, but never in large numbers. A paper is in MS (Jody Martin, Don Cadien, Dr. Richard Heard, and Tom Hansknecht) providing additional information on the species from various points in the tropical West Atlantic, where it appears to be a widespread and characteristic species in reef-associated sands despite the paucity of published records.

The wide distribution of this little animal, with so little evident dispersal ability, is of considerable interest in the evaluation of the rest of the group. Many of the Caribbean and Antillean species described in the genus *Cumella* are known from single collections or limited areas. This is probably artifactual. Many of these species are clearly siblings, and recently derived in what appears to be an active evolutionary center for these small animals. Differentiation of species within this group needs to be particularly well established, given a lack of information on species and population variability, and little or no evident ecological separation between co-distributed congeners at Guana. The larger question of how the distant populations of *Cubanocuma* are interconnected is intriguing. These animals are far too small and weak to swim between isolated island groups, yet they are found on both sides of such imposing zoogeographic divides as the Strait of Florida. They have no planktonic larval stages for dispersal, and brood young to the point at which they begin benthic existence alongside the adult. There is as yet no convincing evidence that the observed distribution of this and similar animals result from vicariant events.

Richard Heard, a man with extensive experience with peracarid crustaceans in the Gulf, Caribbean, and Antillean regions, suggested one possible scenario. He posited a catastrophist distributional method derived from the wind driven surface water movement associated with hurricanes. Small benthic animals such as *Cubanocuma* and other cumaceans are easily resuspended in turbulent near-shore waters, and could potentially be driven in surface waters "before the storm," moving from land-fall to land-fall throughout the region.

One puzzling feature of our several years of collections at Guana is potentially explained by this hypothesis; each year we find a number of different things (and do not find others we have found previously) when the same sites are visited. This degree of species turnover was not really anticipated at the start of the project, when characterization of a perennial reef-associated fauna was expected. The year-in year-out recurrence of energetic storm events in the region, which follow a number of different vectors, and which have redistributive potential for these small animals, might explain this inconstancy. Perhaps a good test case can be constructed from available data to address this possibility. Much less energetic storms have been shown to be effective at altering local distributions in other areas, but these cannot be generalized easily to the present case of suspected long-range dispersal.

It is hoped that the above discussion, without delving into many particulars, will provide an indication of the progress of the work with these animals to date.. In addition to the numerous new species descriptions currently underway, general questions are being posed by the collections made so far. As analysis of those materials continues, perhaps these can be further addressed. Additional and more rigorously experimental data collection with light traps should also be most informative.

Report on Leptostracan Crustacea
Collected at or near Guana Island during 2000

Todd A. Haney

The order Leptostraca is a small group of marine crustaceans, the members of which can be most easily distinguished by the presence of a hinged rostrum, an unhinged, bivalved carapace, and a thorax of eight segments (Figure 1). Leptostracans are predominantly benthic organisms and occur in marine environments worldwide, associated with habitats ranging from coral reefs to hydrothermal vents. In these marine environments, leptostracans can be surprisingly abundant and, in such cases, serve an important ecological role as secondary producers. Despite their ubiquity and a reasonably long history of descriptive work on the group, the order Leptostraca is badly in need of taxonomic revision. The leptostracans are among the most obvious gaps in our knowledge of marine invertebrate biodiversity. Our understanding of the group has not changed significantly since Hansen's (1920) comment that "our present knowledge is quite insufficient, ...a monograph on *Nebalia* based on rich material from most seas must be worked out." To date, the taxonomy of these crustaceans causes confusion, and the need for monographic research on the Leptostraca has been well recognized (Hansen, 1920; Calman, 1927; Pillai, 1959; Brattegard, 1970; Johnson, 1970; Kensley, 1976; Mauchline and Gage, 1983; Dahl, 1985, 1990; Martin *et al.*, 1996).

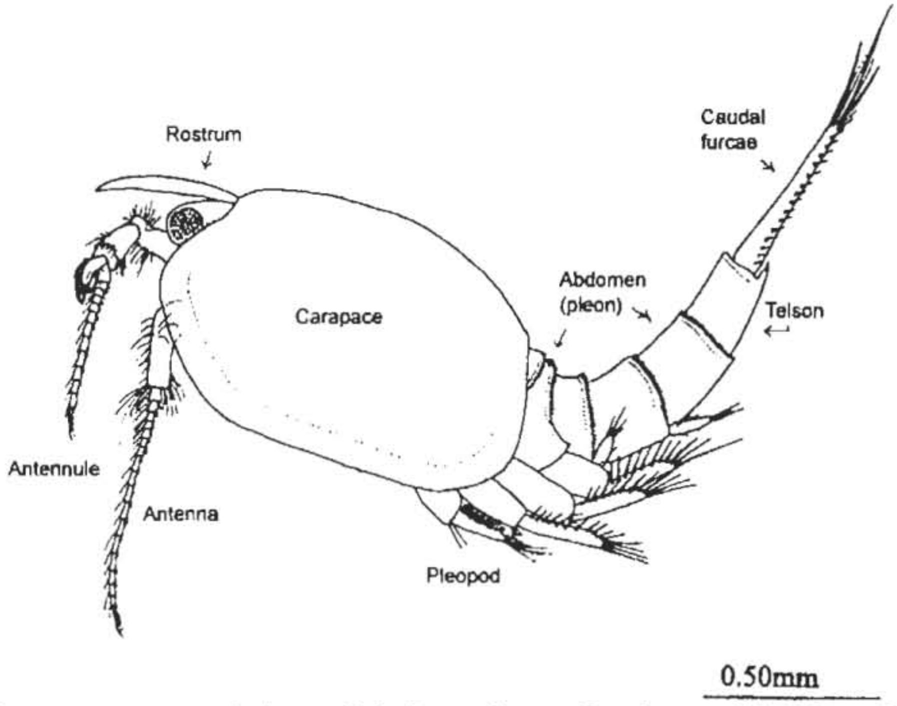

Figure 1. Leptostracan morphology: *Nebalia gerkenae*, female, modified from Haney and Martin, 2000.

Currently, only 33 leptostracan species are known worldwide; this does not reflect low diversity but rather a paucity of collecting and taxonomic efforts. There are various indications that the undiscovered diversity of the group is substantial. For instance, six of the ten genera have been described in only the last 17 years. Additionally, the literature includes numerous accounts of specimens that cannot be assigned to any known species (see Johnson, 1970; Dahl, 1990; Rainer and Unsworth, 1991; Vetter, 1996a). Even populations recently found just off the well-examined coast of California represented several undescribed species (Martin *et al.*, 1996; Vetter, 1996a; Haney and Martin, 2000).

The Marine Invertebrate Survey has resulted in the discovery of at least three leptostracan genera from Guana Island. An unidentified species of the genus *Nebalia* Leach, 1814, was collected from small patches of fine rubble near Long Point at Muskmelon Bay. *Paranebalia longipes* (Willemoes-Suhm, 1875) was collected from widespread localities around the Island. *Paranebalia longipes* was found to be sympatric with *Nebalia* in Muskmelon Bay; this species also occurred in large numbers among open sands and colonies of the alga *Halimeda* sp. from White Bay as well as from the ARM rubble basket from Grand Ghut. The most interesting find was the discovery of a new genus and species of leptostracan. Specimens of the new genus were collected from light traps and colonies of the green alga *Halimeda* from shallow waters (<3 meters) of White Bay. The new genus differs from other leptostracans most notably in the morphology of the antennule and the eighth thoracopod. While its eyes, like those of *Nebalia*, are non-tuberculate, it shares the rostral spine, dentate margin of antennular article four, and serrate pleopodal protopods of *Levinebalia* Walker-Smith, 2000, and *Paranebalia* Claus, 1880. However, the new genus lacks the setal row of the exopod of pleopod one, a feature characteristic of *Levinebalia, Nebalia* and *Paranebalia*.

Although it is undoubtedly a result of the intensive collection effort, a greater diversity of Leptostraca is now known from Guana Island than from any other location in the world. The manuscript in which the new genus and species is currently being described (Haney and Martin, in preparation) will represent only the third published account of Leptostraca from the Caribbean Sea. Previous records are those of *Paranebalia belizensis* Modlin, 1991, from the barrier reef of Belize and *Nebalia lagartensis* Escobar-Briones and Villalobos-Hiriart, 1995, from the Yucatán Peninsula. Further, more detailed studies of the leptostracan fauna of Guana Island will serve to improve our understanding of the distribution and ecology of these animals.

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Hansen, H. J. 1920. Crustacea Malacostraca IV. Danish Ingolf-Expedition. 3(6): 1-86, plates 1-4.

Johnson, D. S. 1970. Occurrence of the mud-shrimp *Nebalia* (Crustacea Leptostraca) at Singapore. Journal of the Singapore National Academy of Science. 2: 50-52.

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Mauchline, J., and J. D. Gage. 1983. The Nebaliacea (Crustacea: Leptostraca) of the Rockall Trough. Journal of the Marine Biological Association of the United Kingdom. 63: 627-631.

Modlin, R. F. 1991. *Paranebalia belizensis*, a new species from shallow waters off Belize, Central America (Crustacea: Malacostraca: Leptostraca). Proceedings of the Biological Society of Washington. 104: 603-612.

Pillai, N. K. 1959. On the occurrence of *Nebalia longicornis* in Indian waters. Journal of the Bombay Natural History Society. 56: 351-353, plate 1.

Rainer, S. F., and P. Unsworth. 1991. Ecology and production of *Nebalia* sp. (Crustacea: Leptostraca) in a shallow-water seagrass community. Australian Journal of Marine and Freshwater Research. 42: 53-68.

Vetter, E. W. 1996a. *Nebalia daytoni* n. sp. a leptostracan from southern California (Phyllocarida) Crustaceana. 69(3): 379-386.

Walker-Smith, G. K. 2000. *Levinebalia maria*, a new genus and new species of Leptostraca (Crustacea) from Australia. Memoirs of the Museum of Victoria. 58(1): 137-148.

Willemoes-Suhm, R. 1875. On some Atlantic Crustacea from the Challenger Expedition. III. On a *Nebalia* from the Bermudas. Transactions of the Linnean Society of London, series 2. 26.

Report on the Opisthobranch Mollusca (Sea Slugs)
of Guana Island

Todd L. Zimmerman

Specimen identifications and information have been provided by Ángel Valdés of the California Academy of Sciences. Opisthobranch mollusks are one of the few groups that can be readily identified using color photographs. Dr. Valdés has been able to identify these animals using only our color images, which we have posted for him on the World Wide Web. This is the first instance of an entire museum collection set being identified using this technology that we are aware of. A great deal of time and money has been saved using this technique, and the threat of important museum specimens being lost in the mail has been overcome. Dr. Valdés believes at least two species (not listed) from Guana Island are new to science. He will be joining the museum staff in the summer of 2001 and will use some of these specimens for his research on molluscan genetics.

The following information has been provided in a format designed for the individual species identification pages of the Guana Survey Website. We have simply included it here in its original format as e-mailed to us. We are hoping that all taxonomists will provide similar information for our website as they incorporate Guana Island specimens into their own research.

Partial list of Guana Island Opisthobranchs

Ángel Valdés

Elysia timida (Risso, 1818)

... Size: Up to 20 mm long.

... Defining characters: Body elongate and slender. Two lateral prolongations on the body (parapodia). Color white with conspicuous red dots.

... Range: Caribbean, Mediterranean and subtropical eastern Atlantic, from France to Cape Verde.

... Depth: Intertidal and subtidal.

... Habitat: On green algae of the genus *Acetabularia*.

... General information: The Caribbean populations of this species were described under the name *Elysia cornigera* Nuttall, 1989, recently synonymized with *Elysia timida* (Risso, 1818) by Ortea *et al.* (1997).

... Literature

Ortea, J., Moro, L. & Espinosa, J. (1997) Nuevos datos sobre el genero *Elysia* Risso, 1818 (Opisthobranchia: Sacoglossa) en el Atlántico. *Revista de la Academia Canaria de Ciencias*, 9: 141-155.

... Links

http://www.seaslugforum.net/elyscftimi.htm http://www.medslugs.de/E/Mediterranean/Elysia_timida.htm

Oxynoe antillarum Mörch, 1863

… Size: Up to 10 mm long.
… Defining characters: Fragile external shell partially covered by lateral prolongations of the body (parapodia). Posterior end of the foot very elongate.
… Range: Caribbean.
… Depth: Intertidal and subtidal.
… Habitat: On green algae of the genus *Caulerpa*.
… General information: When disturbed this species produces dense, white clouds of toxic chemicals.
… Literature
Marcus, Ev. & Marcus Er. (1967) American opisthobranch mollusks. *Studies in Tropical Oceanography*, 6: 1-256, 1 pl.
… Links
http://www.seaslugforum.net/oxynanti.htm

Chromodoris binza Ev. Marcus & Er. Marcus, 1963)

… Size: Up to 30 mm long.
… Defining characters: Body oval, with the dorsum covered with an irregular network of red pigment and pale blue areas.
… Range: From Florida to the southern Caribbean.
… Depth: Intertidal and subtidal.
… Habitat: On hard bottoms.
… Literature
Ortea, J., Valdés, A. & Espinosa, J. (1994) North Atlantic Nudibranchs of the *Chromodoris clenchi* colour group (Opisthobranchia, Chromodorididae). *Journal of Molluscan Studies*, 60: 237-248.
… Links
http://www.seaslugforum.net/chrobinz.htm

Hypselodoris ruthae Ev. Marcus & Hughes, 1974

… Size: Up to 25 mm long.
… Defining characters: Body elongate, with longitudinal yellow or white bands and a wide white area surrounding
… Range: Caribbean.
… Depth: Intertidal and subtidal.
… Habitat: On hard bottoms, on sponges of the genus *Dysidea*.
… Literature
Ortea, J., Valdés, A. & García-Gómez, J. C. (1996) Revisión de las especies atlánticas de la

familia Chromodorididae (Mollusca: Nudibranchia) del grupo cromático *azul*. *Avicennia*, supl. 1: 1-165
.... Links: http://www.seaslugforum.net/hypsruth.htm

Stylocheilus striatus **(Quoy & Gaimard, 1832)**

... Size: Up to 50 mm long.
... Defining characters: Body elongate, with numerous longitudinal dark lines and thin papillae. Lateral prolongations of the body (parapodia) reduced. There is no shell.
... Range: Circumtropical.
... Depth: Intertidal.
... Habitat: On hard and soft bottoms.
... General information: This species is able to swim away from potential predators by violent movements of the posterior end of the foot.
... Literature
Bebbington, A. (1977) Aplysiid species from Eastern Australia with notes on the Pacific Ocean Aplysiomorpha (Gastropoda: Opisthobranchia). *Transactions of the Zoological Society of London*, 34: 87-147.
... Links
http://www.seaslugforum.net/stylstri.htm

Cyerce antillensis **Engel, 1927**

... Size: Up to 35 mm long.
... Defining characters: Body covered with leaf-like appendages (cerata). Dorsal tentacles (rhinophores) bifurcated.
... Range: Caribbean.
... Depth: Intertidal and subtidal.
... Habitat: On algae of the genus *Halimeda*.
... General information: This is a solar-powered sea slug. The animal is able to take the photosynthetic organelles (chloroplasts) from the algae it eats, and keep them alive in the large leaf-shaped dorsal prolongations (cerata). When the animal is disturbed it is able to cast-off the dorsal appendages (cerata).
... Literature
Marcus, Ev. & Marcus Er. (1967) American opisthobranch mollusks. *Studies in Tropical Oceanography*, 6: 1-256, 1 pl.

Aphelodoris antillensis **(Bergh, 1879)**

... Size: Up to 20 mm long.
... Defining characters: Body oval with an irregular pattern of brown and white pigment.
... Range: Circumtropical.
... Depth: Intertidal and subtidal.
... Habitat: On hard bottoms.

… General information: This species is able to swim by means of violent contractions of the body.

… Literature

Hamann, J. C. (1992) A warm water Atlantic synonymy, *Aphelodoris antillensis* equals *Chromodoris bistellata* (Opisthobranchia: Gastropoda). The Veliger, 35: 215-221

Dendrodoris krebsii (Mörch, 1863)

… Size: Up to 55 mm long.

… Defining characters: Body oval, very variable in color. There is no radula.

… Range: Western Atlantic (from Georgia to southern Brazil) and Caribbean.

… Depth: Intertidal and subtidal.

… Habitat: On hard bottoms.

… Literature

Valdés, A., Ortea, J., Ávila, C. y Ballesteros, M. 1996. Review of the genus *Dendrodoris* (Gastropoda, Nudibranchia) in the Atlantic Ocean. *Journal of Molluscan Studies*, 62: 1-31.

… Links

http://www.seaslugforum.net/dendkreb.htm

Aplysia dactylomela Rang, 1828

… Size: Up to 400 mm long.

… Defining characters: Body covered with dark brown or black rings. Shell internal, covered by the lateral prolongations of the body (parapodia).

… Range: Circumtropical.

… Depth: Intertidal to about 20 m depth.

… Habitat: On soft or hard bottoms.

… General information: When disturbed, this species produces a defensive purple ink.

… Literature

Eales, N. B. (1960). Revision of the world species of *Aplysia* (Gastropoda, Opisthobranchia). *Bulletin of the British Museum (Natural History)*, 5: 269-404

… Links

http://www.seaslugforum.net/aplydact.htm

Elysia crispata (Mörch, 1863)

… Size: Up to 40 mm long.

… Defining characters: Dorsal tentacles (rhinophores) enrolled. Lateral prolongations of the body (parapodia) with undulating edges.

… Range: Florida, Bermuda and Caribbean Sea.

… Depth: Intertidal.

… Habitat: On hard or soft bottoms with green algae.

… General information: The common name of this species, lettuce slug, refers to the curled borders of the lateral prolongations of the body.

… Literature

Marcus, Ev. & Marcus Er. (1967) American opisthobranch mollusks. *Studies in Tropical Oceanography*, 6: 1-256, 1 pl.

… Links

http://www.seaslugforum.net/elyscris.htm

Phidiana lynceus Bergh, 1867

… Size: Up to 30 mm long.

… Defining characters: Mid-dorsal whitish line that bifurcates in front of the annulate dorsal tentacles (rhinophores) into each oral tentacle. Dorsal papillae (cerata) with the base dark brown and white apexes.

… Range: Western Atlantic (from Brazil to Florida, Caribbean) and western Africa (Ghana).

… Depth: Intertidal and subtidal.

… Habitat: On hard bottoms.

… Literature

Edmunds, M. (1964). Eolid Mollusca from Jamaica, with descriptions of two new genera and three new species. *Bulletin of Marine Science of the Gulf and Caribbean*, 14: 1-32.

… Links

http://www.seaslugforum.net/phidlync.htm

Aegires sublaevis Odhner, 1932

… Size: Up to 15 mm long.

… Defining characters: Body with two dorsal ridges that merge into a single one near the anterior and posterior ends of the dorsum. There are also several pitches irregularly distributed.

… Range: Tropical Atlantic, from the Mediterranean to the Canary Islands in the east side, and in the Caribbean in the west side.

… Depth: Intertidal and subtidal.

… Habitat: On hard bottoms.

… General information:. This species feeds on sponges of the genus *Clathrina*.

… Literature

Templado, J., Luque, A. A. & Ortea, J. (1987). A new species of *Aegires* Lovén, 1844 (Opisthobranchia: Doridacea: Aegiretidae) from the Caribbean Sea: *Aegires ortizi* spec. nov., with comparative descriptions of the North Atlantic species of this genus. *The Veliger*, 29: 303-307.

Aegires ortizi Templado *et al.*, 1987

… Size: Up to 8 mm long.
… Defining characters: Dorsum covered by conical tubercles arranged in several rows.
… Range: Caribbean.
… Depth: Intertidal.
… Habitat: On hard bottoms.
… General information: This is the second record of this rare species.
… Literature
Templado, J., Luque, A. A. & Ortea, J. (1987). A new species of *Aegires* Lovén, 1844 (Opisthobranchia: Doridacea: Aegiretidae) from the Caribbean Sea: *Aegires ortizi* spec. nov., with comparative descriptions of the North Atlantic species of this genus. *The Veliger*, 29: 303-307.

Tritonia bayeri Ev. Marcus & Er. Marcus, 1967

… Size: Up to 15 mm long.
… Defining characters: Color translucent white with an irregular network of opaque white on the dorsum.
… Range: Caribbean.
… Depth: Intertidal to 20 m depth.
… Habitat: On gorgonians.
… General information: This species feeds on gorgonias of the genus *Pseudopterogorgia*.
… Literature
Marcus, Ev. & Marcus Er. (1967) American opisthobranch mollusks. *Studies in Tropical Oceanography*, 6: 1-256, 1 pl.
… Links
http://www.seaslugforum.net/tritbaye.htm

Chelidonura hirundinina (Quoy & Gaimard, 1833)

… Size: Up to 20 mm long.
… Defining characters: Color dark with a regular pattern of orange, blue and opaque white pigment. Posterior end of the body with two tapering "tails", one of them larger than the other.
… Range: Circumtropical.
… Depth: Intertidal and subtidal.
… General information: This is an active predator of flat worms. It secretes a brown chemical when it is molested.
… Literature
Marcus, Er. & Marcus, Ev. (1970). Opisthobranchs from Curaçao and faunistically related regions. *Studies on the Fauna of Curaçao and other Caribbean Islands*, 33: 1-129
…. Links http://www.seaslugforum.net/chelhiru.htm

Doriopsilla pharpa Er. Marcus, 1961

... Size: Up to 15 mm long.
... Defining characters: Yellowish color with numerous reddish brown spots.
... Range: Western Atlantic, from Massachusetts to the Caribbean.
... Depth: Intertidal and subtidal.
... Habitat: On hard bottoms.
... Literature

Valdés, A. & Ortea, J. (1997). Review of the genus *Doriopsilla* Bergh, 1880 (Gastropoda: Nudibranchia) in the Atlantic Ocean. *The Veliger*, 40: 240-254.

Chelidonura hummelincki (Er. Marcus & Ev. Marcus, 1970)

... Size: Up to 10 mm long.
... Defining characters: Color dark brown with yellowish pigment on the anterior and posterior ends of the body as well as in the center of the dorsum. There are also irregularly arranged yellowish spots on the entire body.
... Range: Caribbean.
... Depth: Intertidal and subtidal.
... Habitat: Unknown.
... General information: This is probably an active predator of flat worms.
... Literature

Marcus, Er. & Marcus, Ev. (1970). Opisthobranchs from Curaçao and faunistically related regions. *Studies on the Fauna of Curaçao and other Caribbean Islands*, 33: 1-129.

Stiliger cricetus Er. Marcus & Ev. Marcus, 1970

... Size: Up to 5 mm long.
... Defining characters: Dorsal papillae (cerata), with green ramified branches of the digestive gland inside and white glands on the apex.
... Range: Caribbean.
... Depth: Intertidal.
... Habitat: On green algae.
... Literature

Marcus, Er. & Marcus, Ev. (1970). Opisthobranchs from Curaçao and faunistically related regions. *Studies on the Fauna of Curaçao and other Caribbean Islands*, 33: 1-129.

Bosellia mimetica Trinchese, 1890

… Size: Up to 10 mm long.

… Defining characters: Body flat, uniformly green, with whitish dorsal tentacles (rhinophores).

… Range: Tropical and subtropical Atlantic.

… Depth: Intertidal and subtidal.

… Habitat: On algae of the genus *Halimeda*.

… General information: This species has the same color an appearance of the "leaves" of the algae of the genus *Halimeda*.

… Literature

Marcus, Er. & Marcus, Ev. (1970). Opisthobranchs from Curaçao and faunistically related regions. *Studies on the Fauna of Curaçao and other Caribbean Islands*, 33: 1-129.

… Links

http://www.seaslugforum.net/bosemime.htm

Report on the Polychaete Worms
Collected at or near Guana Island during 2000

Leslie H. Harris

This year's sampling produced 791 lots of polychaetes, each lot containing from 1 to 100 individuals. 35 families were represented with a minimum of 134 taxa identified mostly to the family or genus-level while live sorting on Guana (Appendix III). When the material is completely identified the number of species is expected to be between 250 and 300 species since a single genus such as *Typosyllis* may contain 15 to 20 as yet unsorted species.

Of particular interest are the species which appear to be both undescribed and new generic records for the entire Caribbean region. Some of these have appeared only once, such as *Reteterbella* sp. 1 (Terebellidae) and *Neoleprea* sp. 1 (Terebellidae), found among algae at the foot of mangroves on Beef Island opposite the old Guana Island boat dock. A single specimen of *Virchowia* sp. 1 (Syllidae) was taken from filamentous red algae growing on light-bulb tunicates on the wall at Long Point, 3 m deep. Other species, such as *Laubierpholoe* sp. 1 (Pholoididae) and *Ophiodromus* sp. 1 (Hesionidae) were never abundant in any one sample but did occur in several different sites around Guana Island in habitats varying from shallow (<1 m) algal turf to sand patches at 15 m. The overall scarcity of these species and the absence of any previous record for the Caribbean can be ascribed to both the lack of collecting in suitable habitats and the small size of the animals, most of which were under 10 mm in length.

The task of identifying the Guana polychaetes is being shared with the personnel of the ECOSUR-Polychaete Lab, headed by Dr. Sergio Salazar-Vallejo. ECOSUR is the ecological research division of El Colegio de la Frontera Sur, Chetumal, Quintana Roo, Mexico.

Report on the Echinoderms
Studied at or near Guana Island during 2000

Gordon Hendler

During the last Summer Science Month reconnaissance, additional species of echinoderms (sea stars, sea urchins and related animals) were added to the faunal list for Guana Island. Records of previously unreported species have continued to accumulate as new sites, habitats, and depths were explored. Last summer's noteworthy additions to the list of brittle stars included *Ophiobyrsa serpens*, of which only a few individuals ever have been collected, and an unusual burrowing species that I now believe to be *Ophiophragmus luetkeni*. In my book on Caribbean echinoderms, I merged *O. luetkeni* with a very similar species, but having examined specimens from Guana Island the distinctive features of the Virgin Islands animals became clear to me. I will be able to verify and publish on that topic once I have examined the type-specimen of *O. luetkeni* housed in Sweden's national museum of natural history. Apropos of that, it should be mentioned that the first significant collections of Caribbean brittle stars were described in the mid-19th century by Ljungman and Luetken, of Sweden and Denmark, respectively, based on specimens collected from the Virgin Islands. Many of Ljungman's specimens came from Tortola and vicinity, while Luetken's came from St. Thomas and vicinity. Collections of echinoderms from Guana Island will enable me to verify that their rather limited list of species are still present, and to show that the fauna of the British Virgin Islands is considerably richer than previously thought. The Guana list may also provide evidence of regional differences of the shallow-water echinoderm fauna of the Caribbean.

During 2000, a dive was made near the locality where one individual of an undescribed species of brittle star had been collected in 1999. The 1999 discovery was significant in that it represents: a previously unknown species, the only shallow-water ophioleucid ever found in the Caribbean, and one of the few brittle stars ever observed with the capacity to launch itself and swim through the water! Unfortunately, a second specimen was not found. On that dive, however, several individuals of a different species, *Ophiostigma isocanthum*, were collected that spawned in the laboratory on my last day at Guana Island. I was able to carry them back to California, "incubating" them in a vial of seawater carried in my pants pocket. Before I could locate a source of food for the larvae, they unexpectedly metamorphosed into baby brittle stars. Similarly rapid, abbreviated development is known for only two other species. I have photographed the preserved specimens of the larvae that I reared and have a publication in preparation describing the phenomenon. In it, I will suggest that that the reason larval forms have been described for so few brittle star species is that many others may, like *Ophiostigma isocanthum*, have short-lived, benthonic ("bottom-hugging") larvae that have never been collected in standard plankton samples.

Progress was also made in a multi-pronged investigation of *Ophioderma brevispinum*, a brittle star associated with seagrass habitats. It has been suggested in the literature that the distribution of the species is constrained by its sensitivity to short-wavelength solar radiation. I carried out a preliminary experiment on Guana Island that suggested the species is indeed sensitive to ultra-violet (UV) radiation, and which indicated that natural levels of UV are lethal to exposed individuals. I made a quantitative field survey of the brittle star and found out that it usually occurs in clear water much less than one meter deep, where UV radiation is particularly severe, Furthermore, I found that individuals do not live "in the open," as suggested in the literature. Rather, they nestle under small pieces of algae, shell, coral, and so on – and are presumably shielded from UV radiation. Why is the species abundant in a physically stressful habitat instead of in immediately adjacent algal/coral reef habitat or at greater depth, protected from harmful UV radiation? I plan to study those questions this year through a series of experiments that will test the importance of predation pressure on the distribution of *Ophioderma brevispinum*.

Guana Island Seagrass Investigations

Rick Ware

Since 1998, the LACMNH scientific team has conducted baseline investigations of the intertidal and shallow subtidal seagrass meadows of Guana Island. In 1998 these investigations were limited to determining the areal extent and density of the turtle grass (*Thalassia*) meadow located in the intertidal and shallow subtidal depths at North Beach. Line transects were established at five meter intervals along the entire length of the turtle grass meadow. Along each transect, the beginning and ending distance of turtle grass was measured and the number of live, green shoots of turtle grass within replicated 1/4 square meter sampling quadrats was counted at the beginning, middle, and deep portions of the turtle grass meadow. These surveys were also conducted as a teaching tool to introduce BVI high school students to ecological field studies using line-transect and quadrat sampling methods. Underwater photographs of the seagrass bed habitat and associated plants and animals were also collected.

In 1999 and 2000, the investigations were expanded to include percent cover measurements of seagrass, algae, unvegetated sand flat, and sediment types (sand, rubble, reef) in order to better characterize seagrass community structure and function. Dominant algae and invertebrates within 1/4 square meter quadrats and randomly along the transects were also identified. Underwater photographs of the North Beach seagrass community were taken during both 1999 and 2000. Researchers also have collected invertebrate specimens within this seagrass habitat between 1999 and 2000. The meadow is approximately 1,404 square meters in size, extends 171 meters along the shoreline, and ranges in width between 2 to 22.8 meters. Examples of the types of data being collected and analyzed are shown in Figure 1.

In July 2000, an intensive, initial underwater mapping effort was undertaken employing a combination of SCUBA and GPS (Global Position System) to map the distribution and species composition of the seagrass meadows between Tom Point and Monkey Point in Guana Channel that separates Guana Island and Tortola, BVI. Initial mapping results suggest that seagrass forms an extensive meadow along approximately 975 meters of shoreline and extends at least 430 meters into Guana Channel at a depth of 11 to 13 meters. However, most of the meadow appears to be less than 150 meters wide. Three species of seagrass were identified from this area; turtle grass, (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), and *Halophila ?decipiens*.

Investigations during 2001 will concentrate on (1) continuing a fourth-year of seagrass bed monitoring at North Bay, (2) completing the mapping of the seagrass bed resources between Tom Point and Monkey Point, (3) identifying depth ranges and distributional ranges of the three species of seagrass observed between Tom Point and Monkey Point, (4) conducting ecological studies of invertebrates within the Guana Channel seagrass ecosystem, and (5) photo-documenting the biological resources within the Guana Channel seagrass ecosystem..

Concluding Remarks

When we first undertook this study in the summer of 1999 (some of the team members had visited Guana before that time), we anticipated making some new discoveries. Nearly any modern survey of any area of high biodiversity results in the discovery of something not seen previously. Nature, after all, is always more diverse than we think she is, and she is masterful at keeping some of her secrets hidden. This is especially true as concerns tropical marine invertebrates, so many of which are small or cryptic. But we were not prepared for the number and significance of what we have found to date. We are uncovering species never seen in the Caribbean before; species seen in the Caribbean but never reported from anywhere in the BVI; species whose closest relatives are in far-flung corners of the globe; species who *have* no known relatives; species completely new to science.

Science, especially the science of discovery and description, is sometimes very slow. The "discovery" phase of a biotic survey or inventory, despite the amount of physical labor involved in our field operations, is actually the easy and quick part of a survey. Often the true results of a serious biological survey take years of laborious, tedious sorting and hours of microscope work to decipher. As an example, among our large collections at the Natural History Museum of Los Angeles County, there are still jars of marine invertebrates that remain unidentified despite the fact that they were collected back in the 1930s and 1940s by the *Velero expeditions* of Captain Allan Hancock. The Smithsonian's U.S. National Museum of Natural History, the largest natural history museum in the world, has literally miles of shelves with unsorted and unidentified invertebrate samples from previous marine surveys. One reason for such backlogs of work is that the description of a new species is no trivial undertaking. Time, money, and dedication are all necessary. The specimen must be compared with all of its closest relatives, compared to museum "type" specimens, photographed or illustrated, sometimes dissected, with all of its legs, mouthparts, antennae, and other appendages drawn in great detail. The process can (and usually does) take over a year from start to finish; consequently, for a mere 10 undescribed species, one could spend a decade describing them correctly. And we have many more new species than that.

Seen in this light, our progress has been amazingly fast. We are describing results from our study on Guana Island as quickly as is possible. Perhaps more importantly, we are also sending specimens to other specialists all over the world so that they can join us in this process. The result is that, both above and below water, Guana is emerging as one of the biologically richest islands in the world, and we are proud of our role in elucidating the marine diversity of the island. The fact that we have done this with virtually no harm to the surrounding reefs (because of our use of Artifical Reef Matrices) adds considerably to our sense of accomplishment.

We are especially pleased that our efforts to date have included a strong education component. Our work with students in the BVI and in Los Angeles has provided strong incentives for pursuing careers in marine biology, and our electronic (CD-ROM) identification guide is being used at colleges and marine labs. We anticipate the continuation of this effort and look forward to future interactions with students and other interested parties in the BVI.

Finally, we thank Henry and Gloria Jarecki, for having the foresight to make Guana Island into a focal point for conservation work and scientific study, and Lianna Jarecki, James Lazell, and Graham Forrester for allowing us to participate in Marine Science Month.

Plans for Summer of 2001

We have been lucky enough to secure additional funding from both the Falconwood Corporation and the National Science Foundation to return for a third field season on Guana Island. In addition we have secured funding (NSF REU supplement) that will enable two undergraduate students to participate in a number of experiments and field studies.

Possible field experiments and studies to be pursued this summer include:

--Characterization of nutrient uptake by shallow water reef sponges (Lianna Jarecki and Students).

--Determination of population structure and reproductive ecology of salt pond fiddler crabs (Todd Zimmerman and Students).

Determining the effect of salinity on the development of mosquito larvae (Lianna Jarecki, Todd Zimmerman, and Students).

--Effect of different light colors for collecting marine invertebrates in light traps (Todd Zimmerman, Todd Haney, and Students).

--Ultraviolet light tolerance of selected brittle star species (Gordon Hendler).

--Population structure and movement patterns of selected brittle star species (Gordon Hendler).

--Characterization and mapping of seagrass beds around Guana Island (Rick Ware).

We also plan to continue evaluating several collecting methods. The artificial reef structures (ARMS), which proved so valuable in 2000, were redeployed at both deeper and shallower depths. An array of large nylon mesh pads was deployed off of the Guana boat dock in late July 2000. This array was made to simulate the algal habitats colonized by many invertebrate types including post-larval lobsters, and it is hoped that it will yield many species that were not attracted to the ARMS. We also plan to test the effectiveness of diver pulled beam and/or sled nets to sample fast moving invertebrates living in the seagrass beds.

Appendix I. Guana Island Products

Resulting either directly or indirectly from specimens or material gained through the grant NSF DEB 99-72100 "Survey of the Marine Invertebrate Cryptofauna of Guana Island, British Virgin Island" and associated grants provided by the Falconwood Corporation.

A. Electronic / Web / CD ROM Products

Zimmerman, T. L., and J. W. Martin. 2000-2001. CD-ROM: Marine Invertebrates of Guana Island, BVI. (Photography by T. L. Zimmerman, L. Harris, and Richard R. Ware). Also available on the web as URL: http://nhm.org/~tzimmerm/bvi_800/0bvi-idx.htm

To eventually include "Searchable Database of Marine Invertebrates of Guana Island" (Currently existing offline as the relational database Caribbean Invertebrates - version 14)

B. Presentations / talks (in chronological order)

Zimmerman, T. L., and J. W. Martin. 1999. Guana Island marine invertebrate biodiversity project. Abstract, p. 62, Program of The Crustacean Society 1999 Summer Meeting, 26-30 May, 1999, Lafayette, Louisiana.

Martin, J. W. 1999. A survey of the marine invertebrates of Guana Island and what it means to the British Virgin Islands. Rotary Club of Tortola, August 5, 1999, meeting, Road Town, Tortola.

Zimmerman, T. L., and J. W. Martin. 2000a. Survey of the shallow water marine cryptofauna of Guana Island, BVI. In: All-hands Biotic Surveys and Inventories workshop, Outlook Inn, Orcas Island, Washington, May 18-21, 2000: 26 (abstract).

Zimmerman, T. L., and J. W. Martin. 2000b. Electronic Publication and Web-based Information -- Guana Island Marine Invertebrate Biodiversity Project. The Crustacean Society Summer Meeting, Puerto Vallarta, Mexico, June 26-30, 2000 (abstract).

Martin, J. W., and D. Cadien. 2000. Notes on peracarids from Guana Island, BVI. The Crustacean Society Summer Meeting, Puerto Vallarta, Mexico, June 26-30, 2000 (abstract).

Martin, J. W. 2000. The Guana Island Marine Biodiversity Project and What it Means to the New Museum. Address given to the Museum Fellows, November 12, 2000, home of John and Mimi Harris, Los Angeles.

Zimmerman, T. L., and J. W. Martin. 2001. Interesting crustaceans from Guana Island, British Virgin Islands. Invited research seminar, USNM / Smithsonian, February, 2001.

Martin, J. W. 2001a. Marine Biodiversity, Guana Island, and the Age of Discovery. Natural History Museum of Los Angeles County, Annual Open House Plenary Lecture, April 14, 2001.

Todd L. Zimmerman 2001. Marine invertebrates: systematics, ecology, and education. Job Seminar. C.W. Post –Long Island University.

Martin, J. W., and T. L. Zimmerman. 2001. Collecting coral reef crustaceans without harming the coral: preliminary results of the Guana Island (BVI) Survey. International Crustacean Congress, Melbourne, Australia, July 9-13, 2001.

Martin, 2001b. An update on the "Updated Classification of Crustacea" project. International Crustacean Congress, Melbourne, Australia, July 9-13, 2001.

Wetzer, R., J. W. Martin, & S. E. Trautwein. 2001. Phylogenetic relationships within the coral crab genus *Carpilius* (Brachyura, Xanthoidea, Carpiliidae) and a preliminary analysis of the relationships of the Carpiliidae to other xanthoid families based on molecular sequence data. International Crustacean Congress, Melbourne, Australia, July 9-13, 2001.

Haney, T. A., & J. W. Martin. 2001. A new leptostracan genus from the British Virgin Islands, Caribbean Sea, with a preliminary analysis of relationships among the families and genera of the Leptostraca. International Crustacean Congress, Melbourne, Australia, July 9-13, 2001.

C. Publications

Peer-reviewed Scientific Articles

(Published, in press, submitted, or in manuscript)

Martin, J. W., and T. L. Zimmerman. 2001. The stomatopod *Alachosquilla floridensis* (Manning, 1962) (Crustacea, Stomatopoda, Nannosquillidae) reported from Guana Island, British Virgin Islands, with observations on color. Gulf and Caribbean Research 13: 87-89.

Fransozo, A., M. L. Negreiros-Fransozo, J. W. Martin, and S. E. Trautwein. 2001. Morphology of the first zoeal stage of *Platypodiella spectabilis* (Herbst, 1794) (Decapoda, Brachyura, Xanthidae) obtained in the laboratory. Gulf and Caribbean Research 13: 79-85.

Martin, J. W., J. C. Christiansen, and S. E. Trautwein. 2001. *Homolodromia monstrosa*, new species, from the western Atlantic, with a redescription of the holotype of *H. paradoxa* A. Milne Edwards, 1880. Bulletin of Marine Science 68(2): 313-326.

Martin, J. W., and T. L. Zimmerman. 2001. Notes on three western Atlantic deep-sea crabs (Decapoda, Brachyura). Crustaceana 00:000-000.

Harvey, A. H., J. W. Martin, and R. Wetzer. In press. Crustacea. In: C. Young (editor), Atlas of Marine Invertebrate Larvae. John Wiley & Sons.

Martin, J. W., and G. E. Davis. In press. An updated classification of the Recent Crustacea. Science Series, Natural History Museum of Los Angeles County.

Fitzhugh, K. Submitted. An emendation of the fan worm genus *Fabricinuda* Fitzhugh, 1990 (Polychaeta: Sabellidae: Fabriciinae), and description of a new species from the Caribbean. Journal of Natural History.

Fitzhugh, K. Submitted. Species of *Novofabricia* Fitzhugh, 1990, and *Augeneriella* Banse, 1957 (Polychaeta: Sabellidae: Fabriciinae), in the Caribbean Sea. Bulletin of Marine Science.

Martin, J. W. Submitted. *Microprosthema jareckii*, a new species of stenopodidean shrimp (Crustacea, Decapoda, Stenopodidea, Spongicolidae) from Guana Island, British Virgin Islands. Proceedings of the Biological Society of Washington.

Heard, R. W., J. W. Martin, and T. Hansknecht. Submitted. A new species *Saltipedis* Gutu, 1995 (Crustacea: Tanaidacea: Parapseudidae) from the Caribbean, with the first description of a male for the genus. Proceedings of the Biological Society of Washington.

Martin, J. W., and J. W. Goy. Submitted. The first larval stage of *Microprosthema semilaeve* (Von Martens, 1872) (Crustacea: Decapoda: Stenopodidea) from Guana Island, British Virgin Islands. Gulf and Caribbean Research.

Wetzer, R., S. E. Trautwein, and J. W. Martin. In manuscript. Genetics of the xanthoid crab genus *Carpilius* across its range. For Biological Bulletin.

Leslie H. Harris and Jennifer Ruiz-Ramirez. In manuscript. A new species of *Branchiosyllis* (Syllidae) from the Grand Caribbean.

Martin, J. W., and T. L. Zimmerman. In manuscript. New records of stenopodidean shrimps from Guana Island, BVI, with a review of the Stenopodidea of the Caribbean and western Atlantic.

Martin, J. W., and J. W. Goy. In manuscript. Redescription of the stenopodidean shrimp *Microprosthema semilaeve* from the Caribbean

Cadien, D. B., R. W. Heard, T. Hansknecht, and J. W. Martin. In manuscript. New records of the cumacean genus *Cubanocuma* Bacescu and Muradian, 1977 (Crustacea: Peracarida: Cumacea: Nannastacidae) from the Caribbean and Gulf of Mexico.

Heard, R. W., and J. W. Martin. In manuscript. A new genus of *Apseudomorpha*-like tanaidacean (family Metapseudidae) from the Caribbean.

Heard, R. W., J. W. Martin, and R. Wetzer. In manuscript. A new species of the isopod genus *Stenetrium* from the Caribbean. Journal of Crustacean Biology.

Felder, D. L., and J. W. Martin. In manuscript. Establishment of *Peripanopeus*, new genus, for several species of small xanthoid crabs from the Atlantic and eastern Pacific Oceans (Crustacea, Decapoda, Panopeidae)

Cadien, D. B., and J. W. Martin. In manuscript. New records of the cumacean genus *Cyclaspis* from Guana Island, British Virgin Islands.

Zimmerman, T. L. In manuscript. Invasion of the swimming crab *Charybdis helleri* (A. Milne Edwards, 1867) (Decapoda, Portunidae) into the central Caribbean.

Books and Popular Articles:

Zimmerman, T. L. 2000. Understanding Caribbean Biodiversity: Guana Island Project. Terra (Natural History Museum of Los Angeles County) 37: 21.

Hickman, C. P., Jr. and T. L. Zimmerman 2000. A Field Guide to Crustaceans of Galápagos. Galápagos Marine Life Series. Sugar Spring Press, Lexington, Virginia: pp.156.

Martin, J. W. In manuscript. The Ages of Discovery. Terra (Natural History Museum of Los Angeles County) 38: 00 (scheduled for fall of 2001).

White Papers

Results of National Science Foundation Biological Surveys and Inventoried Program- All-Hands Workshop

Appendix II. Stomatopod and Decapod Crustacean Species List

collected or sighted 1998-2000

Todd L. Zimmerman

Key

sp.= single unidentified species in a genus
spp. = more than one unidentified species in a genus
sp. 1, 2, 3...= recognized distinct species, but not yet identified
sp. A, B, C,...= recognized as probable new species
? = possible new species identity uncertain
new species = verified unnamed species new to science--Species is being described and named

	1998	1999	2000
Stomatopoda (Mantis shrimps)			
stomatopod sp. 1			X
stomatopod sp. 2			X
Gonodactylidae			
Neogonodactylus curocaoensis	X		X
Neogonodactylus oerstedii	X	X	many
Neogonodactylus spinulosus			X
Pseudosquillidae			
Pseudosquilla oculata			X
Nannosquillidae			
Alachosquilla floridensis		X	
Penaeoidea (Penaeid shrimps)			
Penaeidae			
Penaeid sp. 1		X	X
Penaeid sp. 2			X
Sicyoniidae			
Sicyoniid sp 1			X
Sicyoniid sp 2			X
Sergestidae or Luciferidae			
Acetes or Lucifer sp.			X
Stenopodidea (Stenopidid shrimps)			
Stenopodidae			
Stenopus hispidus	X	X	X
Stenopus scutellatus			X

Spongicolidae			
Microprosthema semilaeve		X	X
Microprosthema new species? (near semilaeve)			X
Microprosthema new species (white)			X
Odontozona new species			X
Caridea (Caridean shrimps)			
Apheidae			
Alpheus armatus			X
Alpheus spp.	few	few	many
Synalpheus spp.	few	few	many
Automate sp.			X
other genera spp.			X
Palaemonidae			
Macrobrachium sp		X	
Palaemonetes spp			X
Periclimenes yucatanensis			X
Periclimenes pedersoni	X	X	X
Brachycarpus biunguiculatus			X
Other genera spp.		few	many
Gnathophyllidae			
Gnathophyllum americanum	X		X
Gnathophylloides mineri	X	X	X
Hippolytidae			
Lyesmata spp.		few	many
Thor ambionensis		X	X
Eualus spp.			X
Hippolyte spp.			
Latreutes sp.		X	X
Latreutes sp. A		X	
Latreutes sp. B			X
Tozeuma sp.			X
Thallasinoidea (Lobster shrimps and Ghost shrimps)			
Axiidae			
Axiopsis sp.			X
Laomidiidae			
Axianassa new species	X	X	
Callianideidae			
Callianidia (laevicauda?)		X	

Callianassidae			
Neocalichirus sp. 1	X	X	X
Neocalichirus sp. 2		X	X
Neocalichirus sp. 3		X	
Upogebiidae			
Pomatogebia operculata		X	
Palinura (Spiny and Slipper lobsters)			
Panuliridae			
Panulirus argus	X	X	X
Panulirus sp. (spiny lobster) juvenile		X	X
Scyllaridae			
Scyllarides aequinoctalis		X	X
Scyllarus sp.			X
Anomura (Porcelain, Hermit and Sand crabs)			
Porcellanidae			
Porcelana sayana	X	X	X
Petrolisthes quadratus	X	X	X
Petrolisthes sp 1		X	X
Petrolisthes sp 2			X
Petrolisthes sp 3			X
Pachycheles sp 1			
Pachycheles sp 2			
Galtheidae			
Galatheid sp 1		X	X
Munid sp 1			
Munid sp 2		X	X
			X
Coenobitidae			
Coenobita clypeatus	X	X	X
Other hermit crabs			
Calcinus tibicen	X	X	X
Clibanarius antilliensis?	X	X	?
Clibanarius tricolor	X	X	X
Dardanus venosus	X	X	X
Iridopaguris sp.		X	X
Pagaristes grayi		X	?
Paguristes cadenati	X	X	X
Paguristes oxyophthalmus ?		X	?

Paguristes puncticeps		X	X
Paguristes sericeus		X	?
Petrochirus diogenes	X	X	X
Pagaristes sp 1		X	?
Hippidae			
Hippa sp.			X
Albuneidae			
Albunea sp.		X	X
Brachyura (True crabs)			
Symethidae			
Symethis sp.		X	
Dromiidae			
Cryptodromiopsis antillensis	X	X	X
Hypoconcha sp.		X	X
Leucosiidae			
Speleophorus sp.		X	X
Iliacantha sp.		X	X
Callidactylus asper?		X	X
Uhlias limbatus			X
Calappidae			
Calappa sp. (shed carapace only)			X
Calappa gallus		X	
Parthenopidae			
Heterocrypta or Cryptopodia sp.			X
Mesorhoea sp.		X	X
Parthenope sp.			X
Solenolambrus sp. 1		X	X
Solenolambrus sp. 2			X
Majidae			
Acanthonyx (petiverii)		X	X
Epialtus bituberculatus	X	X	X
Epialtus kingsleyi			X
Epialtus sp A.	X	X	X
Epialtus sp.?			X
Hemus cristulipes		X	many
Inachid sp.		X	X

Inachoides sp. A	X		
Macrocoeloma sp.	X		
Macrocoeloma trispinosum subspecies 1	X	X	X
Macrocoeloma trispinosum subspecies 2	X	X	X
Microphrys bicornutus	X	X	X
Microphrys sp.?		X	X
Mithrax commensalis	X		X
Mithrax corophe	X	X	X
Mithrax forceps?	X	X	X
Mithrax holderi		X	X
Mithrax pilosus		X	
Mithrax pleuracanthus		X	X
Mithrax sculptus	X	X	X
Mithrax spinosissima		X	
Mithrax verrucosus		X	X
Pelia mutica	X	X	X
Pitho lherminieri		X	X
Pitho mirabilis (shed carapace)		X	
Podochela sp.			X
Stenorhynchus seticornis	X	X	X
Thoe puella		X	
Portunidae			
Areneaus cribrarius		X	X
Callinectes ornatus var humphreyi	X	X	X
Charybdis helleri		X	X
Cronius ruber		X	
Portinus depressifrons	X	X	X
Portunus anceps	X	X	X
Portunus sebae		X	X
Portunus ventralis		X	
Xanthidae			
Carpilius coralinus			X
Chlorodiella longimana			X
Domecia acanthophora			X
Eriphia gonagra	X		
Eurypanopeus abbreviatus		X	X
Melybia thalamita		X	X
Ozius reticulatus		X	X
Panopeus bermudensis			X
Panopeus lacustris	X	X	
Panopeus occidentalis		X	X
Paractaea rufopunctata nodosa			X
Platypodiella spectabilis	X		X
Xanthid sp.			X
Xanthodius depressifrons		X	X

Pilumnidae			
Lobopilumnus sp 1 shallow rocks			X
Lobopilumnus sp 2 shallow rocks			X
Pilumnus sp 1 shallow rocks	X		X
Pilumnus sp 2 shallow rocks			X
Pilumnus sp 3 shallow rocks			X
Pilumnus sp 4 deep sand			
Pilumnus sp 5 deep sand			
Pinnotheridae			
Dissodactylus sp.		X	X
Gecarcinidae			
Cardisoma guanhumi	X	X	X
Gecarcinus lateralis			X
Gecarcinus ruricola	X	X	X
Grapsidae			
Aratus pisonii			X
Armases ricordi			X
Armasss miersii		X	
Cyclograpsus integer		X	X
Geograpsus lividus	X	X	X
Goniopsis cruentata	X		
Grapsus grapsus	X	X	X
Pachygrapsus gracilis		X	
Pachygrapsus transversus	X	X	X
Percnon gibbesi	X	X	X
Sesarma curacaoense	X		
Ocypodidae			
Ocypode quadrata	X	X	X
Uca burgersi	X	X	X

Appendix III. Isopod Crustaceans
of Guana Island

Todd L. Zimmerman

The following is a list of the isopod crustaceans that have been photographed over the course of this study. Specimen numbers having the prefix "Vc" were collected in 2000. Marilyn Schotte of the US National Museum, Smithsonian Institution, kindly identified the specimens. She is currently conducting research to determine if any are new species, and has told us that Guana Island is only the fourth location that *Calyptolana hancocki* has ever been found. Many of these species cannot be identified further unless representatives of both sexes can be collected.

Vc 1533	Calyptolana hancocki	1f
LH 0762	Calyptolana hancocki	1 ovig. f, 1 m
Vc 0041	Paraimene sp	1 f
Vc 0325	Paracerceis sculpta	1 m
Vc 0773	Paracerceis sp.	1 f
Vc 0305	Erichsonella filiformis	1 m, 2 f
Vc 0359	Santia milleri	11
Vc 0890	Gnathia sp.	3 praniza larvae
Vc 0030	Joeropsis bifasciatus	1 ovig. f
Vc 0038	Apanthura cf. cracenta	1 f
Vc 0452	Erichsonella filiformis	1 m
Vc 0191	Santia milleri	1 ovig. f
Vc 0891	Epicaridium larvae	3
LH 0449	Joeropsis bifasciatus	1
Vc 1520	Paracerceis	1 f
Vc 0369	Santia milleri	7
Vc 0034	Apanthura cf. cracenta	1 m
Vc 0356	Cirolana parva	1
Vc 0630	Paracerceis sp.	1 ovig. f
Vc 0041	Paraimene sp.	1
Vc 0031	Joeropsis sp. cf. Antillensis	1
Vc 0214	Mesanthura sp.	1 f
Vc 0852	Carpias sp.	1 f
LH 0153	Gnathia sp.	2 f
Vc 1662	Eurydice personata	2 f
Vc 1821	Paranthura infundibulata	1 f
LH 0654	Paraimene sp.	1 juv.
LH 0705	Santia milleri	1 ovig. f
LH 0104	Carpias algicola	2 m, 1f
Vc 0379	Uromunna sp.	1
Vc 0484	Carpias sp.	1 ovig. f
Vc 0888	Gnathia sp.	1 f
Vc 0889	Gnathia sp.	1f
Vc 0103	Carpias algicola	1 m
LH 0704	Paracerceis sp.	1 f, 1 juv.
Vc 0212	Dynamenella sp.	(tube tail) 1 f

Appendix VI. Cumulative list of Polychaete Taxa
from Guana Island (field identifications)

Leslie H. Harris

Family	Taxon	1997	1998	1999	2000	# of species reported for genus in Caribbean
ABE	Aberranta				x	1
ACR	Acrocirridae				x	
AMP	amphinomid	x	x		x	
AMP	Chloeia			x	x	1
AMP	Eurythoe			x	x	2
AMP	Hermodice	x	x	x	x	1
AMP	Linopherus	x	x	x	x	3
AMP	Notopygos			x		1
AMR	ampharetid				x	
AMR	Isolda				x	1
APH	aphroditid				x	
ARE	Branchiomaldane	x			x	1
CAP	capitellid	x	x	x	x	
CAP	Dasybranchus (green species)				x	3
CAP	Dasybranchus (pink species)				x	
CAP	Decamastus				x	2
CAP	Notomastus	x		x	x	8
CAP	Scyphoproctus	x	x	x	x	2
CHA	Chaetopterus				x	1
CHA	Phyllochaetopterus	x			x	none
CHR	Bhawania				x	2
CHR	chrysopetalid	x	x	x	x	
CHR	Chrysopetalum	x	x	x	x	6
CIR	Chaetozone	x				1
CIR	cirratulid	x	x	x	x	
CIR	cirratulid 1	x				
CIR	Cirriformia	x		x	x	3
CIR	Cirriformia 1	x		x		
CIR	Cirriformia 2	x				
CIR	Cirriformia 3			x		
CIR	Dodecaceria color morph 1			x	x	4
CIR	Dodecaceria color morph 2			x		
CIR	Tharyx	x				1
CIR	Timarete				x	4
CTE	Ctenodrilus	x	x			
CTE	Ctenodrilus 1	x				1
CTE	Ctendorilus 2	x				
DOR	dorvilleid	x	x		x	
DOR	Ophryotrocha-group				x	
EUN	?Nematonereis				x	2
EUN	Eunice sp. 1	x			x	
EUN	Eunice sp. 2	x			x	
EUN	Eunice sp. 3	x		x	x	

EUN	Eunice sp. 4	x		x	x	
EUN	Eunice sp. 5			x	x	
EUN	Eunice spp.	x	x	x	x	54
EUN	Lysidice		x			2
EUN	Marphysa? Paramarphysa?		x			17/0
EUN	Nematonereis				x	
FLA	flabelligerid	x				
FLA	Pherusa				x	6
FLA	Piromis				x	3
GON	goniadid				x	
HES	Gyptis		x			4
HES	Hesione				x	4
HES	hesionid	x	x		x	
HES	Heteropodarke				x	3
HES	Microphthalmus				x	5
HES	Ophiodromus				x	none
LUM	lumbrinerid	x			x	
MAG	Magelona			x		8
MAL	Axiothella		x			1
MAL	Boguea	x				1
MAL	euclymeninae	x		x	x	
MAL	maldanid	x	x			
MAL	Maldanidae genus A	x				
MAL	Praxillella?	x				1
NEP	Aglaophamus	x				3
NER	Ceratonereis				x	9
NER	Micronereis n. sp.		x	x	x	1
NER	nereid n. sp. 1				x	
NER	nereid n. sp. 2			x	x	
NER	nereid n. sp. 3			x	x	
NER	nereid n. sp. 4				x	
NER	nereid n. sp. 5				x	
NER	nereidid	x	x	x	x	
NER	Nereis egregicirrata			x	x	
NER	Perinereis			x	x	7
NRL	nerillid	x				
OEN	arabellin	x				
OEN	Oenone				x	1
ONU	Diopatra			x		4
ONU	Kinbergonuphis sp. 1	x				4
ONU	onuphid	x			x	
OPH	Armandia	x	x	x	x	5
OPH	Armandia sp. 1			x		
OPH	Armandia sp. 2 (?maculata Webster)			x		
OPH	Armandia sp. 3			x		
OPH	Polyophthalmus	x	x	x	x	1
OPH	Polyophthalmus sp. 1				x	
OPH	Polyophthalmus sp. 2				x	
ORB	Naineris			x		6
ORB	orbiniid	x	x			
OWE	Myriochele			x	x	2
PAR	Levinsenia			x		2
PAR	paraonid	x			x	

PHO	Laubierpholoe	x	x		x	none
PHO	Pholoe	x			x	none
PHO	Pholoides	x				1
PHY	Nereiphylla	x	x	x	x	5
PHY	Paranaitis				x	4
PHY	Phyllodoce				x	8
PHY	Pterocirrus			x		2
PIL	Synelmis?			x		3
POL	Halosydna		x		x	2
POL	Halosynda sp. 1			x		
POL	Harmothoe				x	9
POL	Harmothoe sp. 1			x		
POL	Harmothoe cf. lunulata				x	
POL	Hermenia verruculosa			x	x	
POL	Paradyte ?				x	none
POL	polynoid	x	x	x	x	
POL	Subadyte	x				none
SAB	Anamobaea			x	x	1
SAB	Bispira	x	x	x	x	
SAB	Branchiomma	x	x	x	x	2
SAB	Chone		x	x	x	2
SAB	Fabricinae	x	x	x	x	
SAB	Fabricinuda				x	2
SAB	Genus A				x	none
SAB	Megalomma				x	6
SAB	Notaulax			x	x	5
SAB	Pseudaugeneriella				x	none
SAB	Pseudobranchiomma				x	1
SAB	sabellid	x	x	x	x	
SAB	sabellid 1	x				
SCA	scalibregmatid				x	
SER	Filograna				x	
SER	Hydroides				x	
SER	serpulid	x	x	x	x	
SER	Spirobranchus	x	x	x	x	
SIG	Psammolyce				x	5
SIG	sigalionid	x				
SPH	sphaerodorid				x	
SPI	Polydora				x	10
SPI	Prionospio	x		x		4
SPI	Prionospio (Minuspio)	x			x	7
SPI	Rhynchospio/ Malacoceros			x	x	02/02
SPI	Scolelepis			x		2
SPI	Spio			x		1
SPI	spionid	x	x	x	x	
SYL	Amblyosyllis sp. 1	x			x	5
SYL	Amblyosyllis sp. 2				x	
SYL	autolytinae	x	x	x	x	
SYL	autolytinae, Polybostrichus		x		x	
SYL	Branchiosyllis	x	x	x	x	7
SYL	Brania	x	x	x	x	9
SYL	Ehlersia				x	8
SYL	eusyllinae	x	x	x	x	

SYL	eusyllinae, n. gen., n. sp. ?	x				none
SYL	Eusyllis				x	3
SYL	eusyllnae sp. G	x	x	x	x	
SYL	Exogone	x	x	x	x	15
SYL	Exogone cf. lourei	x				
SYL	exogoninae	x	x	x	x	
SYL	Haplosyllis				x	4
SYL	Odontosyllis				x	7
SYL	Opistodonta				x	2
SYL	Opistosyllis			x		2
SYL	Parapionosyllis	x				3
SYL	Parasphaerosyllis		x	x	x	1
SYL	Plakosyllis				x	1
SYL	Sphaerosyllis	x	x	x	x	18
SYL	syllidae	x	x	x	x	
SYL	Syllides	x		x	x	6
SYL	syllinae	x	x	x	x	
SYL	syllinae 1	x				
SYL	syllinae 2	x				
SYL	syllinae 3	x				
SYL	syllinae 4	x				
SYL	syllinae 5	x				
SYL	syllinae 6	x				
SYL	syllinae 7	x				
SYL	syllinae 8	x				
SYL	Syllis				x	5
SYL	Trypanosyllis			x	x	10
SYL	Typosyllis	x	x	x	x	23
SYL	Virchowia		x			none
SYL	Xenosyllis	x				2
TER	Amphitritinae			x	x	
TER	Amphitritinae sp. 1				x	
TER	Amphitritinae sp. 2				x	
TER	Amphitritinae sp. 3				x	
TER	Amphitritinae sp. 4				x	
TER	Amphitritinae sp. 5				x	
TER	Eupolymnia	x				3
TER	Lanice?			x		1
TER	Lanicides ?	x				1
TER	Neoleprea 1	x				none
TER	Pista	x		x	x	6
TER	Polycirrus sp 1	x		x	x	9
TER	Polycirrus sp. 2				x	
TER	Reteterebella sp. 1	x				none
TER	Streblosoma	x				3
TER	Terebella ?	x				2
TER	terebellidae	x	x	x	x	
TER	Thelepinae			x	x	
TER	Thelepinae sp. 1				x	
TRI	Terebellides	x				5

Attachments

Report on the Stenopodidean "Shrimps" of Guana Island, British Virgin Islands.

Marine Invertebrates of Guana Island, BVI. CD-ROM.

The stomatopod *Alachosquilla floridensis* … reported from Guana Island

Morphology of the first zoeal stage of *Platypodiella spectabilis*

An emendation of the fan worm genus *Fabricinuda*

Species of *Novofabricia* …in the Caribbean Sea.

Guana Island Marine Invertebrate Survey, Year 2000

Report Number ___________

Stenopodidean "shrimps" (Crustacea, Decapoda, Stenopodidea) from Guana Island, British Virgin Islands

Joel W. Martin

Natural History Museum ofLos Angeles County

Abstract. – This report concerns a small collection of stenopodidean shrimp collected as part of an ongoing survey of the shallow marine invertebrates of Guana Island, BVI, eastern Caribbean. Included are two species of the genus *Stenopus* (*S. hipsidus* and *S. scutellatus*), three species of *Microprosthema* (*M. semilaeve* and two unnamed species), and an undescribed species of the genus *Odontozona*, usually considered a deep water genus. Color notes are given for two species of *Microprosthema* and for the undescribed species of *Odontozona*, the latter representing the first report of coloration for any species in that genus.

Introduction

The decapod crustacean infraorder Stenopodidea contains a small number of very colorful lobster-like "shrimps." These shrimps are conspicuous members of the reef fauna throughout the Caribbean, and some species are documented to be "cleaner shrimp," removing parasites from passing reef fish. These shrimp are not thought to be closely related to true (caridean and penaeoid) shrimps, but their relationships to true shrimps, and to other groups of decapod crustaceans (lobsters, thalassinoids, etc.), are poorly understood.

At the time of Holthuis's (1955) publication summarizing the state of our knowledge on caridean and stenopodidean shrimp genera, there were only 7 genera known worldwide: *Stenopus, Odontozona, Richardina, Engystenopus, Microprosthema, Spongicola*, and *Spongicoloides*. In subsequent years, Bruce and Baba (1973) described the genus *Spongiocaris* from New Zealand and South African waters, and the genus *Paraspongicola* was described by Saint Laurent and Cléva (1981). Schram (1986) erected the family Spongicolidae to include the genera *Spongicola, Spongicoloides, Spongiocaris*, and *Microprosthema*. He apparently was not aware of Saint Laurent and Cléva's (1981) new genus.

Thus, there are currently two families and nine genera of the Stenopodidea recognized, as follows (and following Holthuis, 1993): Family Stenopodidae Huxley, 1879 (containing the genera *Stenopus, Engystenopus, Odontozona*, and *Richardina*), and Family Spongicolidae Schram, 1986 (containing the genera *Spongicola, Spongicoloides, Spongiocaris, Microprosthema*, and *Paraspongicola*). A tenth genus is being described (Goy, in press) from the Pacific and is not included in this report. Only four Atlantic and one Pacific species are common enough to have been treated and given "common names" by Williams et al. (1989). A key to the currently accepted families and genera is presented as an appendix to this report.

Previous work in the Caribbean and Western Atlantic

In the Caribbean and western Atlantic, relatively few species of stenopodideans have been reported (as compared to the Indo-Pacific region). Published reports include three species of the genus *Stenopus* (*S. hispidus*, *S. scutellatus*, *S. spinosus*), one species of *Richardina* (*R. spinicincta*, known in the western Atlantic from a single specimen; Goy, 1982, but see below), one species of *Spongicola* (*S. hexactinellicola*) (now known from the Bahamas, Dry Tortugas, and Puerto Rico; Berggren, 1993, and J. Goy, unpublished data), two species of *Odontozona* (*O. striata and O. libertae*) (Goy, 1981, and Gore, 1981, respectively), and four species of *Microprosthema*. The species of *Microprosthema* are *M. semilaeve* (von Martens, 1872), *M. manningi* Goy and Felder, 1988, *M. looense* Goy and Felder, 1988, and *M. granatense* Criales, 1997 (see Criales, 1997, for a review and key). Two other species, *Odontozona anaphorae* and *Microprosthema inornatum*, both described by Manning and Chace (1990) from Ascension Island, South Atlantic, could potentially be here, as species of stenopodideans tend to have a relatively long larval duration. Additionally, we are aware of at least two other undescribed species of *Microprosthema* and several unpublished records of *Richardina spinicincta* (J. Goy, unpublished data). Finally, the first record of the genus *Paraspongicola* in the Atlantic has recently been reported from specimens off Caribbean Venezuela (Rodriguez Q. and Goy, in press).

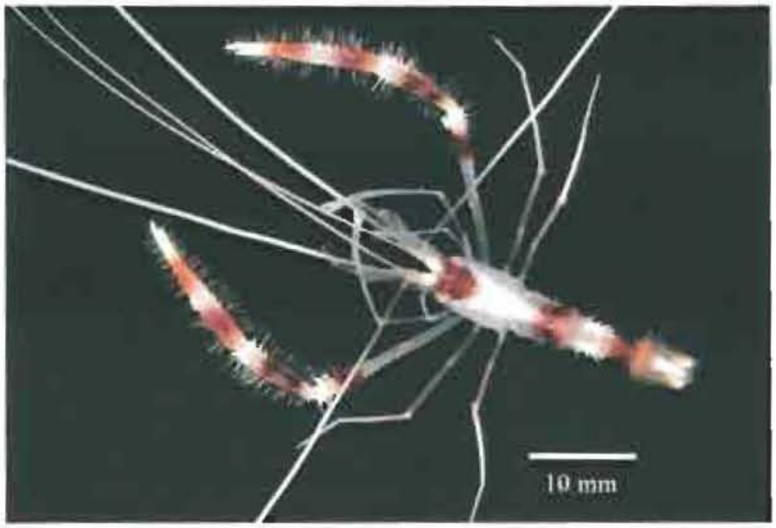
Materials and Methods

The specimens reported below were collected during the course of a survey of the cryptic marine invertebrates of Guana Island, British Virgin Island, led by T. L. Zimmerman and J. W. Martin and funded by grants from the U.S. National Science Foundation and the Falconwood Corporation. Various collecting methods were employed during that survey, including light traps, hand collecting, and arrays of artificial reef matrices (ARMs) consisting of four slabs of concrete containing holes of different sizes, set atop open baskets of coral rubble. These arrays were deployed at a depth of 30 feet at 8 different locations around Guana Island in the summer of 1999 and were collected one year later. With the exception of the ovigerous specimen of *Microprosthema semilaeve*, one specimen of *Odontozona* sp., and the pair of adult *Stenopus hispidus*, all of the stenopodideans in this report were collected from the ARMs. Other Caribbean material was examined during a visit to the U.S. National Museum of Natural History in February of 2001, including the following specimens: USNM 233997, *Microprosthema manningi* Goy & Felder (holotype); USNM 275993, *Microprosthema granatense* Criales, 1997 (holotype), *Odontozona striata* Goy, 1981 (holotype), *Odontozona libertae* Gore, 1981 (holotype), USNM 244439, Bahamas, *Microprosthema semilaeve* ovigerous female (non-type specimen).

Results

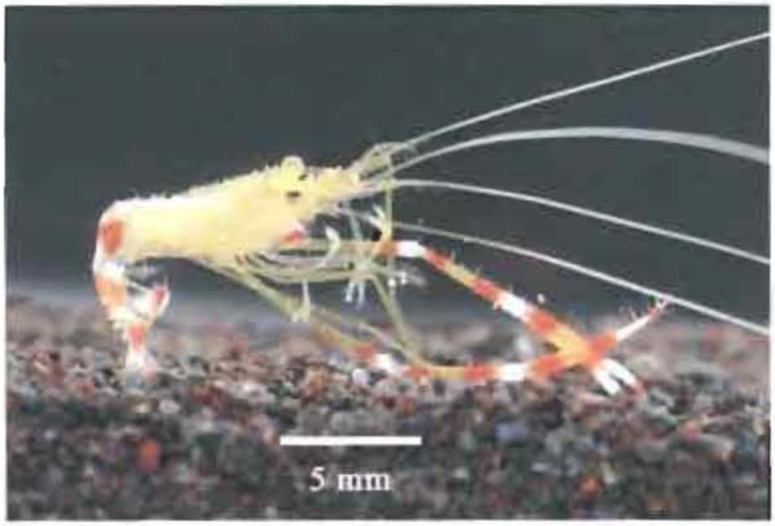
Family Stenopodidae Huxley, 1879

Stenopus hispidus (Olivier, 1811)



Material examined: One male, one female, BVI Station 84, 19 July 2000, Long Point, near end of point, 5-35 feet depth, general coral reef collecting, SCUBA, morning dive. Coll. by T. Zimmerman, R. Ware, T. Haney, and J. Martin.
Photographic voucher number: **Vc1285**
Habitat on Guana Island: Coral reefs and patch corals, dock pilings.
Previously known range: Throughout the Caribbean and western Atlantic; one record for the eastern Pacific (Goy, 1987). Florida, Bahamas, Caribbean, western Atlantic (Williams, 1984; Humann, 1992; Camp, 1998). Bermuda (Chace et al., 1986). Venezuela (Rodriguez, 1980). Brazil (Coelho and Ramos-Porto, in Young, 1998). Chace (1972) gives a very wide distribution for this species: "Bermudas and southern Florida to French Guiana; Red Sea and southeastern Africa to Japan, Hawaii, and Tuamotu Archipelago; to a depth of 210 meters." Reported from the eastern Pacific by Goy (1987). Type locality: "Australasiatic Seas" (see Chace, 1972).
Remarks: *Stenopus hispidus* is the commonly encountered "banded coral shrimp" (Williams et al., 1989) seen often in pairs on coral heads or rocky areas adjacent to coral. It has been reported from throughout the Caribbean and western Atlantic (e.g. see Williams, 1984) and from one locality in the eastern Pacific (Goy, 1987). The red and white banding on the chelipeds and body are useful field characters.

Stenopus scutellatus Rankin, 1898



Material examined: 1 juvenile, BVI Station 46C, 22 July 2000, Monkey Point ARM, SCUBA, morning dive, 30 feet. Coll. by T. Zimmerman, R. Ware, T. Haney, and J. Martin.
Photographic voucher number: **Vc1310**
Habitat on Guana Island: Known only from the Monkey Point ARM collection, but several divers reported seeing a yellow stenopodidean, probably this species, in areas where there was coral.

Previously known range: Florida, Bahamas, Caribbean (Humann, 1992; Camp, 1998). Bermudas and the Gulf of Mexico to Fernando de Noronha, to a depth of 113 meters (Chace, 1972). Type locality: Silver Cay, New Providence, Bahamas (Chace, 1972).

Remarks: This bright yellow species (the "golden coral shrimp" of Williams et al., 1989) is difficult to distinguish from the Mediterranean species *S. spinosus*, which also is known from the western Atlantic (J. Goy, personal communication), although to our knowledge this has not been published. Coloration in both species is predominantly yellow; the juvenile from the ARM at Monkey Point exhibits red banding on the chelipeds, which is not previously reported for this species and may be confined to juvenile stages.

Family Spongicolidae Schram, 1986

***Microprosthema semilaeve* (von Martens, 1872)**

Material examined: One ovigerous female, BVI Station 82, 18 July 2000, North Beach, central to northeast end, shallow water, general collecting, by hand / snorkel. Coll. T. Zimmerman, J. Martin, T. Haney, R. Ware.

Photographic voucher number: **Vc1105**

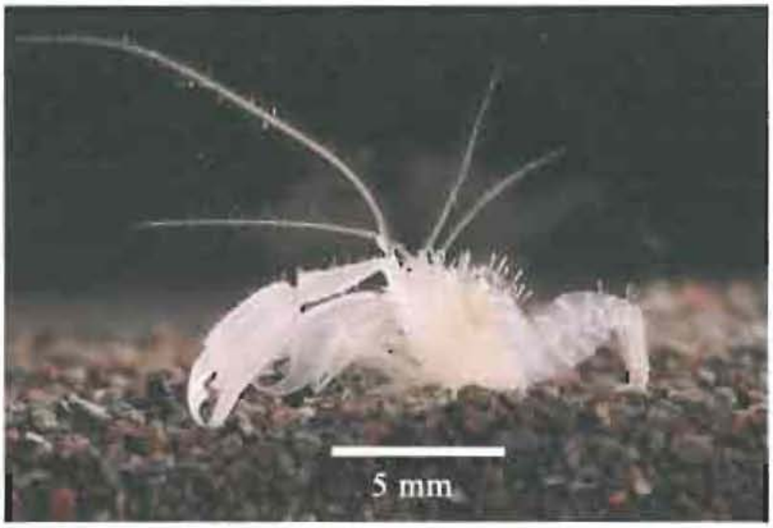
Habitat on Guana Island: Rock and coral rubble; North Beach (above) and off White Bay under rock rubble (in 1999).

Previously known range: Reported from scattered localities throughout the western Atlantic and Caribbean (Holthuis, 1946; Manning, 1961). Bahamas, southern Florida, and Yucatan to Fernando de Noronha, to a depth of 4 meters (Chace, 1972). Venezuela (Rodriguez, 1980). Florida (Camp, 1998). Brazil (Coelho and Ramos-Porto, in Young, 1998). Type locality listed only as "probably from the West Indies" (Rankin, 1898, citing Von Martens, 1872), but given as "Cuba" by Chace (1972). Although most authors indicated some affinity of the species to coral reef areas, Coelho and Ramos-Porto (1998, in Young, 1998) list the habitat in Brazil as "on rocks covered with algae."

Remarks: There is some question as to the identity of our North Beach specimen. Although the color pattern matched closely with the verbal color description given by Manning (1961), the chelipeds of the Guana Island specimen are more delicate and lack the large dactylar tooth. Comparison with specimens of "true" *M. laevis* proved to be difficult, as that species has not been illustrated other than by Rankin (1898, side view of whole animal), Holthuis (1946, scaphocerite only), and Rodriguez (1980, partial views of carapace and abdomen). Thus, although commonly reported in the literature (the species is referred to as the "crimson coral shrimp" in Williams et al., 1989), this species (*M. semilaeve*) lacks a thorough modern description. For the purposes of this report we are assuming that the crimson and white coloration is specific to this species, and so we are referring our Guana Island specimen above to *Microprosthema semilaeve*.

The ovigerous female was kept alive until the eggs hatched. The first stage larvae are being described in a separate report. Larval development in this species was reported by Raje and Ranade (1978) for larvae reared from a female collected in the Indian Ocean. However, *M. semilaeve* does not occur in that part of the world; the species with which they were working is another undescribed species of *Microprosthema* (J. Goy, unpublished data; see also Goy, 1987). Thus, our upcoming report on the first zoeal stage will be the first such report for *M. semilaeve*, with the possible exception of some planktonic larvae off Bermuda that Lebour (in Gurney and Lebour, 1941) attributed to *Microprosthema*.

***Microprosthema* species A**



Material Examined: One male, one female, BVI Station 46C, 22 July 2000, ARM at Monkey Point, 30 feet, SCUBA, airlift, morning dive. Coll. T. Zimmerman, R. Ware, H. Haney, J. Martin.
Photographic voucher number: **Vc1314 (male), Vc1316 (female)**
Habitat on Guana Island: Known only from Monkey Point.
Previously known range: Previously unknown.
Remarks: This distinctive species is clearly a new species of *Microprosthema*, and is being described in a separate report. In addition to morphological characters that distinguish it from other Caribbean species of *Microprosthema*, it is pure white in color. Two other Caribbean species, *M. manningi* and *M. looensis*, were described as being white with some light tan coloration, and *M. looensis* held in captivity later appeared completely white (J. Goy, personal observation). The new species is most similar to *M. manningi*.

Microprosthema species B

Material Examined: One specimen, possibly immature, BVI Station 84, 19 July 2000, Long Point, general coral reef collecting, SCUBA, 5 to 35 feet deep. Coll. T. Zimmerman, J. Martin, R. Ware, T. Haney.
Photographic voucher number: This specimen was not photographed.
Habitat on Guana Island: Known only from Station 84 (coral off of Long Point).
Previously known range: Previously unknown.
Remarks: In some ways, especially in the lack of spination on the carapace, our single specimen appears similar to *M. inornatum* described from Ascension Island, South Atlantic, by Manning and Chace (1990). Possibly, our specimen is a juvenile of *M. inornatum*. If so, it would be the second

time that species has been reported, and the first record of it in the Western Atlantic or the northern hemisphere.

Odontozona species A

Material Examined: One male (Vc0835), BVI Station 07Bc, 15 July 2000, White Bay ARM, 30 feet. One ovigerous female (Vc1137), BVI Station 84, 19 July 2000, SCUBA morning dive, Long Point, near end of point, 5 to 35 feet, general coral reef collecting. Coll. T. Zimmerman, R. Ware, T. Haney, J. Martin. Two specimens (Vc0547, Vc0548), sex not determined, BVI Station 45C, 11 July 2000, Bigelow Beach ARM, 30 feet. Coll. T. Zimmerman, J. Martin, G. Hendler, R. Ware.
Photographic voucher numbers: **Vc0835, Vc0547, Vc0548, Vc1137**
Habitat on Guana Island: White Bay, Bigelow Beach, and Long Point
Previously known range: See Remarks.
Remarks: The genus *Odontozona* has only rarely been reported from the Caribbean. According to Criales (1997), the genus was known "only from West Africa and the Indo-Pacific (Holthuis, 1946) until 1981, when Goy discovered *O. striata* Goy, 1981, in Cuban waters, and Gore (1981) found *O. libertae* in the Florida Keys." However, both Goy's (1981) and Gore's (1981) specimens (Goy had only a single specimen of *O. striata*, whereas Gore had three specimens of *O. libertae*) came from deep waters. *Odontozona striata* was reported from deep waters off the west coast of Cuba, and *O. libertae* was reported from a deep-water reef (57 m) in the Florida Keys.

Criales (1997) reported the first relatively shallow water occurrence of *Odontozona* in the Caribbean when she reported three ovigerous females of *O. libertae* from the talus pile around the burrow of a tilefish (*Malacanthus plumieri*) at a depth of 23 m. Her record was also the first for the genus in the southern Caribbean (Granate Bay, Colombia), and the only other report of *O. libertae* subsequent to the discovery of the type material (although Criales noted some slight differences between her specimens and the original description of *O. libertae* by Gore, 1981).

The species from Guana Island appears to be undescribed. It differs from *O. striata* mostly in characters of the carapace, which lacks a well defined cervical groove in *O. striata*. The new species is more similar to Gore's (1981) description of *O. libertae*, a species that, compared to the Guana

Island specimens, is smaller, less spinose overall, less calcified (the carapace appears soft and pliable), and has less pigmented eyes. Additionally, the spines on the eyestalks of *O. libertae*, although present, are not as well developed and do not appear to extend out over the cornea to the extent that they do in the Guana Island specimens. Because these differences are slight, it is possible that our specimens are simply morphological variants of Gore's (1981) *Odontozona libertae*; if so, our report would still be of significance in that it is the first record of this genus in the eastern Caribbean and the first description of color pattern in the genus.

Coloration of the Guana Island specimens was light orange-brown alternating with white or clear (transparent) areas of the cuticle on the abdomen. The carapace is more or less uniformly the same color. The tips of the chelae are white, as is the base of both fingers of the claws; the white coloration is broken by a wide band of orange-brown color in the middle of each finger. The distal end of the carpus and merus are slightly more darkly colored than the surrounding areas.

Acknowledgements

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Appendix

Key to the families and genera of the Stenopodidea (modified after Holthuis, 1993)

(An additional genus is currently being erected by Chan and Goy, in press)

1. Body laterally compressed. Telson elongate lance-shaped, ending in two strong spines, sometimes with a much smaller spine in between. Endopod of uropod with two longitudinal dorsal ridges. Exopod of third maxilliped..2 (Family Stenopodidae Claus, 1872)

— Body dorsoventrally depressed. Telson broadly lance-shaped or subquadrangular, ending in three to five subequal spines. Endopod of uropod usually with a single longitudinal dorsal ridge. Exopod of third maxilliped sometimes absent or rudimentary....................5 (Family Spongicolidae Schram, 1986)

2. (Stenopodidae) Dactylus of fourth and fifth pereiopods biunguiculate, short 3

— Dactylus of fourth and fifth pereiopods simple, relatively long and slender.......................................4

3. Carapace and abdomen densely covered with uniformly distributed strong spines, which sometimes are arranged in longitudinal rows. Spines erect, curved forwards. Ischium of third maxilliped with external spinules..*Stenopus* Latreille, 1819

— Abdomen without spines dorsally, sometimes with some spinules near the lateral margins of the pleura. Carapace with a cincture of spines along the posterior margin of the cervical groove; often more parallel cinctures present. These spines are straight, directed forwards and are pressed against the surface of the carapace. Ischium of third maxilliped without external spines ....*Odontozona* Holthuis, 1946

4. Carapace with a distinct dorsal cincture of spines along the posterior margin of the cervical groove. Propodus of third pereiopod not more than twice as broad as the carpus. Fingers of third pereiopod without teeth...*Richardina* A. Milne Edwards, 1881

— Carapace glabrous or with evenly spaced spines, no distinct cincture of spines along posterior margin of cervical groove. Propodus of third pereiopod more than twice as broad as carpus. Fingers of third pereiopod with distinct teeth on the cutting edges... ....*Engystenopus* Alcock & Anderson, 1894

5. (Spongicolidae) Third maxilliped with the exopod long and slender. First pereiopod with setiferous organ ["carpal cleaning brush"] at ventral side of anterior part of carpus and posterior part of propodus...6

— Third maxilliped with the exopod rudimentary or absent. First pereiopods without setiferous organs on anterior part of carpus and posterior part of propodus. Carapace glabrous or with some spines near the anterior margin...7

6. Carapace covered with many spinules. Lateral margin of telson with a single tooth .... *Microprosthema* Stimpson, 1860

— Carapace smooth, but for a pair of submedian spines at the base of the rostrum and three spinules on the pterygostomian angle. Lateral margins of telson serrate with numerous teeth .... *Paraspongicola* Saint Laurent and Cléva, 1981

7. Chela of third pereiopod with upper and lower margins serrate. Exopod of second maxilliped present, that of third maxilliped rudimentary..*Spongicola* de Haan, 1844

— Chela of third pereiopod with upper and lower margin entire. Exopod of second maxilliped present or absent, that of third maxilliped absent 8

8. Second maxilliped without exopod. Exopod of uropod with a single median dorsal ridge ....*Spongicoloides* Hansen, 1908

— Second maxilliped with a well-developed exopod. Exopod of uropod with two weak longitudinal dorsal ridges..*Spongiocaris* Bruce & Baba, 1973

* * * * * End of Report * * * * *

SPECIES OF *NOVAFABRICIA* FITZHUGH, 1990, AND *AUGENERIELLA* BANSE, 1957 (POLYCHAETA: SABELLIDAE: FABRICIINAE), IN THE CARIBBEAN SEA

Running title: Caribbean Fabriciinae Fan Worms

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ABSTRACT

Recent collections of Fabriciinae fan worms from Mexico and the British Virgin Islands are reported. Two species from Mexico are new records for genera in the region: *Novafabricia infratorquata* (Fitzhugh), originally described from Belize, and *Augeneriella* sp. cf. *A. hummelincki hummelincki* Banse. *Augeneriella* sp. cf. *A. hummelincki hummelincki* is also reported from Guana Island, British Virgin Islands. Specimens from both localities differ from *A. hummelincki hummelincki* in the infrequent occurrence of branching in the ventral filamentous appendages and length of the manubrium in abdominal uncini. Possible taxonomic implications of these findings for the placement of species in either *Augeneriella* or *Pseudoaugeneriella* Fitzhugh are discussed. A new species of *Novafabricia* Fitzhugh, *N. guana*, is also described from Guana Island. The species is similar to N. infratorquata in having abdominal uncini with a manubrium two times longer than the dentate region, but differs in that the distal margin of the medial lobe of anterior peristomial ring is broad and rounded as opposed to triangular.

Fan worm polychaete species in the subfamily Fabriciinae have been infrequently described from the Caribbean Sea and Gulf of Mexico. Six species have been formally described from intertidal or shallow subtidal depths in the Caribbean: *Augeneriella hummelincki hummelincki* Banse, 1957, from Curaçao and Bonnaire, *Novafabricia infratorquata* (Fitzhugh, 1983), *Fabricinuda trilobata* (Fitzhugh, 1983; see also Fitzhugh, 1990a), *Fabriciola flammula* Rouse, 1993, *Fabriciola parvus* Rouse, 1993, and *Pseudofabriciola quasiincisura* Fitzhugh, 1996, from Belize, and *F. guana* Fitzhugh, 2002, from the British Virgin Islands. One species, *P. sofla* Fitzhugh, 1996, occurs on the Gulf of Mexico continental shelf along the west coast of Florida, and two possible undescribed species in *Fabricinuda* and *Pseudofabriciola* have also been found in the vicinity (originally placed in *Fabriciola* and *Fabricia*, respectively, by Uebelacker, 1984; see Fitzhugh, 1996, 2001). *Augeneriella hummelincki hummelincki* was also reported from San Salvador Island, Bahamas, by Fitzhugh (1990b). Two undescribed species of *Fabriciola* Friedrich, 1939, are also known, one from an inland cave system along the west coast of Florida, and the other from the British Virgin Islands (Fitzhugh, in prep.).

The present paper is based on recent collections of fabriciin fan worms from Guana Island, British Virgin Islands, and from along the east coast of Mexico, along the state of Quintana Roo. Among the specimens collected, the original occurrence of *Novafabricia infratorquata* in Belize is now extended into Mexico and a new species in *Novafabricia* is described from Guana Island, British Virgin Islands. Specimens tentatively identified as *Augeneriella hummelincki hummelincki* are also reported from Guana Island and Mexico. There are, however, distinct morphological differences between these specimens and what has previously been described in the species, which not only raises issues regarding variability in the species, but also calls into question the validity of the genus *Pseudoaugeneriella* Fitzhugh, 1998.

MATERIAL AND METHODS

Samples were fixed in 10% seawater-formalin solution, then transferred to 70% ethanol. All specimens examined for the present study have been deposited in the Los Angeles County Museum of Natural History's Allan Hancock Foundation Polychaete Collection (LACM-AHF). Catalog numbers have only been given to types.

SYSTEMATICS

Novafabricia Fitzhugh, 1990c

Novafabricia infratorquata (Fitzhugh, 1983)

(Figs. 1-3; Table 1)

Fabricia infratorquata Fitzhugh, 1983: 284-289, figs. 3d-j, 4.

Novafabricia infratorquata. Fitzhugh, 1990c 13, fig. 8.

Material examined.— Atlantic Ocean, Caribbean Sea, Mexico, Quintana Roo. Sta. 515 (1 specimen), Majahual, north of main resort area, algal scrapings of *Ectocarpales* sp. and *Padina* sp. off intertidal rock, depth 15 cm, coll. L.H. Harris, 25 February 2001; sta.657 (1 specimen), Isla Contoy, southwestern point of island, mid-intertidal coral reef, algal scrapings of *Codium repens*, depth 0.3 m, coll. L.H. Harris, 2 March 2001.

Description.— Specimen from Majahual a complete male (Fig. 1A), with branchial crown length 0.7 mm and total thorax/abdomen length 1.5 mm; specimen from Isla Contoy a complete female, with branchial crown length 0.6 mm and total thorax/abdomen length 1.4 mm. Both specimens with 8 thoracic and 3 abdominal setigers. Trunk slender, slightly tapering posteriorly. Branchial crown with 3 pairs of radioles, distal ends filamentous, same width as pinnules. Radioles with 4-5 pairs of pinnules; all pinnules terminate at about same height, slightly shorter than tips of radioles. Dorsal lips low, narrow, shelf-like ridges (Fig. 1B). Ventral lips or lip-like processes absent. Dorsal margins of branchial lobes not fused to one another. Branchial hearts present. Anterior margin of anterior peristomial ring a low ridge dorsally and laterally, separated mid-dorsally by a low, triangular, median lobe (Fig. 2A-B); ventral margin of ring developed as low, triangular collar lobe (Fig. 2C). Anterior peristomial ring wider than long. Distinct vascular loops present in anterior peristomial ring (Fig. 2A-B). Annulation between anterior and posterior peristomial rings distinct all around except mid-dorsally. Posterior peristomial ring wider than long, about same length as anterior ring (not including ventral collar lobe) or slightly longer. One pair of black eyes near anterior margin of posterior ring, crescentic in dorsal view, round in lateral view. Setiger 1 same length as posterior peristomial ring, wider than long; setigers 2-3 slightly longer than setiger 1, with setigers 4-5 each about two times longer than setigers 2-3; setigers 6-8 each about one-third longer than setiger 5, nearly as long as wide. Setiger 9 about one-half length of setiger 8, setigers 10-11 each successively shorter. Pygidium about two times longer than setiger 11, posterior margin broadly rounded. One pair of round, black pygidial eyes. Superior thoracic notosetae elongate, narrowly hooded, 3-4 per fascicle. Inferior thoracic notosetae in setigers 2 and 7-8 elongate narrowly hooded, 1-2 per fascicle; setigers 3-5 with pseudospatulate setae, 1-2 per fascicle. Abdominal neuropodia of setigers 9-11 with very elongate, narrowly hooded setae, 1-2 per fascicle. Thoracic uncini acicular, main fang slender; large tooth offset from mid-line of fang, remaining teeth behind main fang slender and slightly decrease in size away from fang; hood present; 6-7 uncini per fascicle, in irregular single or double rows. Abdominal uncini with 7-8 rows of teeth in profile, 3 teeth per row (Fig. 1C); manubrium two times longer than dentate region, slightly expanded proximally; uncini in setigers 9-11 number 19, 17, and 15, respectively. Female with oocytes in setiger 4; male with developing sperm in setigers 4-8. Specimen from Majahual with inner margins of branchial lobes dark brown, with pigment extending along some proximal pinnules; outer surfaces of proximal half of crown light brown; peristomial rings dark brown; setigers 1-5 each with successively lighter brown; remainder of trunk white. Specimen from Isla Contoy without pigmentation in branchial crown; peristomial rings with very light brown; setigers 1-3 each with successively lighter brown; remainder of trunk white. Tubes and brooding not observed.

Distribution.— Twin Cays, Belize (type locality), Majahual and Isla Contoy, Mexico (Fig. 3), intertidal.

Remarks. — The two specimens described here fit well with the descriptions of *Novafabricia infratorquata* given by Fitzhugh (1983, 1990c). Similarities with the specimens from the type locality include the shape of the dorsal lips (cf. Fitzhugh, 1990c: fig. 8), the triangular shape of the ventral collar lobe, distribution of inferior thoracic pseudospatulate setae in setigers 3-5, number and arrangement of thoracic uncini, and the length of the manubrium of abdominal uncini is two times longer than the dentate region.

There are as well some notable differences between the two Mexico specimens and what was described among the type series. The Mexico specimens have total body lengths greater than those from Belize, with total lengths ranging from 2.0 to 2.2 mm, whereas the holotype is 1.6 mm, which is the typical length within the type series. Fitzhugh (1983) reported that all of the type specimens lack body wall pigmentation. The variation in the presence and extent of pigmentation between the type specimens and the Mexico specimens is, however, consistent with what has been reported in *N. chilensis* (Hartmann-Schröder, 1962; see Fitzhugh, 1990c) and *N. tenuiseta* Fitzhugh, 1990c (Table 1). Overall, the variation exhibited among the specimens from Belize and Mexico does not appear to be sufficiently substantial to warrant considering the Mexico specimens as a new species.

Among species in the genus, *Novafabricia infratorquata* is most similar to *N. brunnea* (Hartman, 1969: see also Fitzhugh, 1990d, 1993) and the new species described below, *N. guana*, in that all three have inferior thoracic pseudospatulate setae limited to setigers 3-5 and the manubrium of abdominal uncini is at least two times longer than the dentate region (Table 1). Both *N. infratorquata* and *N. guana* have ventral collar lobes that are triangular, whereas the lobe in *N. brunnea* is distinctly broad and tongue shaped (Fitzhugh, 1990d: fig. 3A, 1993: fig. 1). *Novafabricia guana* differs from *N. infratorquata* in that the dorso-median lobe along the anterior margin of the anterior peristomial ring is broadly rounded (Figs. 6A, 7A) as opposed to narrow and triangular (Fig. 2A).

Novafabricia guana new species

(Figs. 3-7; Table 1)

Material examined.— Atlantic Ocean, Caribbean Sea, British Virgins Islands. Holotype:

LACM-AHF 0000, sta. BVI-062, Guana Island, Atlantic side of Long Point, intertidal to shallow subtidal, algal scrapings off rock wall with large barnacles, coll. T. Zimmerman, G. Hendler, J. Martin, R. Ware. Paratypes: LACM-AHF 0000 (1 specimen), sta. BVI-002, Guana Island, North Bay, dredged area in front of beach house and pier, algal scrapings consisting of *Amphiroa* sp. and blue-green algae off coral rubble, N 18° 28.909', W 64° 34.490', depth 0.5 m, coll. K. Fitzhugh, 3 July 2000; LACM-AHF 0000 (3 specimens), sta. BVI-005, Guana Island, White Bay, finger reef near beach house, east of pier, 40 m offshore, scrapings of zooanthid anemones, sand, and filamentous algae (*Ceramium* sp., *Polysiphonia* sp.) off coral boulder, depth 1.0 m, coll. K. Fitzhugh, 4 July 2000; LACM-AHF 0000 (2 specimens), sta. BVI-017, Guana Island, White Bay, shoreward side of middle finger reefs, east of pier, scrapings of zooanthid anemones and coralline silt off coral boulder, depth 1.0 m, coll. K. Fitzhugh, 6 July 2000; LACM-AHF 0000 (2 specimens), same locality as holotype.

Description.—Holotype a complete male with 8 thoracic and 3 abdominal setigers (Fig. 4A). Branchial crown length 0.60 mm, total thorax/abdomen length 1.50 mm, maximum width 0.18 mm in anterior thorax. Trunk slender, slightly tapering posteriorly. Branchial crown with 3 pairs of radioles, distal ends filamentous, same width as pinnules. Radioles with 4 pairs of pinnules; all pinnules terminate at about same height, slightly shorter than tips of radioles. Dorsal lips low, broadly rounded, shelf-like ridges (Fig. 5B). Ventral lips or lip-like processes absent. Dorsal margins of branchial lobes not fused to one another. Branchial hearts present. Anterior margin of anterior peristomial ring a low ridge dorsally and laterally, separated mid-dorsally by wide, broadly rounded median lobe (Figs. 6A-B, 7A-B); ventral margin of ring developed as low, triangular collar lobe (Figs. 5A, 6C); some paratypes with lobe broadly rounded (Fig. 7C). Anterior peristomial ring wider than long. Distinct vascular loops present in anterior peristomial ring (Figs. 6A-B, 7A-B). Annulation between anterior and posterior peristomial rings distinct all around except mid-dorsally. Posterior peristomial ring wider than long, about same length as anterior ring (not including ventral collar lobe) or slightly longer. One pair of black eyes near anterior margin of posterior ring, crescentic in dorsal view, round or ovoid in lateral view. Setiger 1 same length as posterior peristomial ring, wider than long; setigers 2-4 each successively longer than setiger 1, with setiger 5 about two times longer than setiger 2; setigers 6-7 each about same length as setiger 5, nearly as long as wide; setiger 8 slightly longer than wide. Setiger 9 about one-half length of setiger 8, setigers 10-11 each successively shorter. Pygidium about same length as setiger 11, posterior margin broadly rounded. One pair of round, black pygidial eyes. Superior thoracic notosetae elongate, narrowly hooded, 2-3 per fascicle. Inferior thoracic notosetae in setigers 2 and 7-8 elongate narrowly hooded, 1 per fascicle; setigers 3-5 with pseudospatulate setae, 1 per fascicle (Fig. 4B). Abdominal neuropodia of setigers 9-11 with very elongate, narrowly hooded setae, 1 per fascicle. Thoracic uncini acicular (Fig. 4C), main fang slender; large tooth offset from mid-line of fang, remaining teeth behind main fang slender and slightly decrease in size away from fang; hood present; 6-8 uncini per fascicle, in irregular single or double rows. Abdominal uncini with 7-8 rows of teeth in profile, 3-4 teeth per row (Fig. 4D); manubrium two times longer than dentate region, slightly expanded proximally; uncini in setigers 9-11 number 17, 15, and 9, respectively. Females with oocytes in setiger 4; males with developing sperm in setigers 4-8. Body wall pigmentation absent in all specimens. Tubes composed of thin, inner mucoid layer loosely covered by sand grains. Brooding not observed.

Etymology.— The specific epithet refers to the island around which most specimens of the species were collected.

Distribution.— The species is only known from intertidal and shallow subtidal depths around Guana Island, British Virgin Islands. The species co-occurs with the other fabriciin sabellids, *Fabricinuda guana* and *Augeneriella* sp. cf. *A. hummelincki hummelincki*.

Remarks.— *Novafabricia guana* is very similar to *N. infratorquata* in that both have the combined presence of a triangular ventral lobe collar and abdominal uncini manubrium that is two times longer than the dentate region (Table 1). There is, as well, some interesting variation in the shape of the collar which has not been reported in another other species in the genus. Among the available specimens, the most common condition for the collar lobe is that seen in the holotype, where it is distinctly triangular (e.g., Fig. 6C). The more broadly rounded lobes have only been seen in several specimens lacking a branchial crown (Fig. 7). It is possible that in these latter instances, collar shape reflects some degree of deformation subsequent to loss of the crown while the specimens were alive. For instance, the crown of the paratype illustrated in Fig. 5A was removed subsequent to preservation, and shows the anterior margin of the anterior peristomial ring fully expanded. The broadly rounded collar lobe condition illustrated in Fig. 7 is associated with a very contracted anterior peristomial ring margin which does not appear capable of accommodating the crown.

Novafabricia guana is readily distinguished from *N. infratorquata* by the wide, broadly rounded dorso-median lobe on the anterior peristomial ring (Figs. 6A, 7A). As was described above (cf. Fig. 2A; see also Fitzhugh, 1983: fig. 4a), the lobe in *N. infratorquata* is relatively narrow and distinctly triangular.

The occurrence of *Novafabricia guana* in the intertidal zone among algae growing on hard substrates is consistent with the general habitats from which all other species in the genus have been collected, except in the case of *N. bilobata* Martin and Giangrande, 1991, which is only known from muddy sediments (Martin and Giangrande, 1991).

Augeneriella Banse, 1957

Augeneriella sp. cf. *A. hummelincki hummelincki* Banse, 1957

(Figs. 8-12; Table 2)

Fabricia sabella (not Ehrenberg). Augener, 1936: 351.

Augeneriella hummelincki Banse, 1957: 96-97, fig. 9. Hartman, 1959: 536.

Augeneriella hummelincki hummelincki Banse, 1959: 174, 176. Hartman, 1965: 75. Gitay, 1970: 105, 108. Fitzhugh, 1990b: 197-201, figs. 1-3.

Material examined.—Atlantic Ocean, Caribbean Sea, British Virgins Islands, Guana Island. Sta. LH 418 (4 specimens), North Bay, dredged area in front of beach house and pier, algal scraping of *Amphiroa* sp. off coral rubble, depth 0.3 m, coll. L.H. Harris, 15 October 1997; Sta. BVI-001 (10 specimens), North Bay, dredged area in front of beach house and pier, algal scrapings consisting of *Amphiroa* sp. and blue-green algae off coral rubble, N 18° 28.909', W 64° 34.485', depth 0.7 m, coll. K. Fitzhugh, 3 July 2000; sta. BVI-002 (10 specimens), North Bay, dredged area in front of beach house and pier, algal scrapings consisting of *Amphiroa* sp. and blue-green algae off coral rubble, N 18° 28.909', W 64° 34.490', depth 0.5 m, coll. K. Fitzhugh, 3 July 2000; sta. BVI-003 (33 specimens), North Bay, 30 m west of pier, algal scrapings of *Cladophora* sp. and *G. pusillum*, with coralline silt, crustacean tubes, and detritus off coralline rocks, N 18° 28.913', W 64° 34.503', depth 20 cm, coll. K. Fitzhugh, 3 July 2000; sta. BVI-005 (3 specimens), White Bay, finger reef near beach house, east of pier, 40 m offshore, scrapings of zooanthid anemones, sand, and filamentous algae (*Ceramium* sp., *Polysiphonia* sp.) off coral boulder, depth 1.0 m, coll. K. Fitzhugh, 4 July 2000; sta. BVI-017 (1 specimen), White Bay, shoreward side of middle finger reefs, east of pier, scrapings of zooanthid anemones and coralline silt off coral boulder, depth 1.0 m, coll. K. Fitzhugh, 6 July 2000; sta. BVI-048 (2 specimens), North Bay, slightly north of pier, 10 m offshore, scrapings of loose sand and detritus off, depth 0.5 m, coll. K. Fitzhugh, 11 July 2000; sta. BVI-055 (1 specimen), Muskmelon Bay, Long Point, reef slope, algal scraping, depth 15 m, coll. R. Ware, 11 July 2000; sta. BVI-066 (2 specimens), North Bay, 30 m offshore from pier, algal scrapings consisting of *Amphiroa* sp. and *Dictyota* sp. off coral rubble, depth 0.5 m, coll. K. Fitzhugh, 14 July 2000.

Atlantic Ocean, Caribbean Sea, Mexico, Quintana Roo. Sta. 503 (1 specimen), Majahual, north of main resort area, coral rubble wash, depth 1 m, coll. S. Salazar-Vallejo and L.H. Harris, 25 February 2001; sta.514 (9 specimens), Majahual, north of main resort area, algal scrapings of *Ectocarpales* sp. and *Padina* sp. off intertidal rock, depth 15 cm, coll. L.H. Harris, 25 February 2001.

Description (Guana Island specimens).— Complete specimens with 8 thoracic and 3 abdominal setigers (Fig. 8A-B). Adult body dimensions usually as follows: branchial crown length 0.65 mm, total thorax/abdomen length 1.45 mm (total range among all individuals = 1.8 to 0.4 mm), maximum width 0.20 mm at median thorax. Body slender, slightly tapering anteriorly and posteriorly. Branchial crown with 3 pairs of radioles, distal ends filamentous, same width as pinnules. Radioles each with 4-5 pairs of pinnules, all terminate slightly below level of radioles.

Dorsal lips erect, broadly rounded distally, distinct from radioles (Figs. 8A, 9); ventral lip-like processes present at bases of proximalmost pinnules of ventral radioles. Vascularized ventral filamentous appendages present (Fig. 8A-B); most specimens (*n* = 50) with unbranched appendages in each half of crown, three specimens with one unbranched and one branched appendage (e.g., Fig. 9), and three specimens with both appendages branched; all branched appendages dichotomous, with secondary branch distinctly shorter than primary; most specimens (*n* = 51) with appendages less than one-half length of crown, with four specimens with appendages extending to one-half crown length, and only one specimen with appendages over one-half length of crown; branched appendages present in larger individuals (total thorax/abdomen length 1.8 to 1.3 mm); appendage surface with minute wrinkles, about two times wider than pinnules; interior of each filament occupied by large blood vessel. Dorsal margins of branchial lobes not fused to one another. Branchial hearts present. Anterior margin of anterior peristomial ring a low ridge dorsally and laterally. Collar developed ventrally as triangular lobe; wide basally, tapering distally to distinctly truncate margin (Fig. 8B). Annulation between collar and anterior peristomial ring indistinct. Middorsal medial lobe just dorsal to mouth low, triangular. One pair of round black eyes in anterior peristomial ring. Peristomial rings equal in length. Setiger 1 about one-third longer than posterior peristomial ring, distinctly wider than long; setigers 3-6 successively longer but all are wider than long; setigers 7-8 with length and width comparable. Setiger 9 slightly shorter than 8, with setigers 10-11 each about one-half length of 9. Pygidium about same length as setiger 11, posterior margin broadly rounded. One pair of round, black pygidial eyes. Superior thoracic notosetae elongate, narrowly hooded, 3-4 per fascicle. Inferior thoracic notosetae in setigers 2 and 7-8 also narrowly hooded but shorter, 1-2 per fascicle; setigers 3-6 each with 2 pseudospatulate setae. Abdominal neuropodia of setigers 9-11 with very elongate, narrowly hooded setae, 1-2 per fascicle. Thoracic uncini acicular, main fang slender; single large tooth slightly offset over main fang followed by series of smaller teeth; hood present; 4-6 uncini per fascicle in irregular single rows. Abdominal uncini with 8-10 rows of teeth in profile, 3-4 teeth per row (Fig. 8C); manubrium about same length as dentate region or 1.5 times longer than dentate region, slightly expanded proximally; uncini in setigers 9-11 number 16, 16, and 13, respectively. Females with oocytes in setiger 4; males with developing sperm in setigers 4-8. Most specimens without body wall pigmentation; crown and trunk white. Some specimens with dark brown pigmentation along inner branchial lobe margins and proximal pinnules; peristomial rings dark brown, with lighter brown in setiger 1 and successively lighter in setigers 2-3 or 4. Several specimens with very light brown pigmentation limited to peristomial rings and setigers 1-4. Tubes composed of thin, inner mucoid layer loosely covered by sand grains. Brooding not observed.

Description (Mexico specimens).— Only features differing from Guana Island specimens are presented here. Total thorax/abdomen length among all individuals varies from 1.4 to 0.7 mm (Fig. 10A-B). Radioles each with 4-5 pairs of pinnules. Vascularized ventral filamentous appendages unbranched in all specimens (n = 10; Figs. 10A-B, 11); eight specimens with appendages less than one-half length of crown, two specimens with appendages extending to one-half crown length. Abdominal neuropodia of setigers 9-11 with very elongate, narrowly hooded setae, 2-3 per fascicle. Thoracic uncini acicular, 6-9 per fascicle in irregular single rows. Ontogentically youngest abdominal uncini with 7-8 rows of teeth in profile (Fig. 10C), oldest uncini with 6 rows of teeth (Fig. 10D); manubrium about 1.5 times longer than dentate region; uncini in setigers 9-11 number 20, 17, and 15, respectively. Most specimens without body wall pigmentation;

crown and trunk white. Some specimens with very faint brown pigmentation limited to peristomial rings and setigers 1-4.

Distribution.— The species is known from intertidal and shallow subtidal depths around Guana Island, British Virgin Islands, and Majahual, Mexico (Fig. 12). The Guana Island specimens co-occur with the other fabriciin sabellids, *Fabricinuda guana*, *Novafabricia guana* n. sp., and an undescribed species of *Fabriciola*.

Remarks.— The most recent revision of *Augeneriella* was conducted by Fitzhugh (1990b), in which *A. hummelincki hummelincki* was redescribed from the type series from Bonaire and Curaçao, and supplemented with material from San Salvador Island, Bahamas (Fig. 12). Among the types, vascularized filamentous appendages could only be observed in five individuals, all of which had branched filaments, ranging from 2-4 branches. Of the over 900 specimens from the Bahamas, Fitzhugh (1990b) noted that immature and some adult specimens have unbranched filaments, but that most sexually mature individuals have dichotomous branching, and some were observed with 3-4 branches. Among the San Salvador specimens, appendages are between one-half and three-quarters the length of the crown.

The specimens of *Augeneriella* sp. cf. *A. hummelincki hummelincki* very closely resemble *A. hummelincki hummelincki* in regard to the distal margin of the ventral collar lobe, which is distinctly truncate (Figs. 8B, 10B; Fitzhugh, 1990b: fig. 1C; Table 2). The only other species in the genus with a similar condition is *A. bansei* Hartmann-Schröder, 1986 (Fitzhugh, 1990b: fig. 7C) from Australia. All of these species, as well as *A. hummelincki indica* Banse, 1959, from India and *A. pectinata* Fitzhugh, 1990b, from the western Indian Ocean have inferior thoracic pseudospatulate notosetae in setigers 3-6. The principle differences between *Augeneriella* sp. cf. *A. hummelincki*

hummelincki and *A. hummelincki hummelincki* is in the degree of ventral filamentous appendage branching and manubrium length of abdominal uncini. Of the specimens collected from Guana Island, 90% have unbranched appendages and nearly the same percentage have appendages that are less than one-half the length of the crown. All of the specimens from Majahual have unbranched appendages. Both Banse (1957: fig. 9e) and Fitzhugh (1990b: fig. 3D) described the abdominal uncini as having a manubrium at least two times longer than the dentate region. The uncini examined from specimens from Majahual and Guana Island have a manubrium that is 1.5 times longer, or the same length as the dentate region.

The overall similarities of the Majahual and Guana Island specimens to *Augeneriella hummelincki hummelincki* make it compelling to regard them as this species. The differences, however, between abdominal uncini, coupled with the tendency for having unbranched ventral filamentous appendages, makes that assignment questionable. It is conceivable that at a minimum the Majahual and Guana Island specimens are a new species. But, it is not yet known if the Majahual population exhibits the level of appendage polymorphism of the Guana Island population, or if branching simply never occurs. This is one of the fundamental problems with denoting species: applying the notion that a species should be defined on the basis of a "central tendency"cannot accurately convey the properties of those individuals that do not fall within the prescribed limit. Alternatively, if one considers *A. hummelincki hummelincki* a very widespread and highly variable Caribbean species, this calls into question the monophyly of *Augeneriella* and the relation of this genus to *Pseudoaugeneriella*. Interestingly, some of the recent cladistic analyses of Fabriciinae genera and species (Fitzhugh, 1998, 1999) have called into question the monophyly of *Augeneriella*. Deciding how to realistically represent the variation in filamentous appendages will have significant implications on the recognition of *Augeneriella* and *Pseudoaugeneriella*, which is discussed below.

COMMENTS ON THE STATUS OF *AUGENERIELLA* AND *PSEUDOAUGENERIELLA*

The genus *Pseudoaugeneriella* was originally described by Fitzhugh (1998) to accommodate one species, *P. unirama*, from Okinawa Island, Japan. Based on the four specimens known, the species shows general similarities with species in *Augeneriella*, except that the ventral filamentous appendages are unbranched (Table 2). The appendages extend to near the ends of the radioles (Fitzhugh, 1998: fig. 10B). Fitzhugh (1998) acknowledged that the recognition of *Pseudoaugeneriella* was not based on the presence of any synapomorphies, but rather on the lack of branched appendages. Fitzhugh (1999) then described *P. brevirama* from Thailand, based on 18 specimens, all of which have unbranched filaments that extend about one-half the length of the crown.

The revision of *Augeneriella* by Fitzhugh (1990b) was the first to examine the ontogeny of filamentous appendage branching. At the earliest stage of development, filaments are unbranched, with successive branches originating later off the original, primary filament (e.g., Fitzhugh, 1990b: fig. 10D). As a result, the general interpretation within *Augeneriella* has been that unbranched appendages in small specimens are not yet fully developed, and any adult specimens with unbranched appendages might reflect infrequent anomalous growth patterns. For example, in redescribing *A. bansei* from Australia, which is only known from a single specimen, Fitzhugh (1990b: fig. 7A, C) noted that the filamentous appendages are very short and unbranched. He suggested that in this instance the appendages had not yet fully formed into the branched form typical of species in the genus.

An explicit assumption in the recognition of *Pseudoaugeneriella unirama* and *P. brevirama* has been that individuals in these species do not exhibit filamentous appendage branching. With the finding of infrequent branching in the Guana Island specimens of *Augeneriella* sp. cf. *A. hummelincki hummelincki* and the lack of evidence of branching in the Majahual specimens, the boundary between *Pseudoaugeneriella* and *Augeneriella* becomes obscure. One could just as readily argue that the Majahual specimens belong in *Pseudoaugeneriella* as they do in *Pseudoaugeneriella*. Cladistically, the solution cannot be to place *P. unirama* and *P. brevirama* in *Augeneriella*. The presence of unbranched, vascularized, ventral filamentous appendages is plesiomorphic for the Fabriciinae (Fitzhugh, 1998, 1999), thus cannot be a synapomorphy for a more inclusive *Augeneriella*. At least three issues need to be addressed in the future regarding this problem: (1) further sampling to establish the extent to which branched and unbranched appendages are distributed within populations of the Caribbean species described in the present work, as well as additional sampling of *A. hummelincki hummelincki* from the type localities, (2) determine whether there are synapomorphies which might group *Pseudoaugeneriella* and *Augeneriella* species into an exclusive clade, and (3) obtain additional specimens of *Pseudoaugeneriella* species to determine if only unbranched appendages occur in these taxa. Until these additional data are obtained, it appears that the status of both genera will be unsettled and the assignment of *Augeneriella* sp. cf. *A. hummelincki hummelincki* should remain tentative.

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Table 1. Comparisons of selected features among *Novafabricia* species.

Species	Anterior peristomial ring ventral lobe	Pseudospatulate setae distribution	Abdominal uncini manubrium	Body wall pigmentation	Type locality (and non-type localities)
N. bilobata Martin & Giangrande, 1991	triangular	3-7	same length as dentate region	present	Mediterranean Sea
N. brunnea (Hartman, 1969)	tongue shaped	3-5	two times longer than dentate region	present	California, USA
N. chilensis (Hartmann-Schröder, 1962)	tongue shaped	3-6	same length as dentate region	absent or present	Chile
N. exiguus Fitzhugh, 1998	triangular	3-5	1.5 times longer than dentate region	absent	Papua New Guinea
N. gerdi (Hartmann-Schröder, 1974)	triangular	3-5	same length as dentate region	present	Southern Africa
***N. guana*, new species**	**triangular**	**3-5**	**two times longer than dentate region**	**absent**	**British Virgin Islands**
***N. infratorquata* (Fitzhugh, 1983)**	**triangular**	**3-5**	**two times longer than dentate region**	**absent or present**	**Belize (Mexico)**
N. labrus Fitzhugh, 1998	triangular	3-6	same length as dentate region	present	Australia
N. tenuiseta Fitzhugh, 1990a	triangular	absent	two times longer than dentate region	absent or present	Western Indian Ocean
N. triangularis Fitzhugh, 1990a	triangular	3-5	1.5 times longer than dentate region	present	California, USA

Table 2. Comparisons of selected features among *Augeneriella* and *Pseudoaugeneriella* species.

Species	Ventral filamentous appendages	Anterior peristomial ring ventral lobe	Pseudospatulate setae distribution	Abdominal uncini manubrium length	Type locality (and non-type localities)
Augeneriella bansei Hartmann-Schröder, 1986	unbranched	truncate	3-6	same length as dentate region	Australia
A. basifurcata Fitzhugh, 1990b	branched	triangular	3-7	same length as dentate region	Western Indian Ocean
A. hummelincki hummelincki Banse, 1957	branched	truncate	3-6	two times longer than dentate region	Bonaire, Curaçao (Bahamas)
A. sp. cf. *A. hummelincki hummelincki*	**unbranched/ branched**	**truncate**	**3-6**	**same length as dentate region or 1.5 times longer**	**Mexico, British Virgin Islands**
A. hummelincki indica Banse, 1959	branched	triangular	3-6	unknown	India
A. lagunari Gitay, 1970	branched	triangular	3-7	same length as dentate region	Mediterranean Sea
A. pectinata Fitzhugh, 1990b	branched	triangular	3-6	same length as dentate region	Western Indian Ocean
Pseudoaugeneriella unirama Fitzhugh, 1998	unbranched	triangular	3-6	1.5 times longer than dentate region	Okinawa, Japan
P. brevirama Fitzhugh, 1999	unbranched	triangular	3-6	1.5 times longer than dentate region	Thailand

FIGURE LEGENDS

Figure 1. *Novafabricia infratorquata* from Majahual, Mexico. A. Entire specimen, lateral view (right side). B. Right half of branchial crown, inner margin. C. Abdominal uncinus from setiger 9. Abbreviations: apr, anterior peristomial ring; bh, branchial heart; dl, dorsal lip; ppr, posterior peristomial ring.

Figure 2. *Novafabricia infratorquata* from Isla Contoy, Mexico. A-C. Dorsal, lateral (left side), and ventral views, respectively, of anterior end. Abbreviations: apr, anterior peristomial ring; bh, branchial heart; cl, anterior peristomial ring collar lobe; ml, median peristomial lobe; ppr, posterior peristomial ring; vl, vascular loop.

Figure 3. Occurrence of *Novafabricia infratorquata* and *N. guana* n. sp. in the Caribbean Sea.

Figure 4. *Novafabricia guana* n. sp. (holotype, LACM-AHF 0000). A. Entire specimen, lateral view (right side). B. Inferior thoracic pseudospatulate seta from setiger 5. C. Thoracic neuropodial uncini from setiger 6. D. Abdominal notopodial uncini from setiger 9. Abbreviations: apr, anterior peristomial ring; bh, branchial heart; ppr, posterior peristomial ring; vl, vascular loop.

Figure 5. *Novafabricia guana* n. sp. (paratypes, LACM-AHF 0000). A. Entire specimen, lateral view (right side, missing branchial crown). B. Right half of branchial crown, inner margin. Abbreviations: apr, anterior peristomial ring; bh, branchial heart; cl, anterior peristomial ring collar

lobe; dl, dorsal lip; ml, median peristomial lobe; ppr, posterior peristomial ring.

Figure 6. *Novafabricia guana* n. sp. (paratype, LACM-AHF 0000). A-C. Dorsal, lateral (right side), and ventral views, respectively, of anterior end. Abbreviations: apr, anterior peristomial ring; bh, branchial heart; cl, anterior peristomial ring collar lobe; ml, median peristomial lobe; ppr, posterior peristomial ring; vl, vascular loop.

Figure 7. *Novafabricia guana* n. sp. (paratype, LACM-AHF 0000). A-C. Dorsal, lateral (right side), and ventral views, respectively, of anterior end. Note the broadly rounded shape of the ventral collar lobe compared to the condition shown in Fig. 7C. Abbreviations: apr, anterior peristomial ring; cl, anterior peristomial ring collar lobe; ml, median peristomial lobe; ppr, posterior peristomial ring; vl, vascular loop.

Figure 8. *Augeneriella* sp. cf. *A. hummelincki hummelincki* from Guana Island, British Virgin Islands. A-B. Dorsal and ventral views, respectively, of entire specimen. C. Abdominal notopodial uncini from setiger 9. Abbreviations: apr, anterior peristomial ring; cl, anterior peristomial ring collar lobe; dl, dorsal lip; ppr, posterior peristomial ring; vfa, vascularized, ventral filamentous appendages.

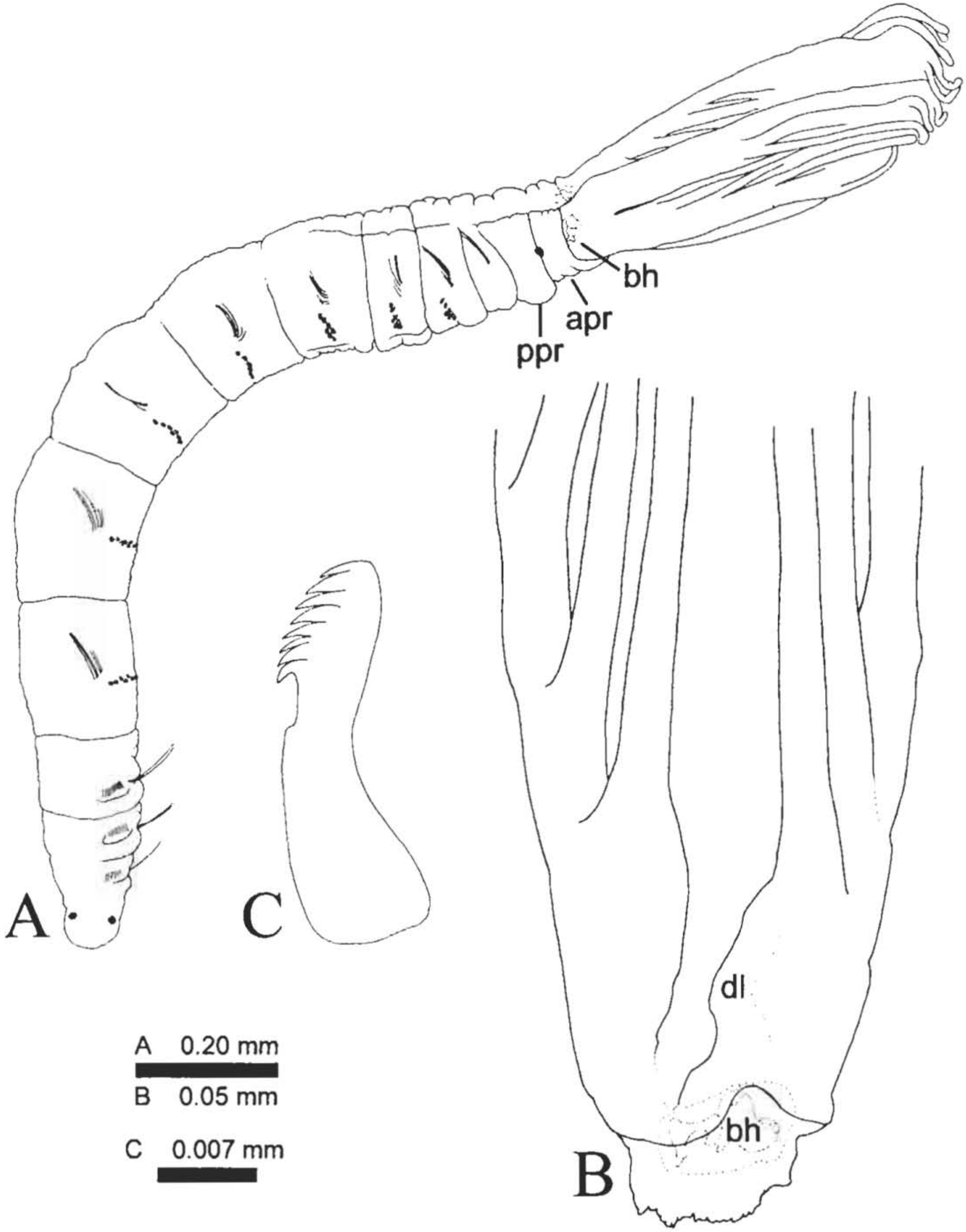
Figure 9. *Augeneriella* sp. cf. *A. hummelincki hummelincki* from Guana Island, British Virgin Islands. A-B. Inner margins left and right halves of branchial crown, respectively, from the same specimen. Note that the ventral filamentous appendage on the left half of the crown is

dichotomously branched, whereas the appendage from the right is unbranched. Total crown length is 0.80 mm; filamentous appendages are 0.30 mm long. Abbreviations: bh, branchial heart; dl, dorsal lip; vfa, vascularized, ventral filamentous appendage; vl, ventral lip-like appendage.

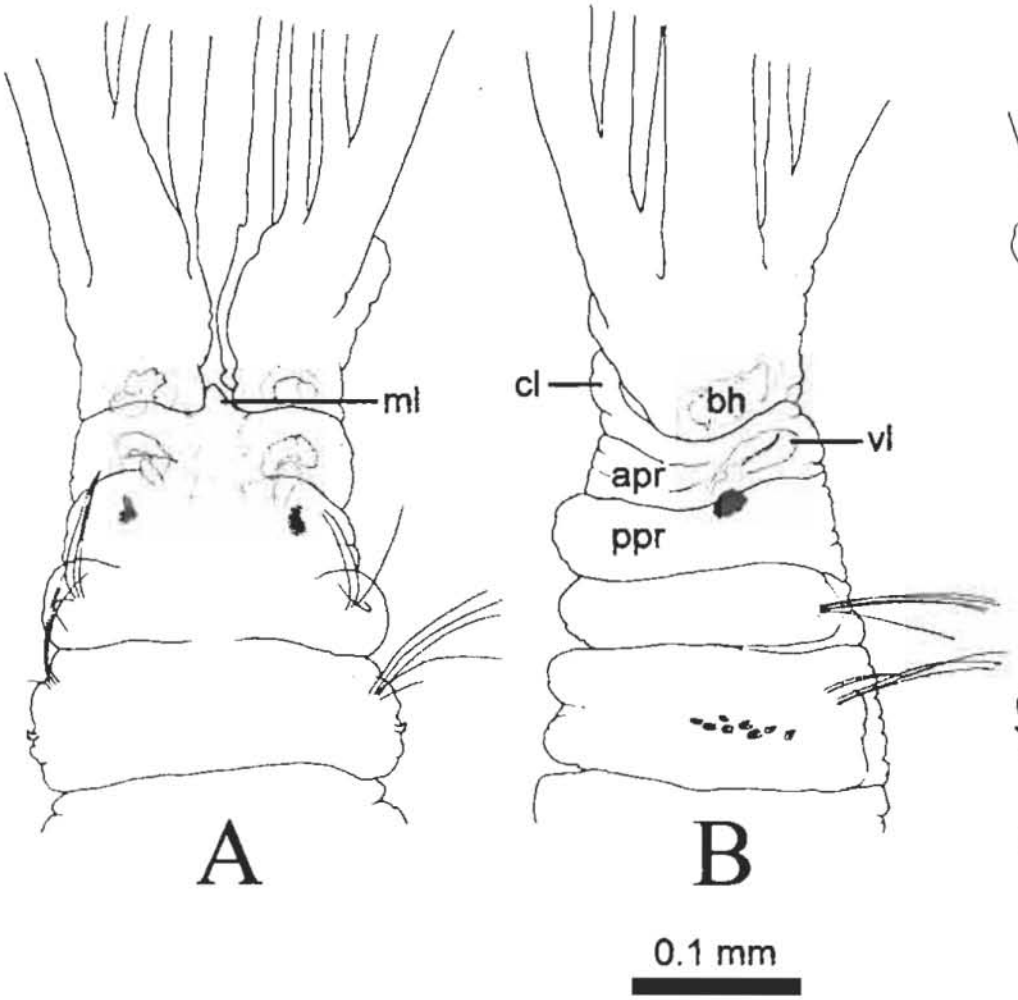
Figure 10. *Augeneriella* sp. cf. *A. hummelincki hummelincki* from Mexico. A-B. Dorsal and ventral views, respectively, of entire specimen. C. Abdominal notopodial uncinus from the dorsalmost part of the fascicle from setiger 9, thus the youngest uncinus. D. Abdominal notopodial uncinus from the ventralmost part of the fascicle from setiger 9, thus the oldest uncinus. Abbreviations: apr, anterior peristomial ring; cl, anterior peristomial ring collar lobe; dl, dorsal lip; ppr, posterior peristomial ring; vfa, vascularized, ventral filamentous appendages.

Figure 11. *Augeneriella* sp. cf. *A. hummelincki hummelincki* from Mexico. Left half of branchial crown, inner margin. Note that the ventral filamentous appendage is unbranched. Total crown length is 0.63 mm; filamentous appendage length is 0.14 mm. Abbreviations: bh, branchial heart; dl, dorsal lip; vfa, vascularized, ventral filamentous appendage; vl, ventral lip-like appendage.

Figure 12. Occurrence of *Augeneriella* species in the Caribbean Sea.



Fitzhugh ms: Figure 1



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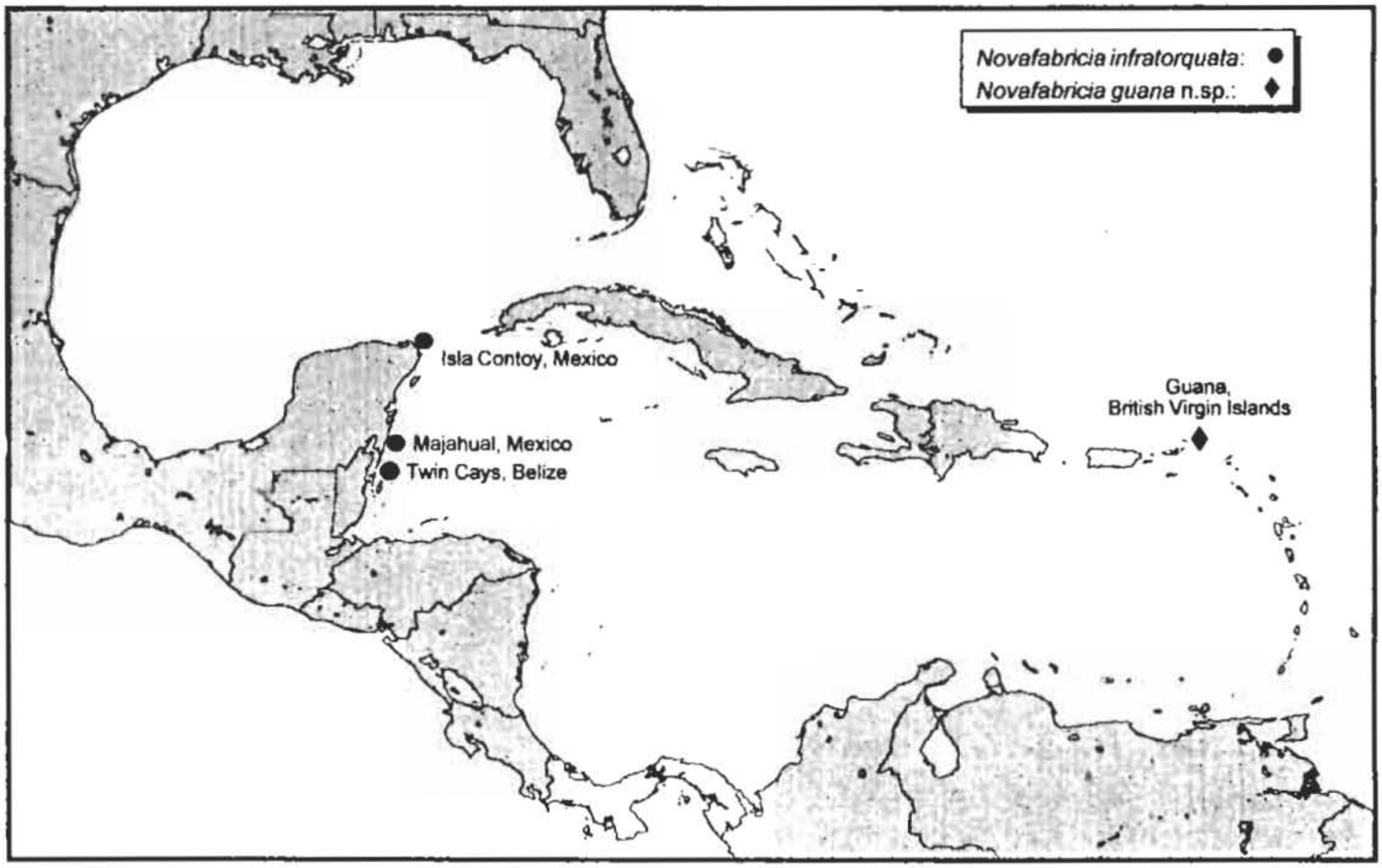

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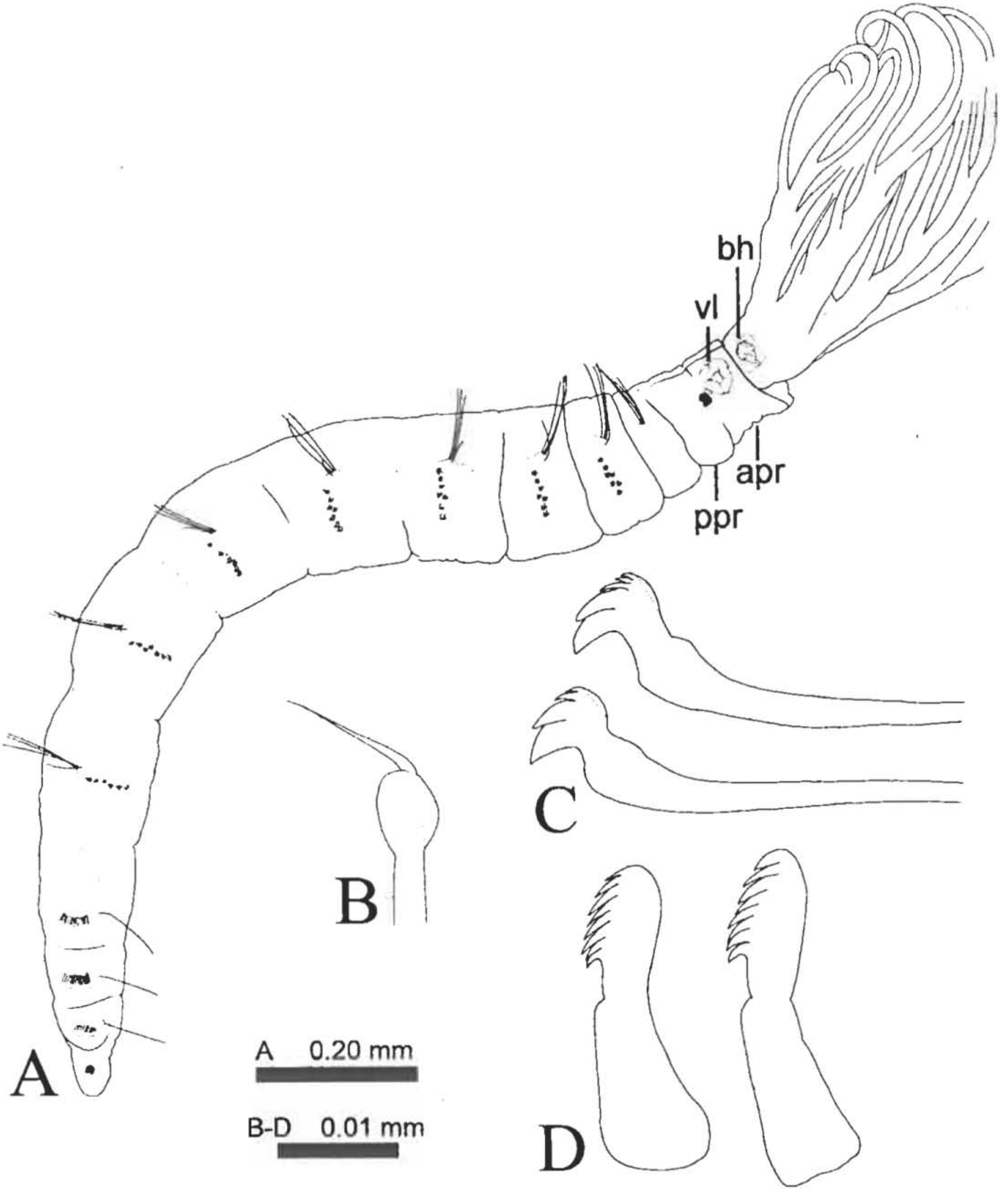

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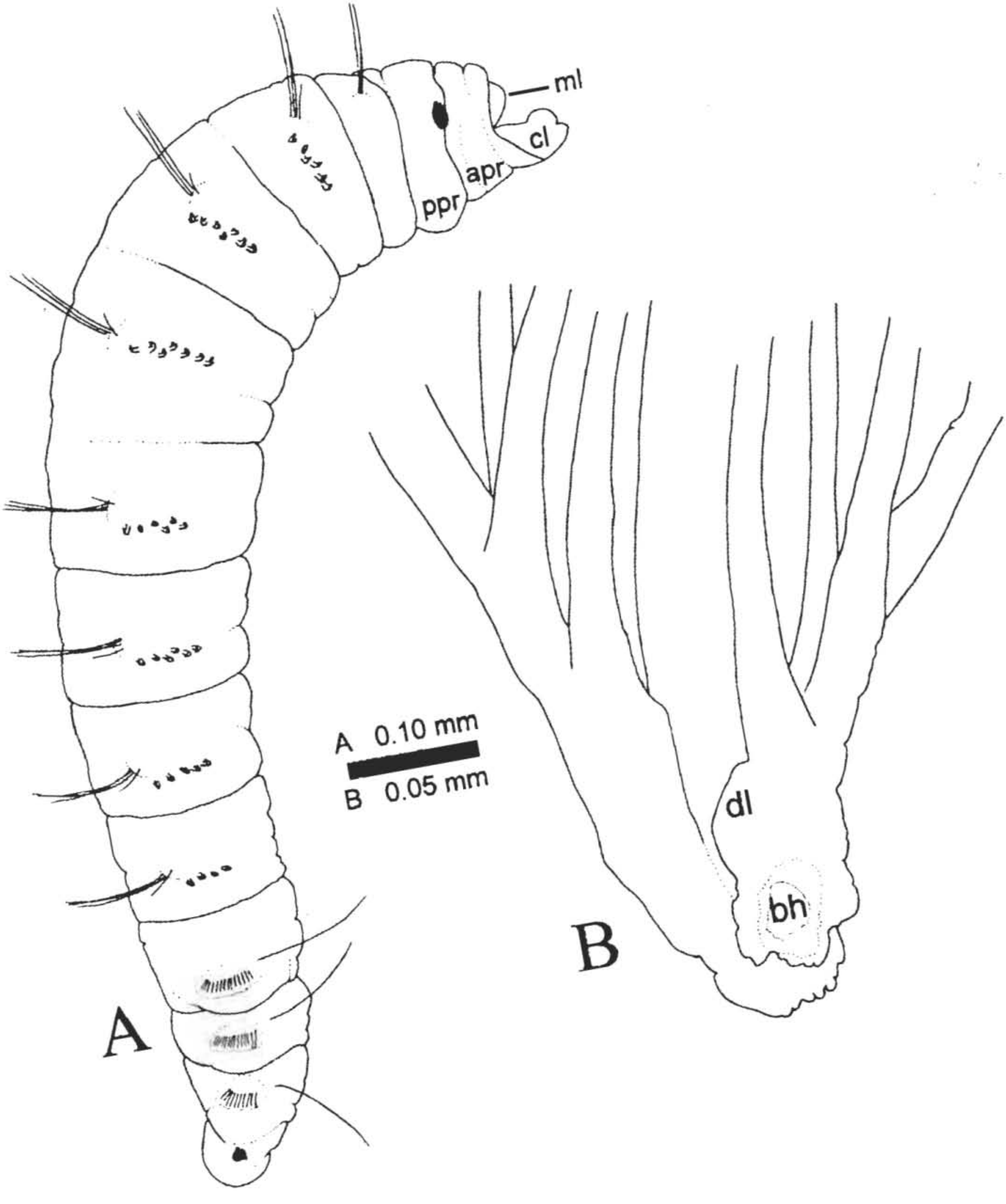

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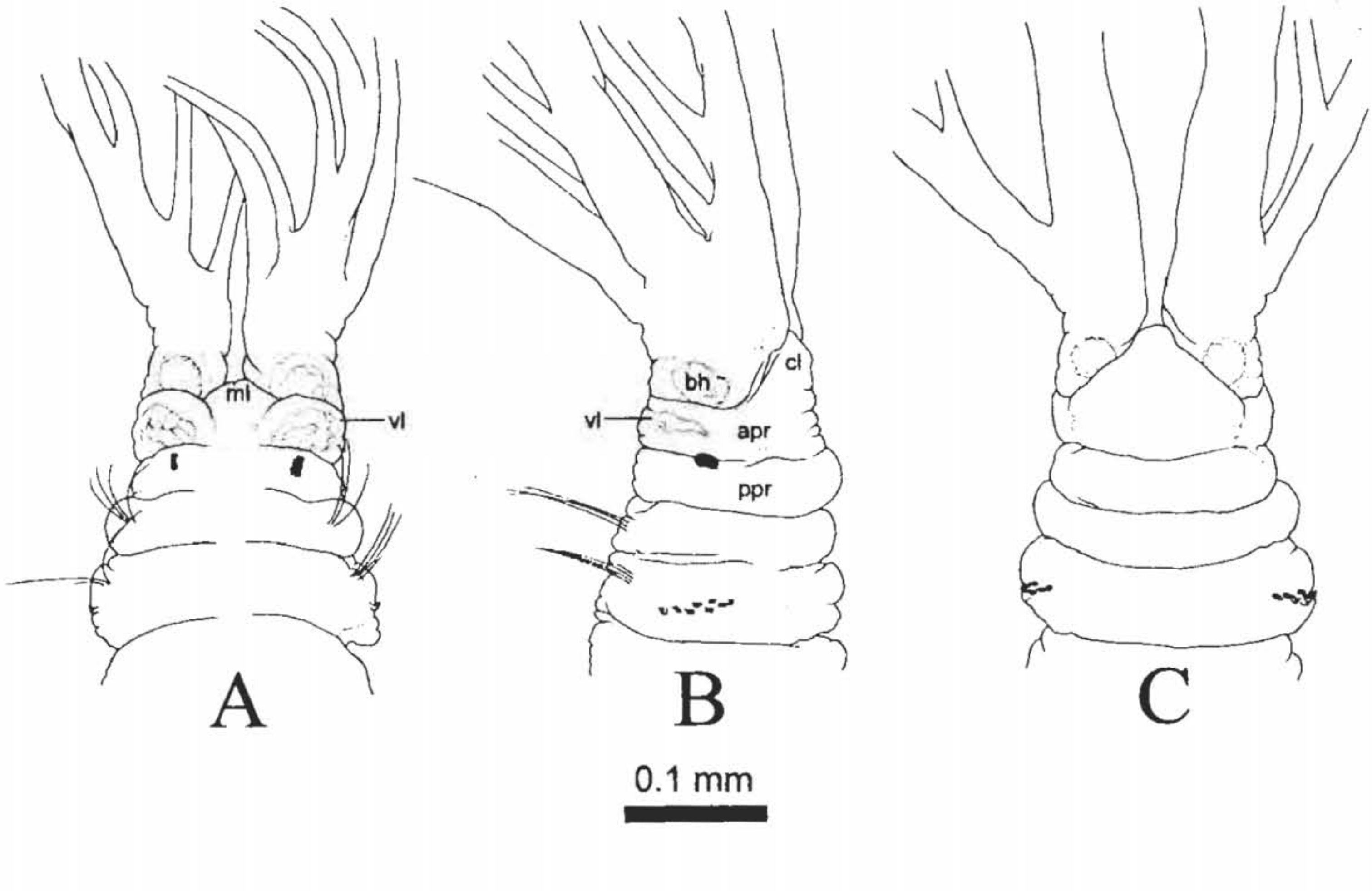

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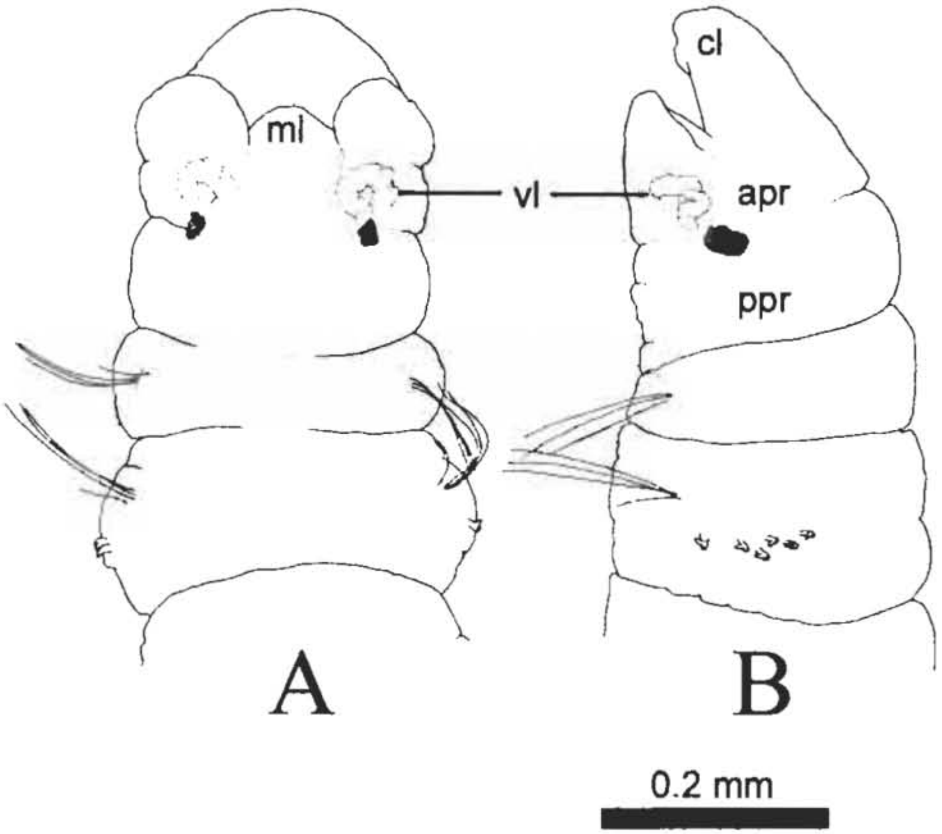
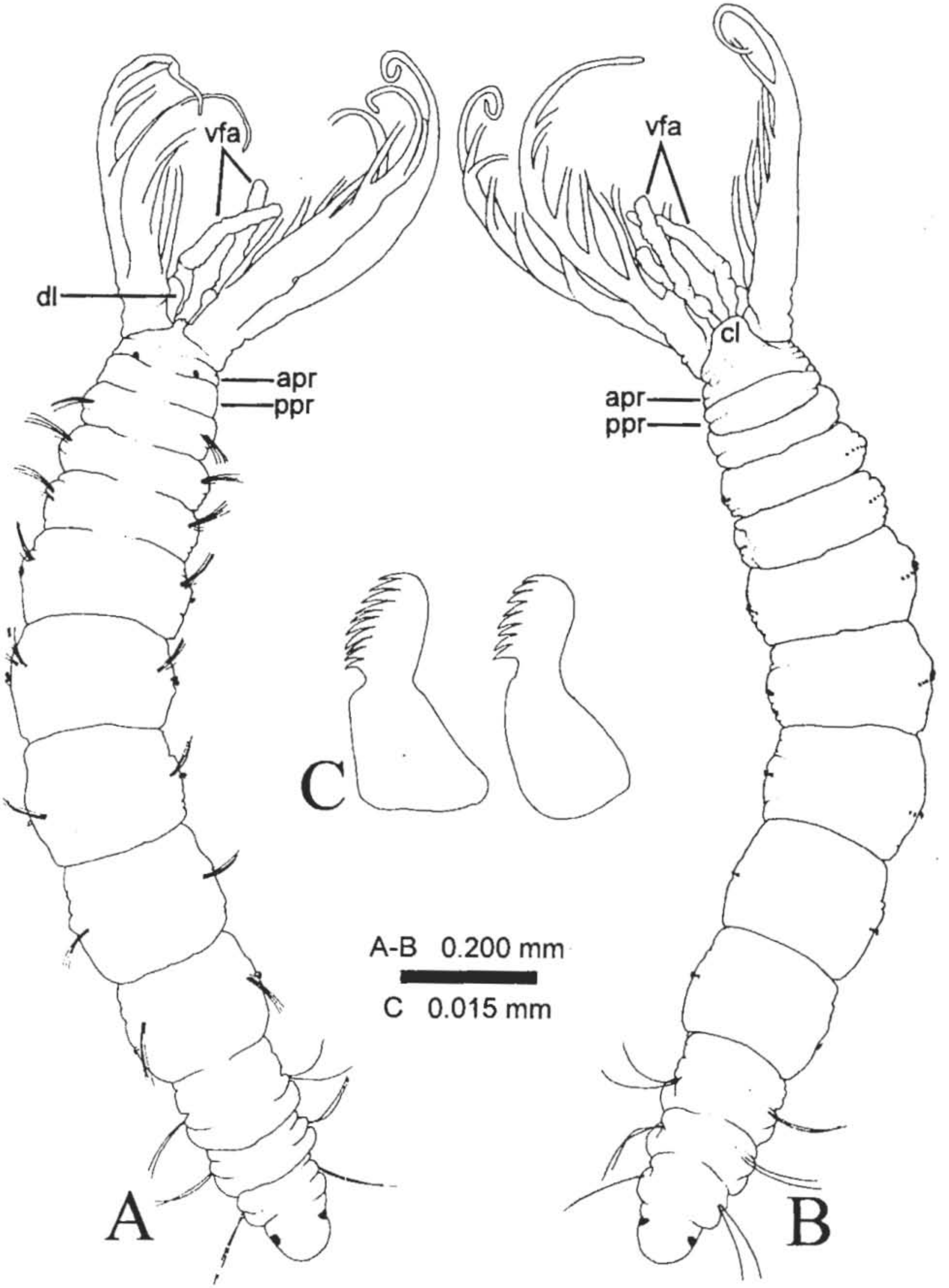


Fitzhugh ms: Figure 7



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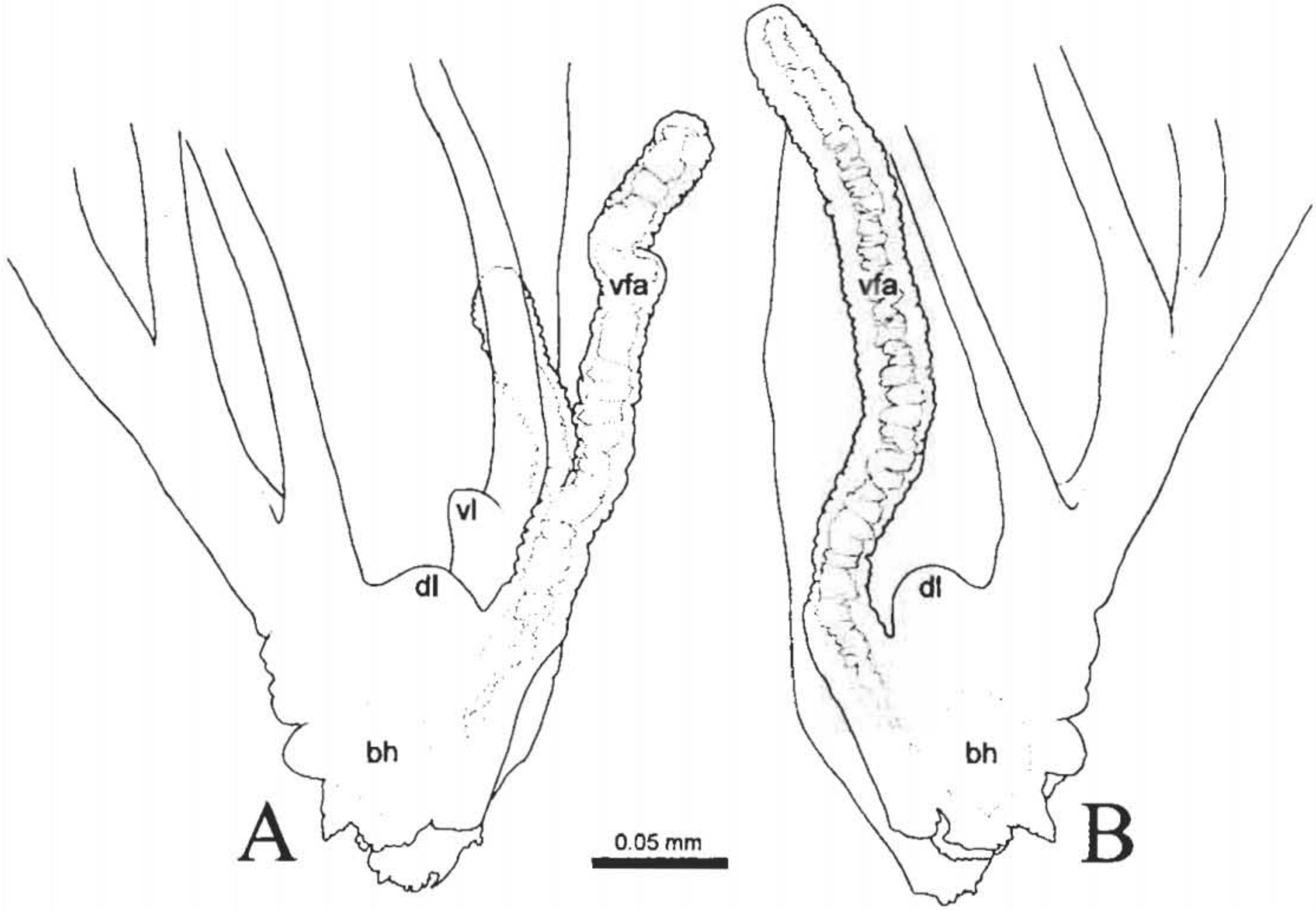

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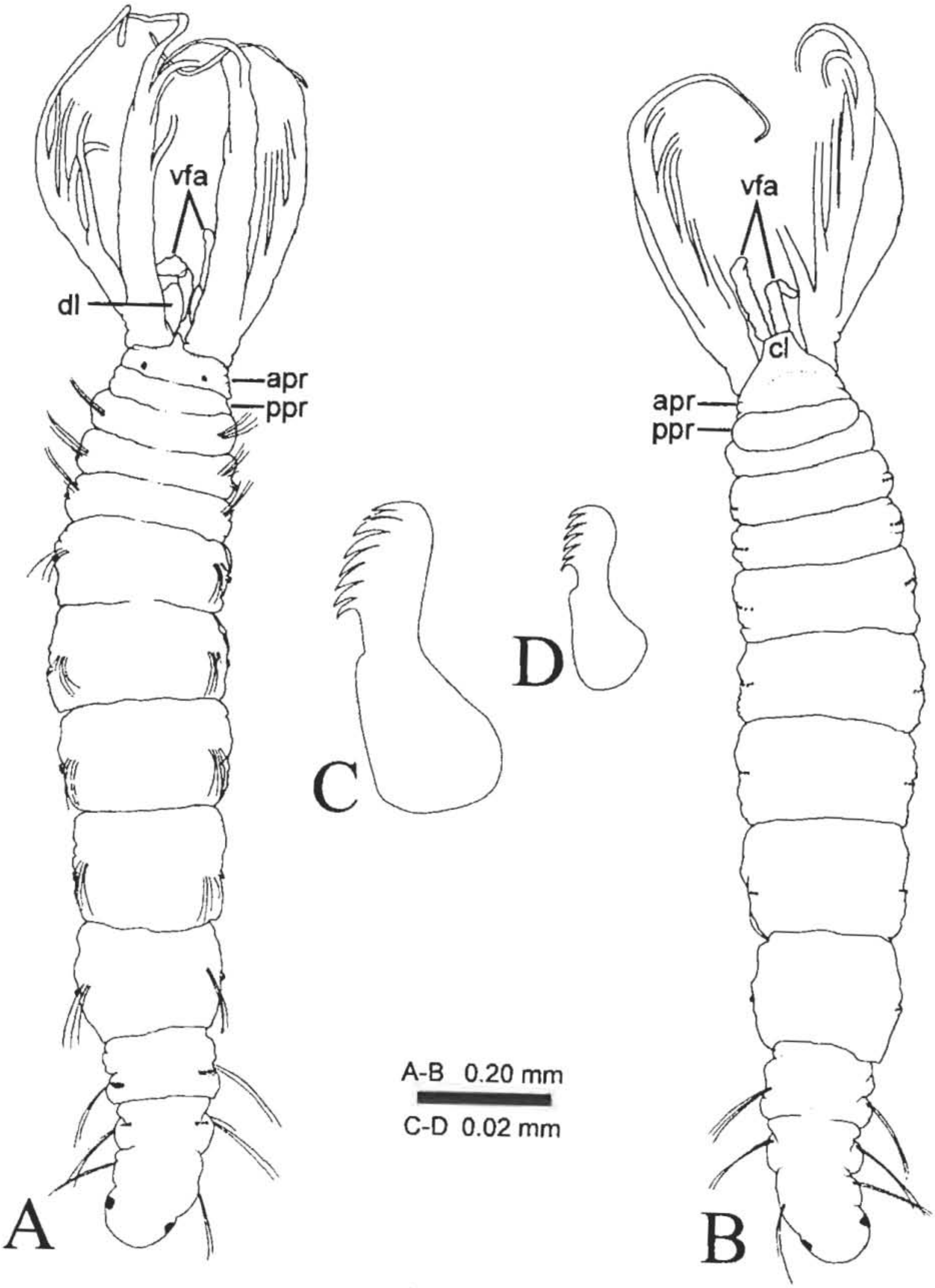
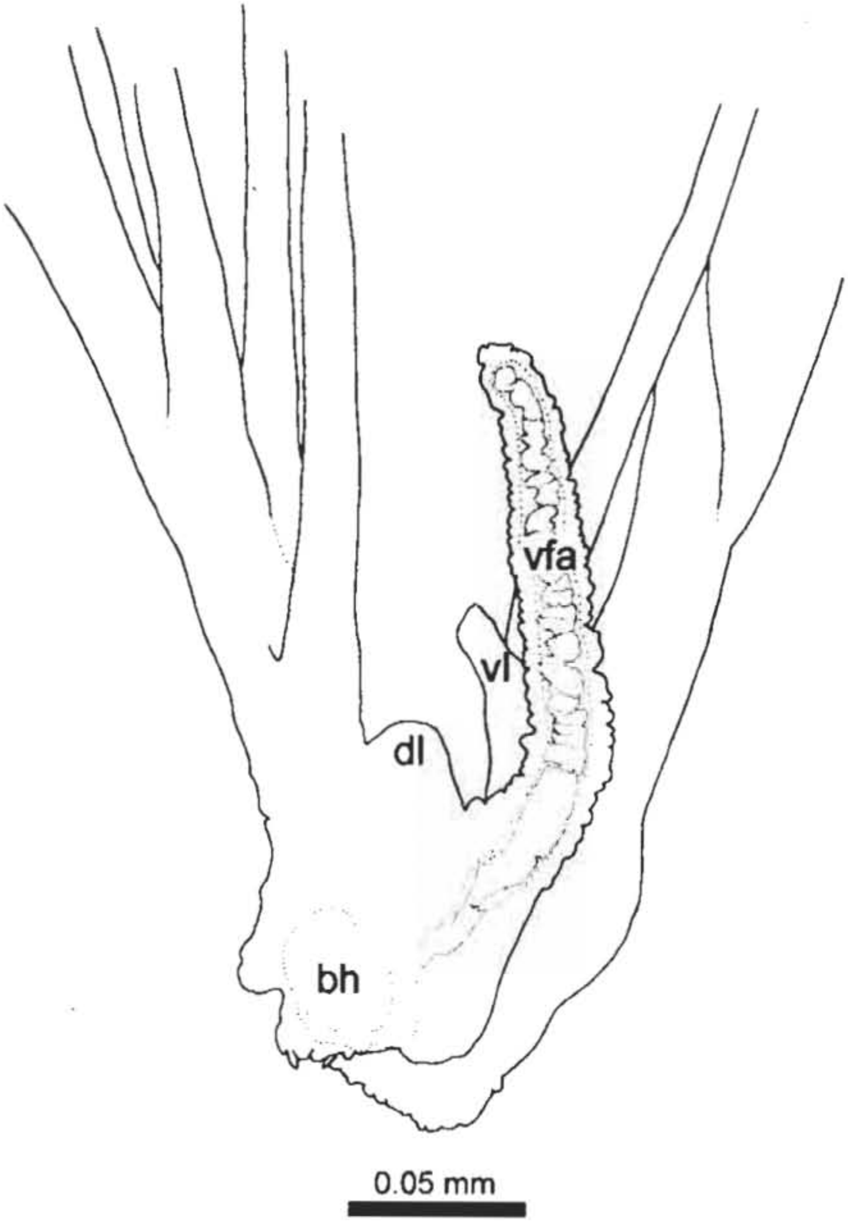
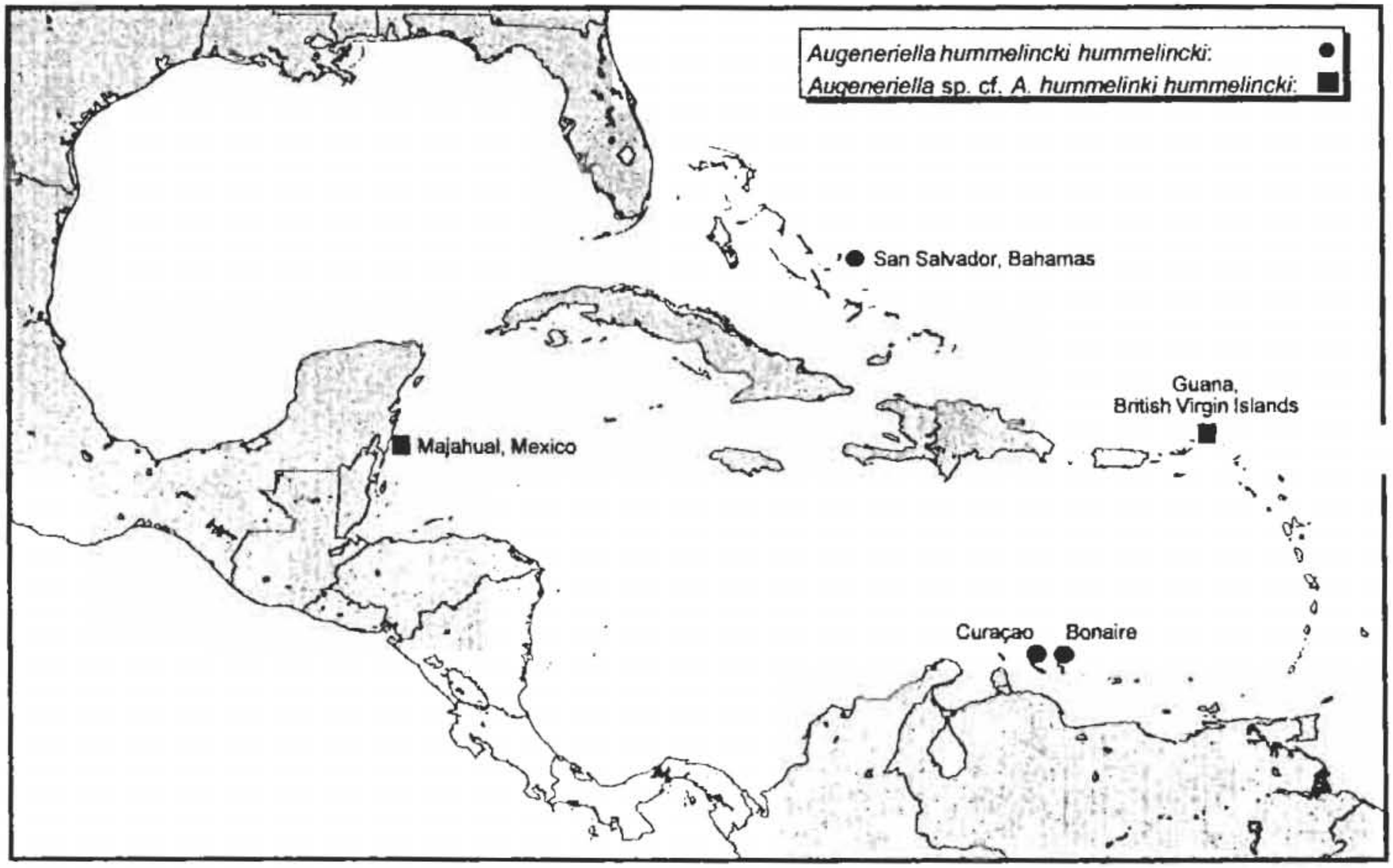


Fitzhugh ms: Figure 10



Fitzhugh ms: Figure 11



Fitzhugh ms: Figure 12

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An emendation of the fan worm genus *Fabricinuda* Fitzhugh, 1990 (Polychaeta: Sabellidae: Fabriciinae), and description of a new species from the Caribbean

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Running title: New Fabriciinae Fan Worm

A new species of *Fabricinuda* Fitzhugh, *F. guana*, is described from the British Virgin Islands, Caribbean Sea, from intertidal to shallow subtidal depths. The species is distinguished from the other six described species in having relatively short, cirriform dorsal lips and thoracic inferior pseudospatulate setae in setigers 3-8. *Fabricinuda guana* most closely resembles *F. bikinii* (Hartman) and *F. trilobata* (Fitzhugh) in the more dorsal placement of the branchial crown, leaving the ventral half of the anterior peristomial ring exposed. An emended diagnosis for the genus is provided, which removes the presence of pseudospatulate setae as a synapomorphy for the genus. In addition, previous descriptions of *F. bikinii*, *F. trilobata*, *F. limnicola* (Hartman), and *F. pseudocollaris* Fitzhugh have stated that dorsal lips are absent, but vascularized, ventral filamentous appendages are present, whereas remaining species (*F. pseudopalpa* Fitzhugh, *F. longilabrum* Fitzhugh) have lobate lips that are slightly longer than wide. These "appendages" are reinterpreted here as highly modified dorsal lips. Cladistic relationships among the seven described species of *Fabricinuda* are presented.

KEYWORDS: Polychaeta, Sabellidae, Fabriciinae, *Fabricinuda*

Introduction

The fan worm genus *Fabricinuda* Fitzhugh, 1990a is known for at least six species from temperate to tropical, intertidal and continental shelf habitats in the Atlantic, Pacific, and Indian Oceans (Fitzhugh, 1983, 1990a, 2001a; Uebelacker, 1984; Nishi, 1996). The genus is one of the more readily recognized from among the small-bodied Fabriciinae, especially because of the highly reduced collar on the anterior peristomial ring, which gives the anterior margin of the ring a more truncate appearance than is seen in species in other genera. In addition to reduction of the collar, the monophyly of *Fabricinuda* has remained very consistent with the occurrence of thoracic pseudospatulate setae in setigers 3-8; these setae are common in the subfamily, but when present in other genera, they have a more limited distribution, usually between setigers 3-6 or 3-7. Previous systematic and cladistic studies involving *Fabricinuda* (Fitzhugh 1990a, 1998, 2001a) have noted the absence of branchial crown dorsal lips in *F. limnicola* (Hartman, 1951), *F. bikinii* (Hartman, 1954), *F. trilobata* (Fitzhugh, 1983), and *F. pseudocollaris* Fitzhugh, 1990a, but these species have been described as having vascularized, ventral filamentous appendages (*sensu* Fitzhugh 1989). Interestingly, appendages are absent in those species with dorsal lips, i.e., *F. pseudopalpa* Fitzhugh, 1990a and *F. longilabrum* Fitzhugh, 2001a.

During a marine invertebrate biodiversity survey in the vicinity of Guana Island, British Virgin Islands, in the Caribbean Sea, a new species of *Fabricinuda* was collected and is described here. The species exhibits a dorsal lip morphology unlike that seen in other members of the genus, and has prompted a reinterpretation of the presence of dorsal lips throughout the genus. The new species also has a thoracic pseudospatulate setal distribution different from that in other species in the genus. As a result, the diagnosis of *Fabricinuda* is emended for the first time since it was named by Fitzhugh (1990a). Subsequent to the cladistic analysis conducted by Fitzhugh (2001a) for species in the genus, a revised analysis is performed with the inclusion of the new species and new character data.

Specimens examined for the present study have been deposited in the Los Angeles County Museum of Natural History's Allan Hancock Foundation Polychaete Collection (LACM-AHF).

Fabricinuda Fitzhugh, 1990a, emended

The following diagnosis mainly follows that given by Fitzhugh (1990a). Those sections which have been emended are indicated in bold, and the justifications for these changes are discussed in the *Remarks*. Synapomorphies for the genus are shown in italics.

Diagnosis. Small species with eight thoracic and three abdominal setigers. Branchial crown with three pairs of radioles; distal ends filamentous, about same width as pinnules. All pinnules terminating at about same height, extending to same height as radioles or slightly shorter. **Dorsal lips present and either (1) short, lobate, and slightly longer than wide, (2) short and cirriform, or (3) very elongate and filiform; lips of types (1) and (2) with very narrow, longitudinal blood vessel, type (3) contains a very wide vessel**. Branchial hearts present. Branchial lobes not fused together mid-dorsally; lobes attached to peristomium in typical sabellid form or with very narrow attachment along dorsal half of peristomial margin. Mouth located centrally between branchial lobes or shifted dorsal to attachment point of lobes. *Anterior margin of anterior peristomial ring as low, even or slightly oblique ridge all around except for narrow mid-dorsal separation which is continuous with low, median lobe*; lateral margins of mid-dorsal separation smooth or with pair of low, rounded lobes. *Anterior peristomial ring as wide as long or longer*. Peristomial eyes black, round to crescentic; pygidial eyes black, round. Superior thoracic notosetae elongate, narrowly hooded. Inferior thoracic notosetae short, elongate narrowly hooded in setiger 2 **and sometimes setiger 8; setigers 3-7 or 3-8 with pseudospatulate setae**. Thoracic uncini acicular, with large tooth above main fang; hood present. Abdominal uncini rasp-shaped plates; manubrium about same length as dentate region; dentate region with several teeth per row. Abdominal neurosetae elongate, with very narrow hoods. Body wall pigmentation present or absent. **Females with ovaries in setiger 4. Males with sperm development in setigers 4-8; spermatids arranged in groups of more than 100 attached to central cytophore. Young brooded in maternal tubes to juvenile stage**.

Remarks. The present diagnosis is a modified version of that provided by Fitzhugh (1990a). The original diagnosis did not include the occurrence of gamete formation and brooding among species in the genus. These data have been included based on the work of Rouse & Fitzhugh (1994), Nishi (1996), Fitzhugh (2001a, pers. obs.), Rouse (pers. comm.), and the present study.

Based on the present study, the diagnosis has changed in two respects. First, Fitzhugh (1990a, see also Fitzhugh 1998, 2001a) included as a synapomorphy for the genus the distribution of inferior thoracic pseudospatulate setae in setigers 3-8. Among other Fabriciinae species with pseudospatulates, occurrence is more limited, usually between setigers 3-6 or 3-7. The new species of *Fabricinuda* described below has pseudospatulates in setigers 3-7, thereby precluding the 3-8 distribution as a synapomorphy for the genus (see **Cladistic relationships among species of *Fabricinuda*** below).

A second significant change in the diagnosis pertains to the interpretation of dorsal lips. Originally, Fitzhugh (1990a) described *Fabricinuda* species as either having dorsal lips or vascularized, ventral filamentous appendages. In contrast to what was seen in other genera with appendages (Fitzhugh 2001b: figure 1), dorsal lips and appendages were never seen occurring simultaneously in a species of *Fabricinuda*. Dorsal lips have been described in *F. pseudopalpa* and *F. longilabrum* as being slightly longer than wide and distally rounded (Fitzhugh 1990a: figure 6E, 2001a: figure 1B, respectively), but otherwise similar to the more triangular shape seen in most other Fabriciinae species (e.g., Fitzhugh 1989: figure 14D, E, 1990b,1993, 1996: figure 1B, 1998: figures 2B, 10B,1999: figures 1B, 3B, 2001a: figure 3). Previous distinctions between the shapes of dorsal lips have only taken into consideration whether lips are well developed (i.e., triangular or slightly elongate) or reduced to narrow ridges (Fitzhugh 1998). Discriminating between lips that are triangular and the more elongate form seen in *F. pseudopalpa*, *F. longilabrum*, and the new species described below, is warranted since these respective shapes are easily characterized. In addition to the elongate, lobate lips in *F. pseudopalpa* and *F. longilabrum*, a slightly different elongate form will be described below in the new species, where the lips are distinctly narrower than long and cirriform. Fitzhugh (1998: figure 9B) described the dorsal lips in *Brifacia metastellaris* as being slightly longer than wide, and are similar in appearance to the lips in *F. pseudopalpa* and *F. longilabrum*.

Four *Fabricinuda* species have been described in the past as having vascularized, ventral filamentous appendages (Fitzhugh 1990a, see also Fitzhugh 1998, 2001a): *F. bikinii*, *F. limnicola*, *F. pseudocollaris*, and *F. trilobata*. As noted earlier, dorsal lips have been described as being absent in these instances, which differs from what has been observed in other fabriciins with appendages in that these structures are always associated with triangular dorsal lips. The presence of cirriform dorsal lips in the new species described below, *F. guana*, raises the question of the homologous relations between the "appendages" in these four *Fabricinuda* species and appendages and dorsal lips in other fabriciins. The dorsal lips in *F. guana* are essentially intermediate in form between the wider, elongate lips in *F. pseudopalpa* and *F. longilabrum* and what were originally interpreted by Fitzhugh (1990a) as vascularized, ventral filamentous appendages in the other four species. As will be described below, the dorsal lips in *F. guana* have a narrow blood vessel extending through their length. A similar vessel can also be seen in *F. longilabrum* (pers. obs.) and probably also exists in *F. pseudopalpa*, although I have not examined specimens of the latter for this structure. These observations preclude using the presence of the larger blood vessel in the "appendages" in *F. bikinii*, *F. limnicola*, *F. pseudocollaris*, and *F. trilobata* as a basis for judging these structures as different from what have been interpreted as dorsal lips in the other three species. Based on these observations, it seems reasonable to reinterpret the "appendages" in *F. bikinii*, *F. limnicola*, *F. pseudocollaris*, and *F. trilobata* as dorsal lips as opposed to filamentous appendages. This reinterpretation establishes a greater level of uniformity in the genus in that all species have dorsal lips as opposed to the view that some species have dorsal lips and other species have filamentous appendages, with concurrent loss of lips. This uniformity is also consistent with the patterns seen among other fabriciins, where dorsal lips are always associated with ventral filamentous appendages. Figure 1 provides a summary of the homologous relations between dorsal lips and filamentous appendages among Fabriciinae genera, as well as the general shapes of lips. Based on the present interpretation of dorsal branchial lobe structures in *Fabricinuda*, species in this genus exhibit the greatest variation in dorsal lip structure. A different type of variability occurs among species in *Pseudofabriciola* Fitzhugh, 1990b, where dorsal lips are either triangular or as narrow ridges, and vascularized, ventral filamentous appendages can be present or absent (see review by

Fitzhugh 1998, 2001a; figure 1).

There is the alternate interpretation that might be applied to *Fabricinuda*, namely that all of these dorsal branchial lobe structures represent filamentous appendages, with the loss of dorsal lips as a synapomorphy for the genus. Relative to what is seen in the Fabriciinae overall, this conclusion seems less tenable. Exclusive of *Fabricinuda*, all Fabriciinae species have dorsal lips (Fitzhugh 1998, 2001b; figure 1). It is the presence or absence of filamentous appendages that is variable. Given the consistency of occurrence of dorsal lips in the subfamily and the presence of what might appear to be dorsal lips in *F. pseudopalpa*, *F. longilabrum*, and the new species described here, it appears more parsimonious to interpret all of the structures along the inner dorsal margins of the branchial lobes as dorsal lips.

Fitzhugh (1990a) identified three characters as establishing the monophyly of *Fabricinuda*: (1) reduction of the anterior peristomial ring margin to a low ridge, in contrast to having a well-developed collar; (2) the anterior peristomial ring being at least as wide as long, as opposed to distinctly wider than long; and (3) the occurrence of thoracic pseudospatulate setae in setigers 3-8, rather than in a fewer number of contiguous setigers. As is indicated in the diagnosis, and will be shown in the cladistic analysis below, the pseudospatulate distribution in setigers 3-8 is no longer a synapomorphy for the genus, but characters (1) and (2) continue to define the genus. With the reinterpretation of ventral filamentous appendages in *Fabricinuda* species as dorsal lips, it is conceivable that one could consider the more general condition of lips being longer than wide as an additional synapomorphy. In the emended diagnosis and the cladistic analysis for the present study, I have opted for the alternative of characterizing dorsal lip shapes among species more explicitly with regard to specific shapes. As part of the present study, the possibility that the elongate dorsal lips among species in *Brifacia* and *Fabricinuda* might be considered a synapomorphy for an exclusive sister-group relationship between these two genera will be discussed as part of the cladistic analysis of relationships among *Fabricinuda* species presented below. In the event these two genera are sister taxa, this would preclude elongate lip shape as being a synapomorphy for *Fabricinuda*.

Fabricinuda guana, n.sp.

(figures 2-4; table 1)

Material examined. Atlantic Ocean, Caribbean Sea, British Virgins Islands. Holotype: LACM-AHF 0000, sta. BVI-059, Beef Island, Trellis Bay, adjacent to airport runway, scrapings of algae off coral rubble, depth 1.0 m, coll. K. Fitzhugh, 12 July 2000. Paratypes: LACM-AHF 0000 (five specimens), sta. BVI-001, Guana Island, North Bay, dredged area in front of beach house and pier, algal scrapings consisting of *Amphiroa* sp., *Gelidium pusillum*, *Laurencia* sp., blue-green algae, with coralline silt and crustacean tubes off coral rubble, N 18° 28.909', W 64° 34.485', depth 0.7 m, coll. K. Fitzhugh, 3 July 2000; LACM-AHF 0000 (10 specimens), sta. BVI-002, Guana Island, North Bay, dredged area in front of beach house and pier, algal scrapings consisting of *Amphiroa* sp. and blue-green algae off coral rubble, N 18° 28.909', W 64° 34.490', depth 0.5 m, coll. K. Fitzhugh, 3 July 2000; LACM-AHF 0000 (eight specimens), sta. BVI-003, Guana Island, North Bay, 30 m west of pier, algal scrapings of *Cladophora* sp. and *G. pusillum*, with coralline silt, crustacean tubes, and detritus off coralline rocks, N 18° 28.913', W 64° 34.503', depth 20 cm, coll. K. Fitzhugh, 3 July 2000; LACM-AHF 0000 (five specimens), sta. BVI-005, Guana Island, White Bay, finger reef near beach house, east of pier, 40 m offshore, scrapings of zooanthid anemones, sand, and filamentous algae (*Ceramium* sp., *Polysiphonia* sp.) off coral boulder, depth 1.0 m, coll. K. Fitzhugh, 4 July 2000; LACM-AHF 0000 (27 specimens), sta. BVI-017, Guana Island, White Bay, shoreward side of middle finger reefs, east of pier, scrapings of zooanthid anemones and coralline silt off coral boulder, depth 1.0 m, coll. K. Fitzhugh, 6 July 2000; LACM-AHF 0000 (one specimen), sta. BVI-020, Guana Island, Grand Ghut, scraping off sponges, depth 9.0 m, coll. L. Jarecki, 6 July 2000; LACM-AHF 0000 (11 specimens), sta. BVI-055, Guana Island, Long Point, Muskmelon Bay, algal scrapings off reef slope, depth 15.0 m, coll. R. Ware, 11 July 2000; LACM-AHF 0000 (one specimen), same station as holotype; LACM-AHF 0000 (1 specimen), sta. BVI-066, Guana Island, North Bay, 30 m offshore from pier, algal scrapings of *Amphiroa* sp. and *Dictyota* sp. off coral rubble, N 18° 28.909', W 64° 34.490', depth 0.5 m, coll. K. Fitzhugh, 14 July 2000.

Description. Holotype a complete male with 8 thoracic and 3 abdominal setigers. Branchial crown length 2.0 mm, remainder of body 2.40 mm long, maximum width 0.2 mm in anterior thorax. Trunk slender, slightly tapering posteriorly (figure 2A). Branchial crown with 3 pairs of radioles, distal ends filamentous, same width as pinnules. All radioles with five pairs of pinnules; all pinnules terminate at about same height, slightly shorter than tips of radioles. Dorsal lips erect, about five times longer than wide, distally rounded (figure 2B, C); narrow coelomic space containing blood vessel extends through entire length of lips (figure 2C). Ventral lips and ventral filamentous appendages absent. Dorsal margins of branchial lobes not fused to one another. Branchial hearts present (figure 2A, B). Anterior peristomial ring collar as a low ridge, separated mid-dorsally by distinct gap; dorsolateral collar margins as small lobes partially overlapping mid-dorsal medial lobe (figures 3A, 4A). Mid-dorsal medial lobe broadly rounded distally, extending slightly beyond collar.

Several paratypes with distinct pair of spherical "auxiliary" lobes lateral to median lobe and partially beneath lateral collar lobes (figure 4A); "auxiliary" lobes originate along dorso-lateral margins of anterior peristomial ring; composed of single layer of thick cells surrounding hollow (coelomic?) space. Annulation between collar and anterior peristomial ring not visible. Antero-dorsal margin of anterior peristomial ring extends beyond antero-ventral margin, creating a shelf-like appearance along ventral half of anterior peristomial margin; some paratypes with similar arrangement as in holotype, other paratypes with anterior margin relatively even (figures 3, 4A). Anterior peristomial ring slightly longer than wide, about five times longer than posterior peristomial ring in holotype (figure 2A). Annulation between rings visible ventrally and laterally (figures 2A, 3, 4A). Mid-dorsum of anterior peristomial ring with shallow groove extending from mid-dorsal collar separation to posterior peristomial ring (figure 4A), groove same width as mid-dorsal collar separation. Pair of crescentic or round, black eyes near bases of dorso-lateral collar lobes. Setiger 1 about one-half length of anterior peristomial ring (slightly shorter in some paratypes: figures 3, 4A), wider than long; setigers 2-3 each about same length as setiger 1; setigers 4-8 successively longer than setiger 3, with setiger 8 about 2.5 times longer than setiger 1. Setiger 9 slightly shorter than setiger 8, with setigers 10-11 each successively shorter than 9. Pygidium about same length as setiger 11, posterior margin slightly tapered, rounded (figure 2A). Pair of round, black pygidial eyes (figure 2A). Superior thoracic notosetae elongate, narrowly hooded, 3-4 per fascicle. Inferior thoracic notosetae in setigers 2 and 8 elongate narrowly hooded, 2 per fascicle; setigers 3-7 with pseudospatulate setae (figure 4B), 2 per fascicle. Abdominal neuropodia of setigers 9-11 with very elongate, narrowly hooded setae, 1-2 per fascicle. Thoracic uncini acicular, main fang slender (figure 4C); large tooth offset from mid-line of main fang present, remaining teeth behind main fang slender and slightly decrease in size away from fang; hood present; 5-6 uncini per fascicle in irregular single rows. Abdominal uncini with 7-8 rows of teeth in profile, 3 teeth per row (figure 4D); manubrium about same length as dentate region, slightly expanded proximally; uncini in setigers 9-11 number 19, 20, and 14, respectively. Females with oocytes in setiger 4, males with developing sperm in setigers 4-8. Pigmentation absent on branchial crown and body wall of all specimens. Specimens occasionally found in tubes composed of coralline sand and fine detritus. No brooding of young observed.

Etymology. The specific epithet refers to the island around which most specimens of the species were collected.

Remarks. *Fabricinuda guana* is readily distinguished from other species of *Fabricinuda* by the presence of thoracic pseudospatulate setae in setigers 3-7, whereas all other described species have pseudospatulates in setigers 3-8. The cirriform shape of the dorsal lips is also a unique feature. As was indicated in the *Remarks* for the generic diagnosis, all other species of *Fabricinuda* have dorsal lips that are either wider and more lobate or have the appearance of "vascularized, ventral filamentous appendages."

Fabricinuda guana shows greatest similarities to *F. bikinii* and *F. trilobata* in that the branchial crown in each species is shifted dorsally, leaving the ventral half of the anterior peristomial ring well exposed (table 1). Among these three species there is also the tendency for the anterior peristomial margin to be either transverse relative to the long axis of the body (figure 3) or distinctly oblique (figure 2A; Fitzhugh 1990a: figures 2B, 3D; Nishi 1996: figures 2A, D, 4A). In all other species, the margin is always transverse and completely covered by the attachment of the crown.

There is some superficial resemblance between *Fabricinuda guana* and *F. pseudopalpa* in that both species have paired extensions from the dorso-lateral margins of the anterior peristomial ring. The extensions are not, however, homologous. Fitzhugh (1990) showed that the palp-like structures in *F. pseudopalpa* are elongations of the dorso-lateral collar lobes, within which are located the anterior vascular loops. The "auxiliary" lobes in *F. guana* are completely separate from the collar lobes and internally appear to contain coelomic spaces, but with no blood vessels. As well, the extensions in *F. pseudopalpa* are very variable in length, ranging from about as long as wide to much longer than wide (Fitzhugh 1990a: figure 7). It is unknown at this time whether the "auxiliary" lobes in *F. guana* are preservation artefacts or a feature present in living specimens.

The description of *Fabricinuda guana* raises the number of western Atlantic/Caribbean species to three, the other species from the region being *F. trilobata* from the intertidal zone along Belize and *F. pseudocollaris* from shallow subtidal depth along the west coast of Florida. A possible additional undescribed species (Fitzhugh 2001a) was identified as *F. trilobata* by Uebelacker (1984, as *Fabriciola trilobata*) from the Gulf of Mexico continental shelf off Texas and Florida at depths ranging from 10 to 189 m. The known depth distribution for *F. guana* is from the intertidal zone to 15 m.

Key to species of *Fabricinuda*

The following key has been modified from that presented by Fitzhugh (1990a). The principle change is in the interpretation of what have previously been regarded as vascularized, ventral filamentous appendages, which are now interpreted as dorsal lips. The original key by Fitzhugh (1990a) contained five species, whereas the present key also includes *F. longilabrum* and *F. guana*.

1a. Dorsal lips very elongate, filamentous, with large internal blood vessel (Fitzhugh 1990a: figures 1E, 2E, 3E, 5A, 9A), closely resembling the vascularized, ventral filamentous appendages of species in *Pseudoaugeneriella* and some *Pseudofabriciola* 4

1b. Dorsal lips short, lobe like (Fitzhugh 1990a: figure 6E, 2001a: figure 1B) or cirriform (figure 1B, C), without large internal blood vessel (but might have a narrow vessel) 2

2a. Thoracic inferior pseudospatulate notosetae in setigers 3-8; dorsal lips lobe like 3

2b. Thoracic inferior pseudospatulate notosetae in setigers 3-7; dorsal lips short, cirriform .. .. ***F. guana*** **n.sp.**

3a. Anterior peristomial ring distinctly longer than wide (e.g., Fitzhugh 1990a: figure 1B, 2001: figure 2B) .... *F. longilabrum*

3b. Anterior peristomial ring as long as wide (Fitzhugh 1990a: figure 6B) .. *F. pseudopalpa*

4a. Branchial crown attachment to peristomium shifted dorsally to some extent, exposing antero-ventral peristomium margin (e.g., figure 1A) 5

4b. Branchial crown attached over entire anterior peristomium margin (e.g., Fitzhugh 1990a: figure 1B) 6

5a. Mouth located in typical sabellid position, i.e., centrally on the anterior peristomium margin (Fitzhugh 1990a: figure 5B) .... *F. trilobata*

5b. Mouth located along antero-dorsal margin of peristomium, dorsal to branchial lobe attachment (Fitzhugh 1990a: figure 2F) .... *F. bikinii*

6a. Ventrum of anterior peristomial ring with paired, membranous lappet-like processes (Fitzhugh 1990a: figure 8C) .... *F. pseudocollaris*

6b. Ventrum of anterior peristomial ring smooth, without processes .... *F. limnicola*

Cladistic relationships among species of *Fabricinuda*

Previous cladistic analyses examining relationships among species of *Fabricinuda* were reviewed by Fitzhugh (2001a), who also presented the first cladistic analysis limited to species in the genus. As was noted by Fitzhugh (2001a), all previous studies had only considered relationships within *Fabricinuda* in the context of relationships with all other Fabriciinae genera and species (i.e., Fitzhugh, 1991, 1992, 1993, 1995, 1998, 1999). The purpose of the present analysis is to examine the relationship of *F. guana* to other species, as well as to modify the characters used by Fitzhugh (2001a) based on the reinterpretation of dorsal lip morphologies and to correct a previous error in character coding regarding length/width relations in the anterior peristomial ring.

The analysis performed by Fitzhugh (2001a) consisted of six ingroup taxa and the properties associated with four morphological features (table 2). These features included (1) the ventral margins of branchial lobes, which pertained to the presence or absence of ventral filamentous appendages; (2) the presence or absence of dorsal lips; (3) position of the branchial crown; and (4) dimensions of the anterior peristomial ring. The present analysis includes the seven species in the genus, but only considers properties among three features (table 3): dorsal lip shape, branchial crown position, and anterior peristomial ring dimension. Consistent with the above modifications in the interpretation of dorsal lips in the genus, feature (1) of Fitzhugh (2001a) has been removed, and the properties of the dorsal lips have been expanded to accommodate the very elongate, digitiform condition seen in most species (table 3: feature 1) and to differentiate the lobate and cirriform conditions from the more typical triangular shape seen in most fabriciins. The lobate lips in *Fabricinuda pseudopalpa* and *F. longilabrum*, and the cirriform lips in *F. guana* were considered equivalent in this analysis since the overall shapes can be characterized as moderately longer than wide, in contrast to the very elongate, digitiform conditions seen in *F. bikinii*, *F. limnicola*, *F. trilobata*, and *F. pseudocollaris*.

The analysis by Fitzhugh (2001a) incorrectly treated the anterior peristomial ring in *Fabricinuda pseudopalpa*, which is about as long as wide (Fitzhugh 1990a: figure 6B), as plesiomorphic (cf. Table 2), thus equivalent to the condition seen in other Fabriciinae. Exclusive of *Fabricinuda*, the anterior peristomial ring in other Fabriciinae species is distinctly wider than long, not including the anterior collar extensions seen in genera such as *Fabricia* Blainville, 1828, *Fabriciola* Friedrich, 1939, *Novafabricia* Fitzhugh, 1990b, or *Pseudofabriciola* Fitzhugh, 1990b. Within *Fabricinuda* (see *Diagnosis* for the genus above), the anterior peristomial ring is at least as wide as long, as in *F. pseudopalpa*, or longer than wide as in all other described species in the genus. As a result, the greater length of the ring is a synapomorphy for the genus and not relevant to discerning cladistic relationships among species. Properties related to anterior ring dimensions are therefore not included in the present analysis. With the occurrence of inferior thoracic pseudospatulate setae in setigers 3-7 in *F. guana*, which is also seen in some other Fabriciinae species, as opposed to the 3-8 distribution in all other species in the genus, the occurrence of this setal type has been included in the present analysis (table 3).

A feature not considered by Fitzhugh (2001a), or in any of the previous cladistic analyses involving *Fabricinuda*, is the occurrence of body wall pigmentation, either on the crown or the anterior region of the trunk (Table 1). At least three species of *Fabricinuda* are known to consistently lack pigmentation: *F. bikinii*, *F. longilabrum*, and *F. guana*. All of the remaining species have been described as having brown pigmentation, usually on the branchial crown, especially the inner margins of the branchial lobes, the median lobe on the anterior peristomial ring and adjacent faecal groove, peristomial rings, and occasionally some anterior thoracic setigers. In some instances, pigment patterns can be very discrete. For instance, Uebelacker (1984: figure 54-16) and Fitzhugh (2001a) described for *F. trilobata* and *Fabricinuda* sp., respectively, the presence of dark brown pigmentation limited to the median lobe of the anterior peristomial ring. With the degree of variability in the patterns of pigment distribution between species, as well as within (Fitzhugh 1983, 1990a), the more general presence or absence of body pigmentation has not been included in the present analysis.

The determination of plesiomorphic properties was based on outgroup comparisons with the remainder of the Fabriciinae. For dorsal lip shape (table 3: feature 1), species in *Fabricinuda* all have lips that are longer than wide. Among other fabriciins, only *Brifacia metastellaris* has dorsal lips that are slightly longer than wide and somewhat similar to the forms seen in *F. pseudopalpa* and *F. longilabrum*. Remaining fabriciin species either have lips that are distinctly triangular or reduced to narrow, shelf-like processes. A preliminary, unpublished cladistic analysis involving the majority of Fabriciinae species and genera reveals that in some topologies, *B. metastellaris* is the sister taxon to the *Fabricinuda* clade, thus rendering the elongate dorsal lip condition plesiomorphic for the latter genus. There are as well topologies in which triangular or shelf like dorsal lips are plesiomorphic relative to *Fabricinuda*. As a result, two outgroups were considered for dorsal lips in the present analysis, one consisting of *B. metastellaris* and the other representing the more generic fabriciin condition of lips being either triangular or narrow and shelf-like. With respect to features (2) and (3), both of these outgroups are functionally equivalent.

Methods and results

Cladograms were constructed from the character matrix presented in table 4 using the 'AllTrees' command in PAUP* 4.0b7 (Swofford, 1998), with all characters given equal weight. A single cladogram was obtained using either outgroup, both with the same topology, and each with a length of 4 steps, and ci and ri of 0.75 and 0.83, respectively (figure 5). Relationships are relatively consistent with the results obtained by Fitzhugh (2001a: figure 10; figure 6), although, considering the marked differences in the characters used in the two studies, there is no utility in making specific comparisons between results. In the present study, *Fabricinuda bikinii* and *F. trilobata* form the most apomorphic sister group, defined by the shift of the branchial crown to a more dorsal position [character 2(1)] - this condition is homoplasious, also occurring in *F. guana* (figure 5). The sister group to this most apomorphic clade comprises a polytomy involving *F. limnicola* and *F. pseudocollaris*. This more inclusive group is based on the presence of the very elongate, digitiform dorsal lips with prominent blood vessels [character 1(2)], i.e., closely resembling the vascularized, ventral filamentous appendages in species in some other genera. *Fabricinuda pseudopalpa* and *F. longilabrum* then form a polytomy with these four more apomorphic species, all of which have thoracic pseudospatulate setae in setigers 3-8 [character 3(1)]. *Fabricinuda guana* is the most plesiomorphic species in the genus. The transformation series for the dorsal lips among *Fabricinuda* species are identical regardless of whether the outgroup condition is the presence of triangular or narrow lips [character 1(0): figure 5A] or moderately long lips [character 1(1): figure 5B]. It is, however, only in the case of the outgroup condition being the presence of triangular or narrow dorsal lips (figure 5A) that elongate lips is a synapomorphy for *Fabricinuda*.

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Table 1. Comparisons of selected features among *Fabricinuda* species.

Species	Dorsal lips	Branchial crown position	Anterior peristomial ring	Pseudospatulate setae distribution	Body wall pigmentation	Type locality (and other reported localities)
F. bikinii (Hartman, 1954)	very elongate, filiform, with large blood vessel	shifted dorsally	longer than wide	setigers 3-8	absent	Bikini Atoll (Okinawa, Aldabra Atoll)
***F. guana* n.sp.**	**cirriform**	**shifted dorsally**	**longer than wide**	**setigers 3-7**	**absent**	**British Virgin Islands**
F. limnicola (Hartman, 1951)	very elongate, filiform, with large blood vessel	over entire anterior end	longer than wide	setigers 3-8	present	California
F. longilabrum Fitzhugh, 2001a	lobe like	over entire anterior end	longer than wide	setigers 3-8	absent	Thailand
F. pseudocollaris Fitzhugh, 1990	very elongate, filiform, with large blood vessel	over entire anterior end	longer than wide	setigers 3-8	present	Florida
F. pseudopalpa Fitzhugh, 1990	lobe like	over entire anterior end	as wide as long	setigers 3-8	present	California
F. trilobata (Fitzhugh, 1983)	very elongate, filiform, with large blood vessel	shifted dorsally	longer than wide	setigers 3-8	absent or present	Belize
Fabricinuda sp. *sensu* Fitzhugh, 2001a	unknown	over entire anterior end	longer than wide	setigers 3-8	present	Thailand

Table 2. Properties for the four morphological features used by Fitzhugh (2001a) to determine cladistic relationships among *Fabricinuda* species (cf. table 3).

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1. Ventral margins of branchial lobes: (0) as narrow shelf-like processes; (1) as ventral filamentous appendages (i.e. vascularized & unbranched).
2. Branchial lobes adjacent to dorsalmost radioles: (0) as dorsal lips; (1) as even shelf continuous with ventral branchial lobe margins.
3. Branchial crown: (0) located over entire anterior end; (1) shifted dorsally.
4. Anterior peristomial ring: (0) at least as wide as long; (1) distinctly longer than wide.

Table 3. Revised properties of features used to determine cladistic relationships among *Fabricinuda* species in the present study.

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1. Dorsal lip shape: (0) triangular [e.g., *Fabricia stellaris* (Müller)] or narrow, shelf like (e.g., *Novafabricia* spp.); (1) moderately longer than wide, i.e., lobe like or cirriform; (2) very elongate, digitiform.
2. Branchial crown position: (0) extends over entire anterior peristomial margin; (1) shifted dorsally, exposing ventral half of anterior peristomial margin.
3. Distribution of inferior thoracic pseudospatulate setae: (0) setigers 3-7; (1) setigers 3-8.

Table 4. Character matrix for Fabricinuda species based on characters presented in table 3.

Characters	1	2	3
Outgroup$_1$: *Brifacia metastellaris*	1	0	0
Outgroup$_2$: *Fabricia, Novafabricia*	0	0	0
F. bikinii	2	1	1
F. guana **n.sp.**	**1**	**1**	**0**
F. limnicola	2	0	1
F. longilabrum	1	0	1
F. pseudocollaris	2	0	1
F. pseudopalpa	1	0	1
F. trilobata	2	1	1

Figure legends

Fig. 1. Relationships between the occurrence of branchial crown dorsal lips (dark gray) and ventral filamentous appendages (light gray) among Fabriciinae genera.

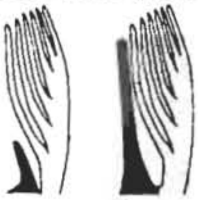
Fig. 2. *Fabricinuda guana*: (A) holotype, LACM-AHF 0000; (B-C) paratypes LACM-AHF 0000: (A) entire specimen, lateral view (left side); (B) right half of branchial crown, inner margin; (C) detail of dorsal lip. Abbreviations: apr, anterior peristomial ring; bh, branchial heart; bv, blood vessel; dl, dorsal lip; ppr, posterior peristomial ring.

Fig. 3. *Fabricinuda guana* (paratype LACM-AHF 0000): (A-C) dorsal, lateral (right side), and ventral views, respectively, of anterior end (branchial crown missing). Abbreviations: apr, anterior peristomial ring; cl, dorsolateral collar lobes; ml, median peristomial lobe; ppr, posterior peristomial ring.

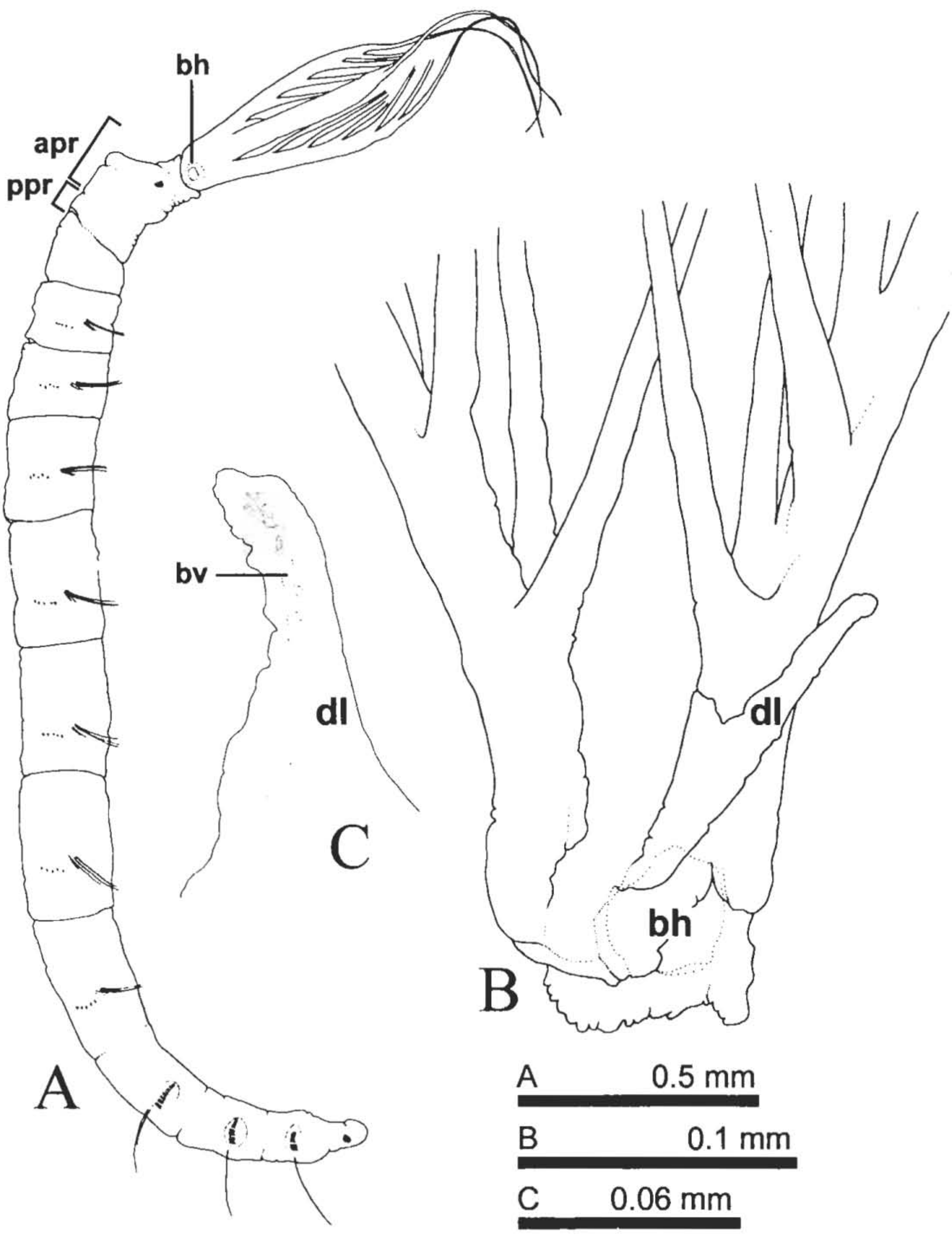
Fig. 4. *Fabricinuda guana* (paratype LACM-AHF 0000): (A) dorsal view of anterior end (branchial crown missing), showing the presence of distinct, "auxiliary" lobes (cf. figure 2A); (B) inferior thoracic notopodial pseudospatulate setae from setiger 5; (C) thoracic uncinus from setiger 5; (D) abdominal uncini from setiger 9. Abbreviations: al, "auxiliary" lobes; apr, anterior peristomial ring; cl, dorsolateral collar lobes; ml, median peristomial lobe; ppr, posterior peristomial ring.

Fig. 5. Relationships among species of *Fabricinuda* based on the data matrix presented in Table 3. Transformation series for the apomorphic properties referring to dorsal lip shape (1), branchial crown position (2), and thoracic pseudospatulate setae distribution (3) are shown: (A) transformation series in which either triangular or narrow, shelf-like dorsal lips is plesiomorphic [1(0)]; (B) transformation series in which dorsal lips that are moderately longer than wide is plesiomorphic [1(1)].

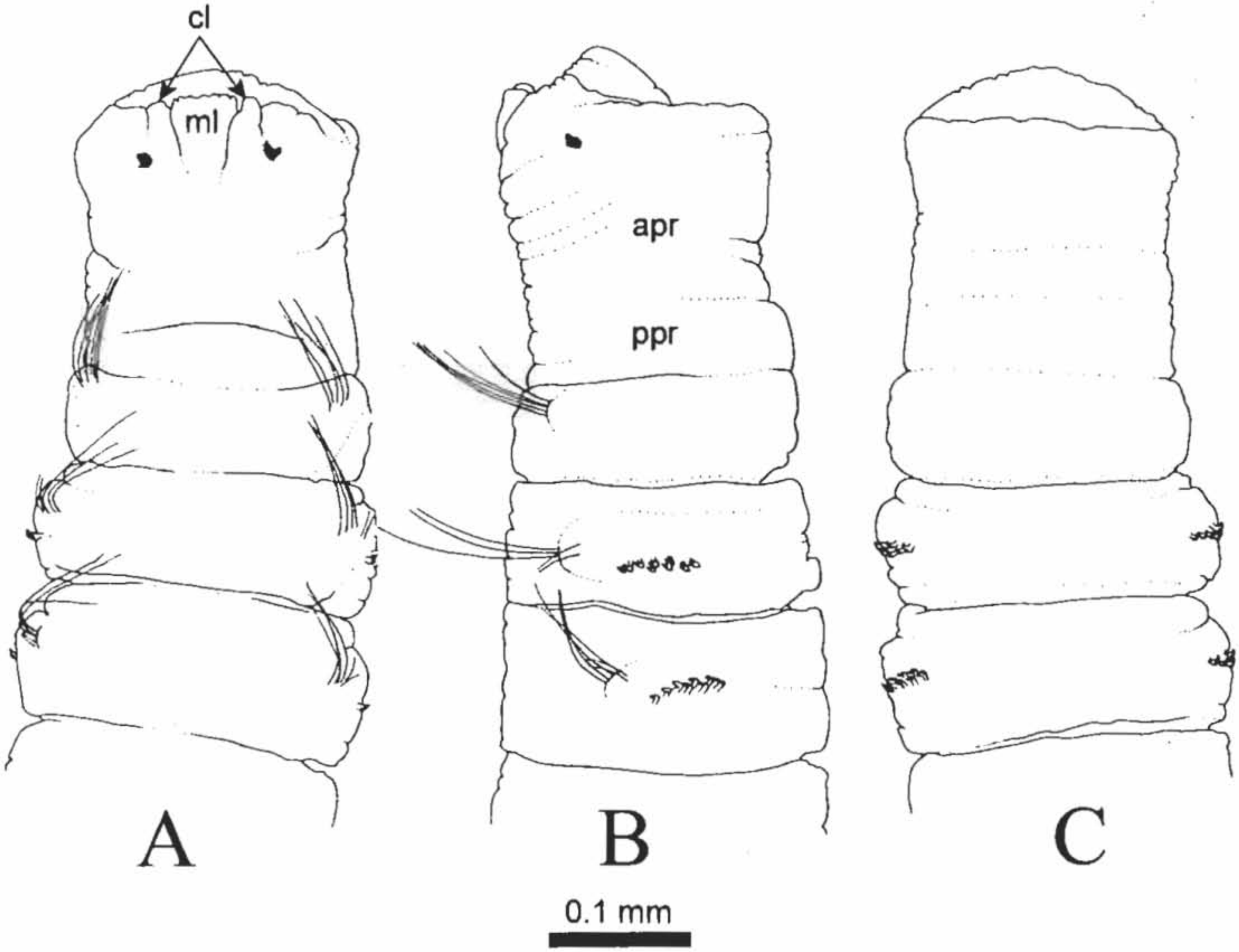
Fig. 6. Comparison of (A) the minimum-length tree obtained by Fitzhugh (2001a: figure 10) and (B) the topology from the present study (cf. figure 5).

- dorsal lips present - ventral filamentous appendages absent			*Brifacia* *Fabricia* *Parafabricia* *Pseudofabriciola*$_1$ *Raficiba*
			*Novafabricia* *Pseudofabriciola*$_2$
			*Brifacia* ***Fabricinuda***$_1$
			***Fabricinuda***$_2$
- dorsal lips present - ventral filamentous appendages present	- 'nonvascularized' ventral filamentous appendages		*Fabriciola*
			*Pseudofabricia*
	- 'vascularized' ventral filamentous appendages		*Manayunkia* *Monroika* *Pseudoaugeneriella* *Pseudofabriciola*$_3$ 'Genus A'
			*Augeneriella*

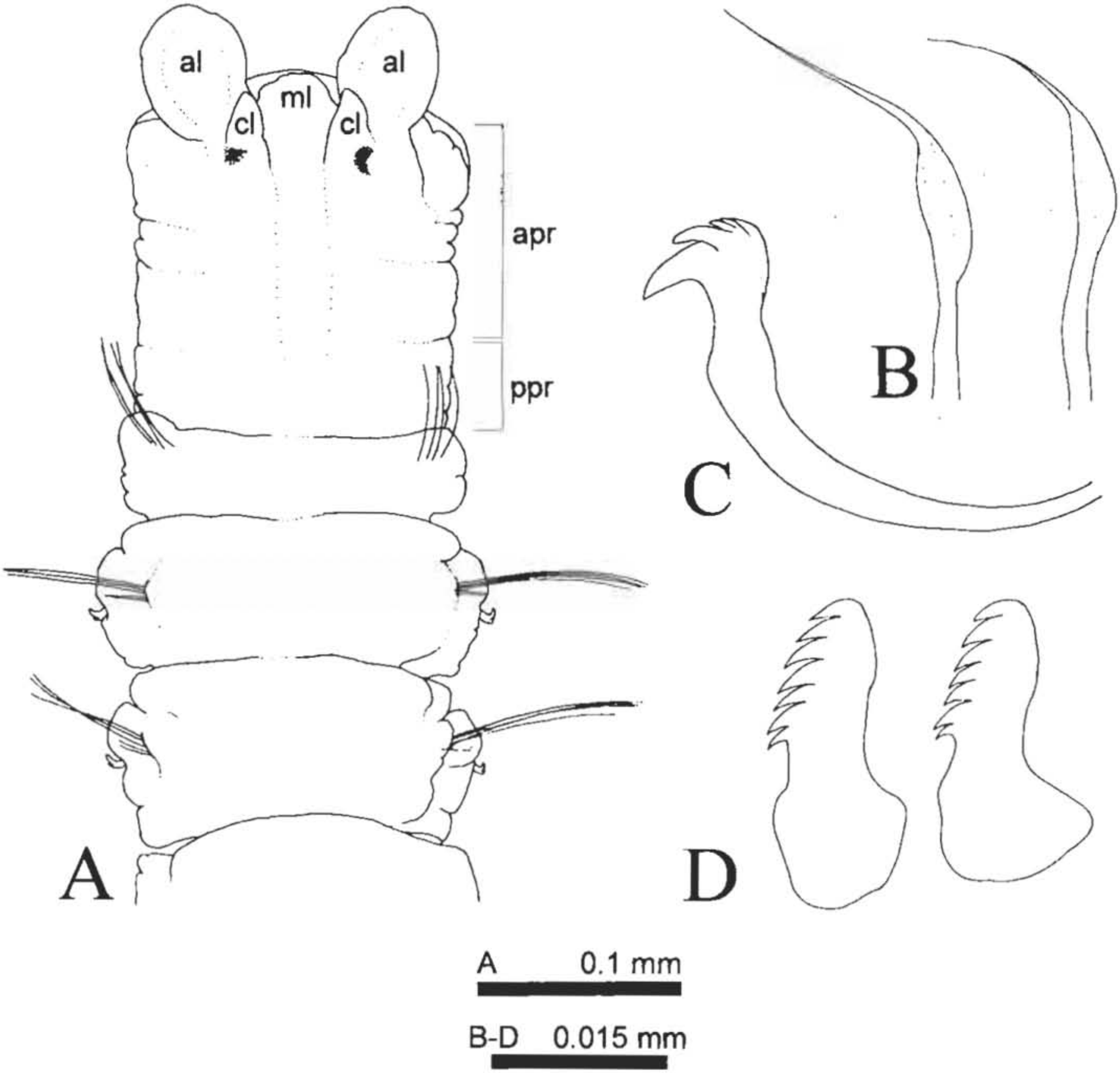
Fitzhugh ms: Fig. 1.



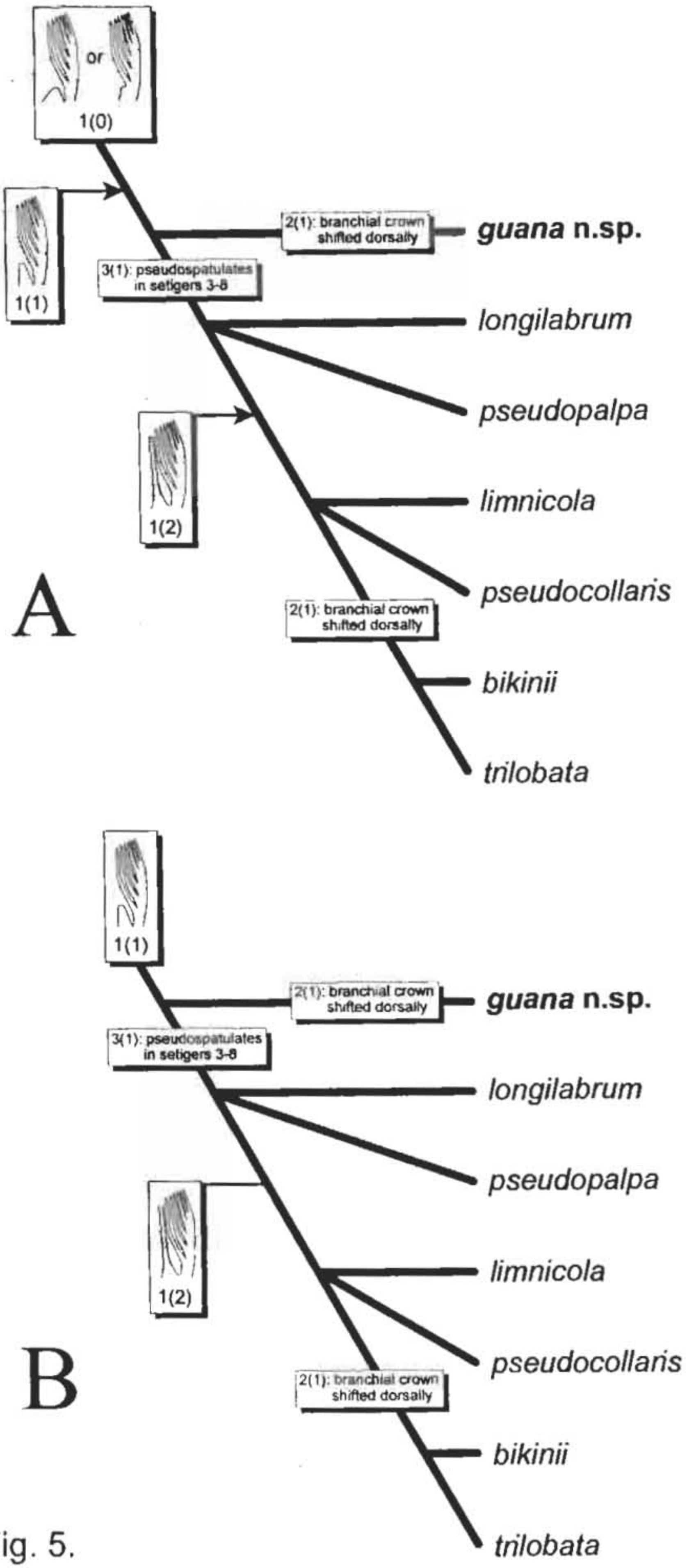
Fitzhugh ms: Fig. 2. *Fabricinuda guana* n.sp.



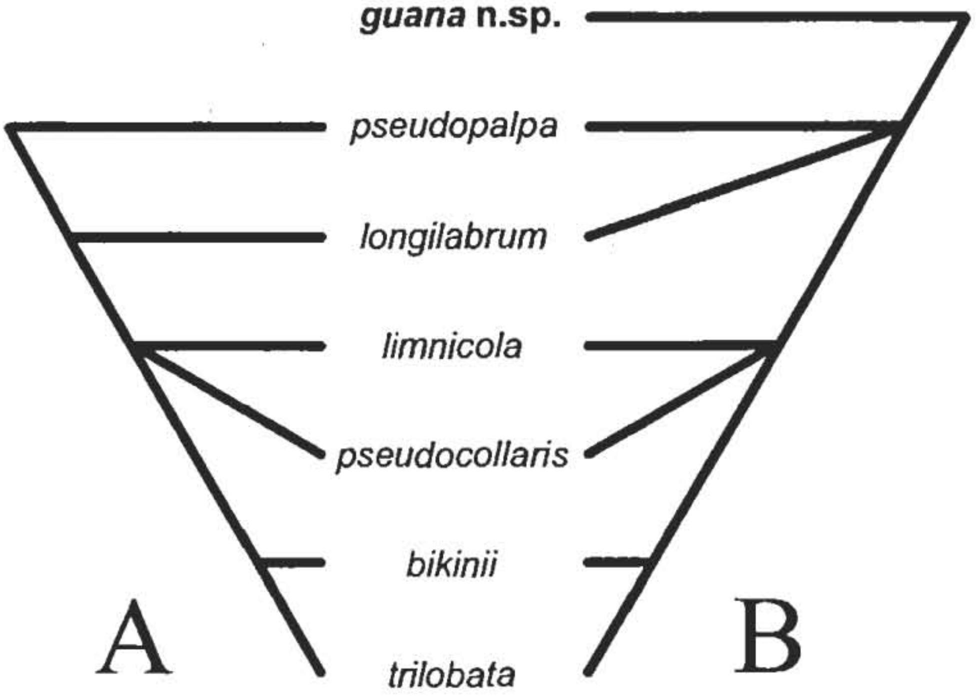
Fitzhugh ms: Fig. 3. *Fabricinuda guana* n.sp.



Fitzhugh ms: Fig. 4. *Fabricinuda guana* n.sp.



Fitzhugh ms: Fig. 5.



Fitzhugh ms: Fig. 6.

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MORPHOLOGY OF THE FIRST ZOEAL STAGE OF *PLATYPODIELLA SPECTABILIS* (HERBST, 1794) (DECAPODA, BRACHYURA, XANTHIDAE) OBTAINED IN THE LABORATORY

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[3]*University of California Los Angeles*

Abstract Ovigerous females of the xanthid crab *Platypodiella spectabilis* (Herbst, 1794) were obtained from 2 widely separated localities: the Ubatuba coast (Félix Beach, São Paulo) of Brazil and Guana Island in the British Virgin Islands (BVI). First stage zoea larvae were obtained from females at both locations. Those from Brazil are described and illustrated. The first zoea bears dorsal, rostral, and lateral carapace spines, plus a well-developed and spinose antennal protopod that bears a greatly reduced exopod with 2 minute setae. This antennal morphology, along with other characters, places the species among the "Group I" xanthid zoeas of Rice (1980) and Martin (1984, 1988). Differences between larvae from Brazil and those from the BVI are minor and are attributed to within-species variation. Characters that serve to separate these larvae from those of co-occuring xanthids are presented. Comments on the distribution and size of *Platypodiella spectabilis* are included.

INTRODUCTION

The xanthid crab genus *Platypodiella* was erected in 1967 (Guinot 1967:562) to accommodate 4 species formerly treated as *Platypodia* Bell, 1835. Two of the species, *P. gemmata* (Rathbun, 1902) and *P. rotundata* (Stimpson, 1860), are known from the eastern Pacific. Garth (1991:131), in discussing the Galapagos crab fauna, pointed out that the 2 Pacific species are possibly the adult (described as *P. rotundata*) and young (*P. gemmata*) of the same species, with the name *P. rotundata* having precedence. Other workers feel that the 2 Pacific species are distinct (I. Zimmerman, personal communication, Natural History Museum of Los Angeles County, Los Angeles, CA, USA). The other 2 species are Atlantic, with *P. picta* (A. Milne Edwards, 1869) restricted to the eastern Atlantic and *P. spectabilis* (Herbst, 1794) known from the western Atlantic.

Platypodiella spectabilis is a relatively small xanthid found in or near coral reefs and rocky shorelines throughout most of the western Atlantic. The species has been reported as far north as Bermuda (Chace et al. 1986:346, plates 115 and 11:11, in Sterrer 1986, as *Platypodia spectabilis*) and as far south as Rio de Janeiro, Brazil, including the Fernando de Noronha Archipelago and Trindade Island (Melo 1998:490). The current report extends the southern range to the São Paulo state of Brazil. Thus, the range of the species is an impressive 7,000 km from northern to southern extent. Distributional records within this range, and extending westward into the Gulf of Mexico, can be found in Rathbun (1930), Felder (1973), Powers (1977), and Abele and Kim (1986). Because of its spectacular coloration and color pattern, *P. spectabilis* is often depicted in faunal or regional guide books (Humann 1992), and the species is sometimes referred to as the calico crab (Chace et al. 1986) or gaudy clown crab (Williams et al. 1989).

The use of crab larval morphology, and in particular characters of the first zoeal stage, in elucidating phylogeny is now well established (see references in Clark et al. 1998) especially within the Xanthidae (Clark and Al-Aidaroos 1996, Clark and Galil 1998, Clark and Ng 1998). To date, nothing is known about larval development in the genus *Platypodiella*, and thus no larval evidence has been brought to bear on the question of how this genus relates to other genera within the Xanthidae *sensu stricta* or to other families within the superfamily Xanthoidea (sensu Martin and Davis, in review). In this paper we provide the first description of zoeal larvae in this genus.

MATERIALS AND METHODS

In February 1998, 4 ovigerous female *P. spectabilis* were collected by scuba diving along the infralittoral region of a rocky shore (Félix Beach) in Ubatuba, São Paulo, Brazil (23°23'00"S, 44°57'06"W). The crabs were maintained separately in an aquarium provided with seawater from the collecting site (salinity 35‰, temperature 24 ± 1°C) until hatching. The eggs of 2 of these females, carapace widths 28.1 and 29 mm, hatched. Newly hatched zoeae were fixed in 10% formalin and were then transferred to a mixture (1:1) of 70% ethyl alcohol and glycerin; 15 specimens were dissected for detailed examination and description. Additional ovigerous females were collected from the eastern Caribbean as part of an ongoing survey of the marine invertebrates of Guana Island, British Virgin Islands (BVI) (led by T.L. Zimmerman and J.W. Martin). These specimens came from North Beach, Guana Island, from interstices of dead coral (mostly clumps of dead *Porites*) in shallow water (1 m and less), on 14 July 2000 (Station 65 of the Zimmerman/Martin survey of Guana Island). A single ovigerous female (later photographed alive, photographic voucher number Vc0796), carapace width 10.5 mm, carapace length (as measured from front to back and excluding the rostrum) 7.1 mm, was kept alive in a small plastic container of fresh seawater until the eggs hatched later that evening. Examination of these larvae occurred in the laboratory of the 3rd and 4th authors in Los Angeles.

Illustrations were made from fixed material and are based on at least 15 specimens (Brazil) or 5 specimens (BVI). First stage zoeae were dissected under a stereomicroscope and mounted on semi-permanent slides. Morphological characters were examined with a Zeiss Axioskop 2 compound microscope attached to a personal computer using an Axiovision Image Analysis system (Brazil) or a Wild M5APO dissecting microscope and Nikon Labophot compound microscope with drawing tube (Los Angeles, for the BVI specimens). For the description of the larvae we followed the format suggested by Clark et al. (1998). Larvae and one parental female from Brazil have been deposited in the collection of the Departamento de Zoologia, Instituto de Biociencias, UNESP, Botucatu, SP, Brazil, NEBECC/LC 00076.1 (larvae) and NEBECC/LC 00076.0 (female). Larvae and the parental female from the BVI have been deposited in the collections of the Natural History Museum of Los Angeles County (LACM CR 20000061), as has a second large ovigerous female from Brazil (LACM CR 19981421).

RESULTS

Size. Larvae from the Brazilian female were slightly longer than those from the BVI, averaging 1.43 ± 0.18 mm from tip of rostrum to tip of dorsal spine (compared to 1.20 mm for BVI larvae) and 0.53 ± 0.03 mm total carapace length (compared to 0.42 mm in BVI larvae). However, width of the larvae from the 2 localities was the same; both Brazilian and BVI larvae averaged 0.79 ± 0.04 mm from tip to tip of the lateral carapace spines.

Carapace (Figure 1a, 3a). Globose, bearing dorsal, rostral, and lateral spines. Lateral spines shorter than dorsal and rostral spines. Rostral spine with 2 to 6 spinules (always 6 in Brazilian specimens) along mediodistal two thirds. Eyes sessile.

Abdomen (Figure 1b). With 5 abdominal somites, each bearing pair of posterodorsal setae. Somite 2 bearing lateral knobs projecting anteriorly and dorsally. Somite 3 bearing small lateral knobs projecting laterally or posterolaterally. Somites 3–5 with acute posterolateral processes. Pleopods absent.

Telson (Figure 1b, 3b). Bearing on each branch one large lateral spine, one small seta-like spine directly posterior to large lateral spine, and one short dorsal spine located posterior to these. Three pairs of minutely serrate spines on posterior emargination; innermost pair with 3

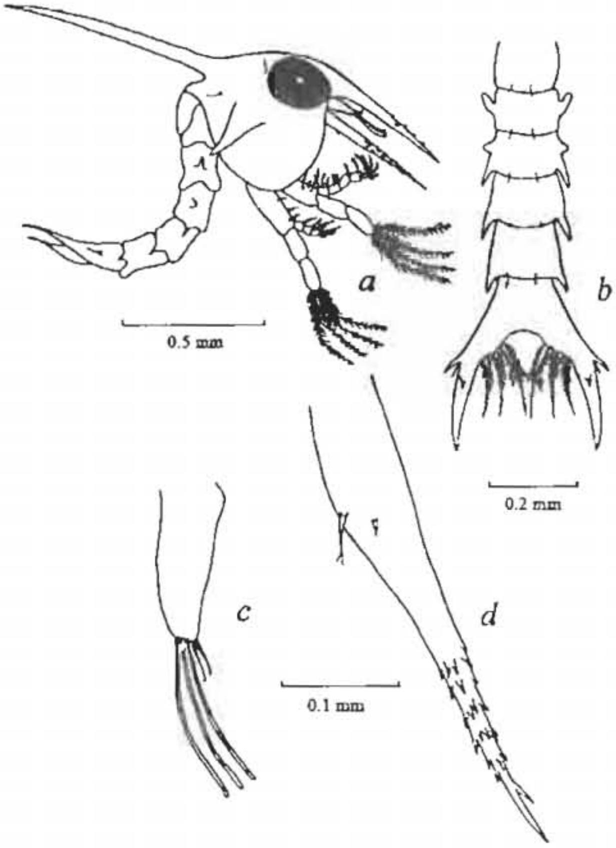

Figure 1. Morphology of the first zoea of *Platypodiella spectabilis* (based on specimens from Brazil). a, entire zoea, lateral view. b, abdomen and telson, dorsal view. c, antennule. d, antenna.

or 4 setules at approximate midlength in addition to serrations.

Antennule (Figure 1c, 3c). Uniramous. Endopod absent. Exopod unsegmented, with 3 aesthetascs (Brazil; only 2 in BVI) and 2 simple setae.

Antenna (Figure 1d, 3c). Protopod well developed, as long as rostral spine, and distally spinulate. Endopod reduced, represented by small spine at 1/3 length of protopod. Exopod greatly reduced, less than 1/10 length of protopod, and bearing 2 minute simple setae.

Mandible (Figure 2a). Incisor process stout. Molar process well developed. Endopod palp absent.

Maxillule (Figure 2b). Basial endite with 2 plumodenticulate to cuspidate setae, 2 plumodenticulate setae and 1 plumose setae. Coxal endite with 5 plumodenticulate setae and 1 plumose seta. Endopod 2-segmented, with 1 plumose seta on proximal article and 6 plumose setae (2 subterminal + 4 terminal) on distal article.

Maxilla (Figure 2c). Coxal endite bilobed with 4 + 4 plumodenticulate setae. Basial endite bilobed with 4 + 4 plumodenticulate setae. Endopod bilobed with 3 + 5 (2 subterminal + 3 terminal) plumodenticulate setae. Scaphognathite with 4 marginal setose setae and stout posterior process.

First Maxilliped (Figure 2d). Coxa with one plumose seta. Basial segment with 10 medial plumose setae arranged 2, 2, 3, 3. Endopod 5-segmented with 3, 2, 1, 2, and 5 plumose setae. Exopod 2-segmented with 4 terminal plumose setae.

Second Maxilliped (Figure 2e). Coxa without setae. Basial segment with 4 medial plumose setae arranged 1, 1, 1, 1. Endopod 3-segmented, with 1, 1, and 2 subterminal + 3 terminal plumose setae. Exopod 2-segmented, with 4 terminal plumose setae.

REMARKS AND DISCUSSION

Comparison of larvae from Brazil with those from the eastern Caribbean

Larvae from Guana Island (BVI) differ from those from Brazil only slightly. Brazilian larvae were longer, based on measurements of the rostral-to-dorsal spine

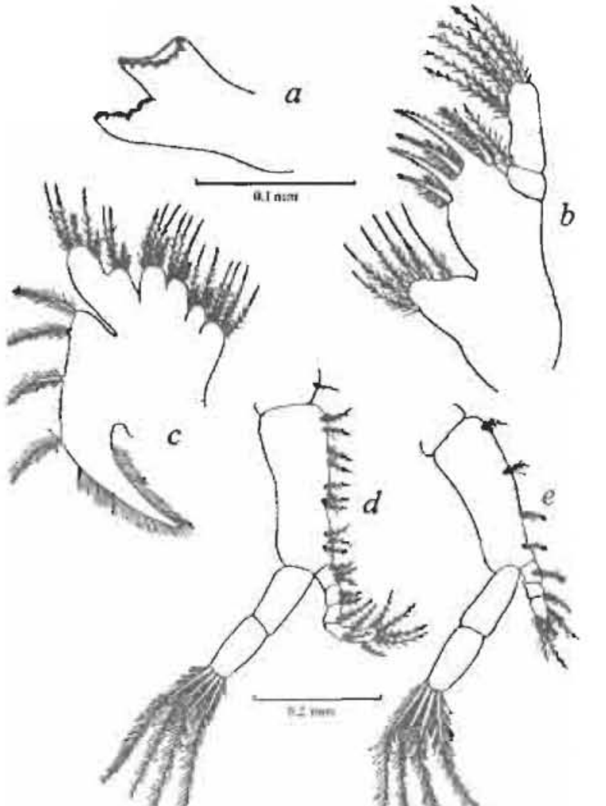

Figure 2. Morphology of the first zoea of *Platypodiella spectabilis* (based on specimens from Brazil). a, mandible. b, maxillule. c, maxilla. d, first maxilliped. e, second maxilliped.

Figure 3. Additional figures of the first zoea of *Platypodiella spectabilis* from a female collected in the British Virgin Islands. a, frontal view showing relative lengths of lateral and dorsal carapace spines. b, right fork of telson and right side setae, dorsal view. c, antenna (left) and antennule (right).

lengths, but were equally wide (lateral spine tip-to-tip length). Rostral spinules were fewer in the BVI specimens, with sometimes as few as only 2 spinules, whereas Brazilian larvae always possessed 6 rostral spinules. Aesthetascs of the antennule usually numbered 2 in the BVI specimens but 3 in the Brazilian specimens. Placement of the 2nd (smaller) lateral spine on the telson appeared to be slightly more posterior in the BVI specimens (compare Figures 1b and 3b), although this may be only a matter of interpretation of the illustrator. Thus, despite the geographic distance separating the parental females, larvae from the 2 areas are quite similar.

Observations on hatching behavior of the parental female

The parental female collected in the BVI was observed from the time of collection (late afternoon) until about 0130 the following morning. Hatching of the eggs commenced at about 1930 on July 14. As hatching began, the female began rhythmically pumping her abdomen at a rate of about 1 pump per second, with a pattern of 4 or 5 pumps followed by a short pause, followed by 4 or 5 pumps, followed by another pause. This rhythmical pumping continued for several hours, gradually slowing at 0130 the next morning (15 July), at which time the female and her remaining eggs were preserved. At the time of preservation, there were still a large number (we estimate about 1/10) of the original number of eggs remaining on the pleopods. It is not known if these eggs would have continued to hatch throughout the night. Thus, hatching in this species can take at least 5 hours based on these limited laboratory observations. The effects of captivity and confinement in a small container are unknown; these factors also could play a role in the crab's behavior.

Systematic position of *Platypodiella* based on larval morphology

The reduced antennal expopod, well-developed lateral carapace spines, and setation of the endopods of the maxilla, maxillule, and both maxillipeds all combine to suggest that *Platypodiella* belongs among the Group I xanthid zoeas of Rice (1980) and Martin (1984). Within this group, *Platypodiella* belongs to a subgroup that bears spinules on the protopod of the antenna (see below).

Guinot (1967), when erecting the genus *Platypodiella*, remarked on the similarities between species of this genus and those of *Platyactaea* Guinot, 1967, and to a lesser extent to species of *Atergatis* De Haan, 1833 and *Atergatopsis* A. Milne Edwards, 1862, as well as to members of *Platypodia*. The latter 3 genera are usually considered members of the xanthid subfamily Zosiminae (Serène 1984, Clark and Ng 1998). Thus, one might expect to find morphological and zoeal similarities among species of these genera. To our knowledge, within these genera descriptions of the first zoea exist only for *Atergatis* (Terada 1980) and for *Platypodia* (Hashmi 1970). Larvae of another Zosiminae genus, *Lophozozymous*, were recently described by Clark and Ng (1998). Martin (1984) placed *Atergatis* (based on Terada's description of the larvae of *A. reticulatus* DeHaan, 1835) in Group I, but was indecisive about Hashmi's (1970) description of the zoea of *Platypodia cristata* (A. Milne Edwards, 1865), and left it in an "incertae" grouping of xanthid larvae having no clear affinities. Hashmi (1970) did not provide illustrations of any larval features of *P. cristata*, instead indicating the antennal and telson "types" using a schematic diagram. The antenna of *P. cristata* was categorized by Hashmi (1970) as "type b," where the antennal exopod was at least 1/2 the length of the protopod. Thus, in this feature there is a significant difference between larvae of *Platypodia* and larvae of *Platypodiella*.

Concerning relationships of *P. spectabilis* to the numerous and diverse families of "xanthoids" (treated as the superfamily Xanthoidea, containing 12 families, by Martin and Davis in review): the rostral and antennal morphologies of the zoea of *P. spectabilis* may indicate an affinity with the subfamily Panopeinae (the Panopeidae of Guinot 1978, and Martin and Davis in review). The zoea of *P. spectabilis* is also similar to those of the Indo-Pacific *A. reticulatus* (as described by Terada 1980), sometimes considered a member of the xanthoid subfamily Zosiminae (Serène 1984). Clark and Ng (1998) correctly note that antennal morphology alone is insufficient for determining subfamiliar affinities within the xanthoids.

Comparison of the larvae of *P. spectabilis* with those of other western Atlantic xanthoids

Martin (1984), in his review of the larvae of xanthid crabs, listed some 25 species of xanthids (*sensu largo*) from the western Atlantic and Gulf of Mexico for which at least the first zoeal stage was described. Most of these (15) belonged to the Group I larvae as described above. Since that time several other descriptions of western Atlantic xanthid larvae have appeared (see Martin et al. 1985 for *Panopeus bermudensis* Benedict and Rathbun, 1891; Iorio and Boschi 1986 for *Platyxanthus patagonicus* A. Milne Edwards, 1879; Negreiros-Fransozo 1986a, b for *Panopeus americanus* De Saussure, 1857 and

Eurypanopeus abbreviatus Stimpson, 1860, respectively; Fransozo 1987 for *Eriphia gonagra* (Fabricius, 1781; Ingle 1985 for *Panopeus occidentalis* De Saussure, 1857; Ingle 1987 for *Cataleptodius floridanus* (Gibbes, 1850); Montú et al. 1988 for *Panopeus austrobesus* Williams, 1983; Martin 1988 for a review of xanthid larvae and information on phyletic utility of the megalopa stage; Bakker et al. 1989 for *Hexapanopeus schmitti* Rathbun, 1930; Fransozo et al. 1990 for *Hexapanopeus paulensis* Rathbun, 1930; Messerknecht et al. 1991 for *Eurytium limosum* [previously described by Kurata et al. 1981]; and Vieira 1999 for *Hexapanopeus caribbaeus* (Stimpson, 1871).

The first zoeal stage of *P. spectabilis* is very similar to the first zoea of a large number of western Atlantic xanthids. However, it can be readily distinguished from larvae of any of the previously described western Atlantic species by 2 characters. First, the antennal exopod is greatly reduced (true of all "Group I" xanthid zoeas), while the antennal protopod bears rows of spines on the distal 1/4 to 1/2 of its length. In this character, the first zoea of *P. spectabilis* is similar to existing descriptions of the first zoeal stage of *P. occidentalis*, *P. herbstii*, *P. americanus*, *P. austrobesus*, *E. limosum*, *Eurypanopeus abbreviatus*, *E. depressus*, *C. floridanus*, and *H. paulensis*. Second, the spinules on the rostral spine are known only for this species and for the first zoeas of *Garthiope barbadensis* (Rathbun, 1921), formerly *Micropanope* Stimpson, 1871 (Gore et al. 1981) and *C. floridanus* (Ingle 1987). The rostral spine of *P. spectabilis* can bear up to 6 sharp spinules, whereas first zoeal larvae of *G. barbadensis* and *C. floridanus* were each described as having only 2 such spinules.

Geographical Distribution

The distribution of *P. spectablis* as presently understood (i.e., assuming that there is a single species in the western Atlantic rather than a species complex) is in excess of 7,000 km. When we add to this the fact that *P. spectabilis* is found in the far western Gulf of Mexico (Felder 1973) and far eastern Caribbean (e.g., British Virgin Islands, this report), it becomes clear that the range of the species is extraordinarily large. However, such a range is not unique; there are other species of xanthoid crabs (e.g., *Eriphia gonagra* and *Carpilius corallinus* (Herbst, 1783) that have similar ranges (T. Zimmerman, personal communication). It is possible that the spectacular color pattern, from which the species derives its name, has caused workers to quickly and easily "identify" all of the various color forms (see description of color variation in Chace et al. 1986) as *P. spectabilis*. Because cryptic species are being discovered frequently on the basis of subtle color differences (see Zimmerman and Felder 1991 for species of *Sesarma* Say, 1817; Williams and Felder 1989 for species of *Menippe* De Haan, 1833), it is certainly possible that the wide range of colors and color patterns in *P. spectabilis* is hinting at a species complex rather than one wide-ranging species. If such is the case, it is also possible that we have misinterpreted the differences in larvae from the eastern Caribbean and Brazil (where the adult females are nearly 3 times the size of those in the BVI) as being caused by intraspecific, rather than interspecific, variation. On the other hand, this species can exhibit a wide range of colors and patterns within a very small geographic region (T.L. Zimmerman and J.W. Martin, unpublished data). Clearly more work on morphological and color variation in this species across its entire range is needed.

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THE STOMATOPOD *ALACHOSQUILLA FLORIDENSIS* (MANNING, 1962) (CRUSTACEA, STOMATOPODA, NANNOSQUILLIDAE) REPORTED FROM GUANA ISLAND, BRITISH VIRGIN ISLANDS, WITH OBSERVATIONS ON COLOR

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INTRODUCTION

Although color pattern can vary among and within species of the Crustacea, it can also be a conservative feature that can be very helpful in field identifications. This is often the case in the Crustacea Decapoda, where sibling species can be detected by subtle differences in color (e.g., Williams and Felder 1989, Zimmerman and Felder 1991, Knowlton and Mills 1992). Stomatopods are among the most colorful crustaceans when living. Many species show a great deal of variability (Manning 1969, Camp 1973), and knowledge of this coloration is often key to their identification in the field and in the lab (Schotte and Manning 1993).

As part of an ongoing survey of the marine invertebrate fauna of Guana Island, British Virgin Islands, we collected 2 large (45 mm and 48 mm TL) females, and one male specimen (30 mm TL) of the rarely reported stomatopod species *Alachosquilla floridensis* (Manning 1962). To our knowledge, the species has been reported previously in the literature only 4 times (see Schotte and Manning 1993). These reports are based on a total of 8 specimens. Previous distribution records for the species include Lake Worth Inlet, Florida; Virgin Gorda, US Virgin Islands; Isla Marguerita, Venezuela; Bahia, Brazil; and Saint Giles Island and London Bridge Rock, Tobago, West Indies (Manning 1969, Schotte and Manning 1993).

Alachosquilla floridensis was first described as *Lysiosquilla floridensis* by Manning (1962). The species was transferred to the genus *Acanthosquilla* by Manning (1963), along with *L. digueti* (Coutière 1905) from the eastern Pacific. Later, Manning (1974) synonymized *A. floridensis* with *A. digueti*. Subsequently Schotte and Manning (1993) recognized the differences between the 2 species, and also placed the 2 into a newly created genus, *Alachosquilla*.

MATERIALS AND METHODS

Two female and one male specimens of the stomatopod *Alachosquilla floridensis* (LACM CR1999020.1, 48 mm TL female; LACM CR1999020.2, 45 mm TL female, and 30 mm TL male), cataloged in the Crustacea collections of the Natural History Museum of Los Angeles County, were collected from shallow subtidal waters (1–1.5 m) along White Beach, a protected calcareous sand beach on Guana Island, British Virgin Islands, on 6 August 1999. They were collected using a stainless steel "yabby pump" suction device (see Manning 1975) while collecting callianassid shrimp (*Neocalichirus* spp.). It is not known if the stomatopods were sharing the callianassid burrows or had formed their own. Although 3 species of *Neocalichirus* were collected at this time, no specimens were brought up with the stomatopods, and no balanoglossids were seen.

Specimens were taken directly to the lab and chilled on ice until dead, at which time the larger female (LACM CR1999020.2) was photographed. Digital images were cleaned (backgrounds were replaced with solid black, and the images were adjusted for brightness and filtered using "unsharp mask") using Adobe Photoshop 5.5 software.

RESULTS

The dorsal and lateral integument is bright white. More-or-less transparent regions across the middle of each abdominal somite and between somites allow the orange-tan colored ovary to show through (Figure 1a, b) in the females. In our preserved specimens, dark chromatophores are present, forming very thin lines along the posterior margin of each abdominal somite. Two widely spaced spots of chromatophores occur at the posterior margin of the 5th abdominal somite. On the dorsal surface of the telson, a short longitudinal band of chromatophores lies on either side of the median dorsal tooth (Figure 1a, 2a). Manning (1969, Figure 16b) showed these bands as surrounding the bases of the 2 flanking teeth, and Schotte and Manning (1993, Figure 3b) omitted them from their figure altogether, but mentioned them in the text. This is the pigmentation pattern used to separate *A. floridensis* from its only eastern Pacific congener, *A. digueti*, which has but one central coalesced

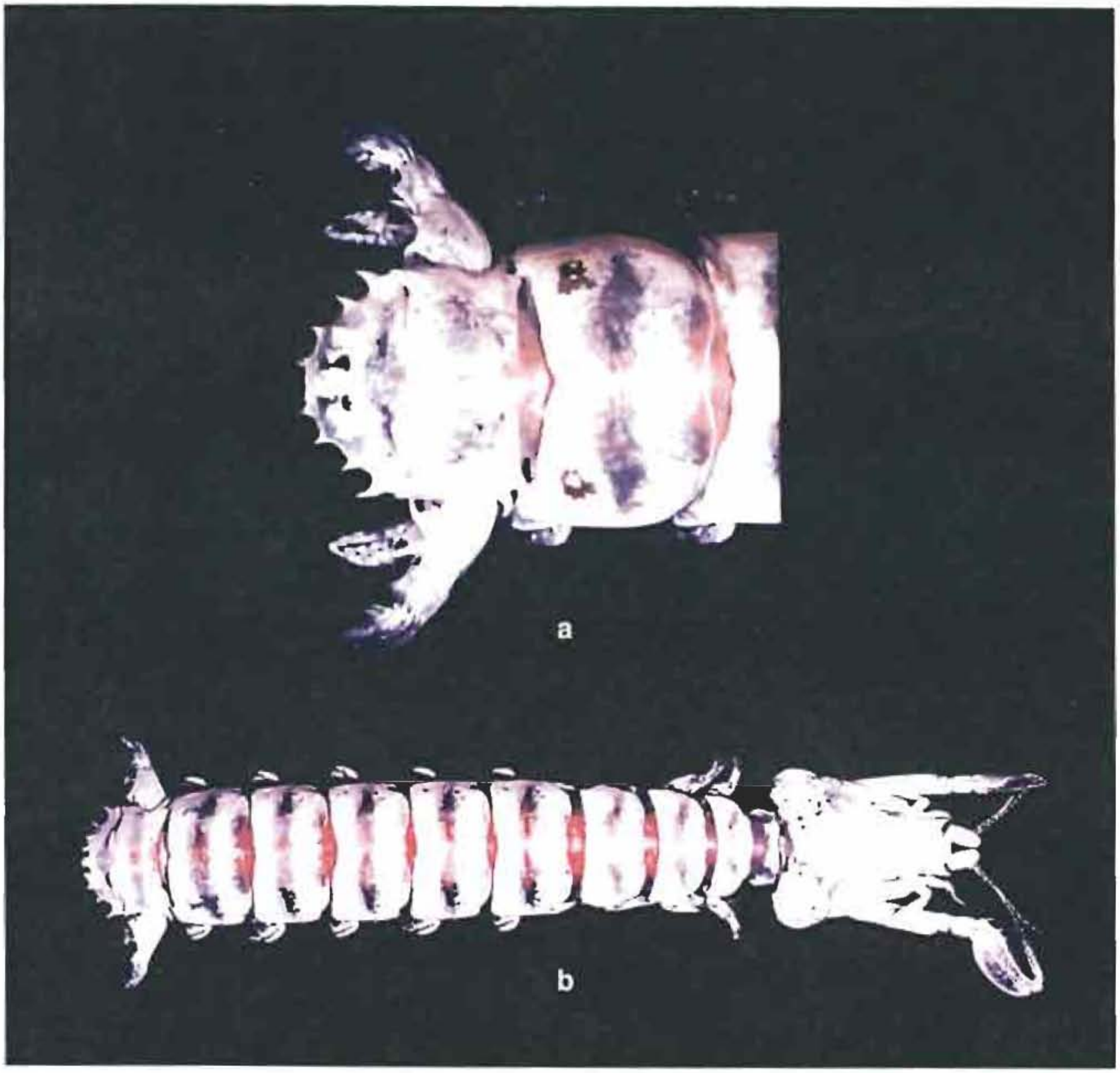

Figure 1. Color pattern of a fresh specimen of *Alachosquilla floridensis* (Manning, 1962) LACM CR1999020.2; a = close up of telson and posterior somites in dorsal view; b = whole animal in dorsal view.

spot. On the ventral surface of the telson, a small field of chromatophores can be seen posterior to the anus on one specimen. A dark crescent of chromatophores occurs at each posterolateral corner of the carapace. Scattered chromatophores also occur on the carapace, rostral plate, and eyestalks.

In all of our specimens (one preserved using only 75% EtOH = LACM CR1999020.1, and 2 fixed first in 10% formalin =LACM CR1999020.2) the teeth of the rostral plate extend only to the bases of the ocular peduncle, and the bases of the eyestalks are plainly visible. The expanded, fused ocular scales are clearly visible, protruding laterally from under the proximal half of the median rostral spine (Figure 2b).

DISCUSSION

Description of the animal's habitat is scattered. The type specimen came from "Shoreline" along Cape Florida, Key Biscayne, Florida (Manning 1962). Brazilian specimens (from Praia do Araçá) came from a very sheltered beach between normal low and extremely low tide level (Rodrigues 1971) with sediments consisting of layers of fine sand (predominantly 0.1–0.07 mm) overlying strata

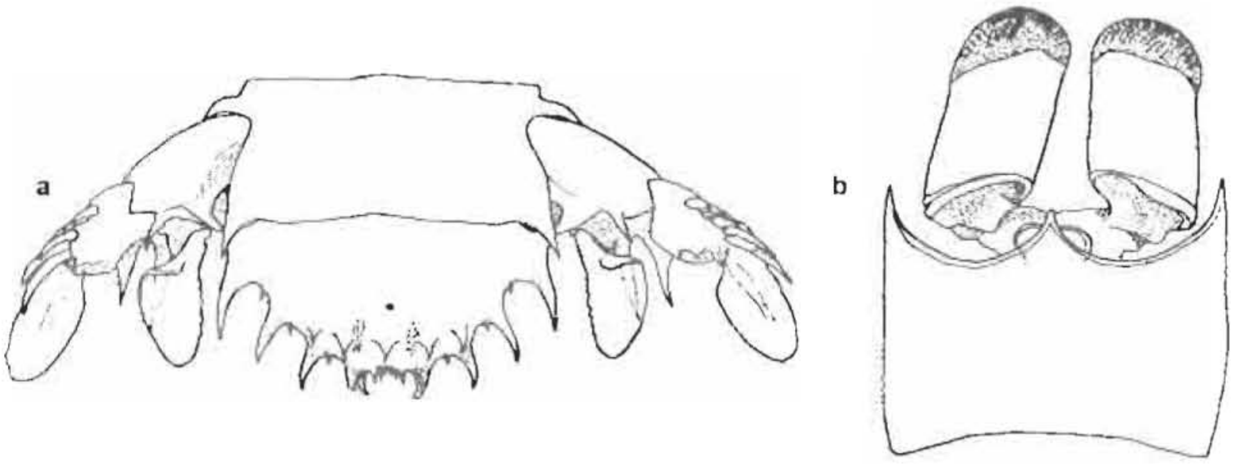

Figure 2. Diagnostic characters of *Alachosquilla floridensis* (Manning, 1962) from LACM CR1999020.1; a = telson and 6th abdominal somite, dorsal view (setae omitted); b = head in dorsal view.

of gravel (Burdon-Jones 1969, p. 256, Appendix 1). Habitat notes for Tobago specimens include: "Sublittoral, in 6–11 and 13–28 m; from rock, rubble, with live and dead coral, 6–11 m; and vertical rock wall to ledge, 13–28 m. This species, which burrows in level bottom substrates, certainly was taken from sand on the ledge rather than on the wall itself" (Schotte and Manning 1993: 573). Rodrigues (1971) mentioned taking *A. floridensis* with balanoglossids in Brazil in his original account of *Callianassa (Sergio) gaussitinga*.

Morphologically, and especially in regard to the very distinctive rostrum, our specimens agree with the figures and descriptions provided by Manning (1962, 1969) and Schotte and Manning (1993). One subtle difference is in the amount of head covered by the rostral plate, but this may be due to the relaxed death of the animals (D. Camp, personal communication, P.O. Box 4430, Seminole, FL 33775-4430).

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The first larval stage of *Microprosthema semilaeve* (Von Martens, 1872) (Crustacea: Decapoda: Stenopodidea) from Guana Island, British Virgin Islands

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Abstract. - The first larval stage of *Microprosthema semilaeve* (von Martens, 1872) is described from an ovigerous female collected off Guana Island, British Virgin Islands, Caribbean. The larvae are characterized by a broad, triangular telson bearing posterolateral spines and an "anomuran seta," a first maxilliped that differs markedly from the very similar (to each other) second and third maxillipeds, and the presence of the first pereiopod as a swimming appendage upon hatching, as is apparently true of all stenopodidean first stage larvae. Characters of the larvae are compared to those described from the Indian Ocean by Raje and Ranade (1978), and mistakenly attributed to this same species, and to those of stenopodidean larvae described by Gurney and Lebour (1941) from Bermuda plankton. Problems in identifying adult specimens of *Microprosthema* from the Caribbean are discussed.

Introduction

The decapod crustacean infraorder Stenopodidea comprises two families and 9 genera (see Holthuis, 1993) (a tenth genus is currently being described; see Chan and Goy, in press) of small, lobster-like shrimp, many of which are highly colorful. The affinities of stenopodideans to other groups of decapod crustaceans has been an ongoing source of controversy and interest (e.g. see Abele, 1991; Martin and Davis, in press). Despite the uncertainty that has always surrounded the relationships of stenopodideans to other decapods, and despite the recognized value of larval stages in taxonomy and phylogeny of decapods (e.g. see Rice, 1980, 1983), there are surprisingly few reports of larval stages of any stenopodideans. Gurney and Lebour (1941) (and following Gurney, 1936, on *Stenopus hispidus*) described some stenopodidean larvae from Bermuda plankton, and were able, with some uncertainty, to attribute most of them to genus level. To our knowledge, the only other publications in which stenopodidean larvae have been described in any detail are the works of Cano (1892, *Stenopus spinosus*) and a more recent paper by Raje and Ranade (1978), who described the larval stages of a species of *Microprosthema* from the Indian Ocean. Raje and Ranade (1978) attributed those larvae to the species *M. semilaeve* (Von Martens, 1872); however, the species could not have been *M. semilaeve*, because that species is restricted to the Caribbean and western Atlantic. Thus, Raje and Ranade described larvae of an undescribed species of *Microprosthema* that one of us (JWG) is describing (see also Goy, 1987).

Microprosthema semilaeve is a commonly encountered associate of reefs and rocky areas. The species has been reported throughout the Caribbean and western Atlantic, and was thought common enough by Williams et al. (1989) to be assigned the common name "crimson coral shrimp." Below, we provide the first description of the larvae of *Microprosthema semilaeve* (von Martens).

Materials and Methods

This study was prompted by the discovery of several small stenopodidean shrimps collected during a survey of the cryptic marine invertebrates of Guana Island, British Virgin Island, led by T. L. Zimmerman and J. W. Martin and funded by grants from the U. S. National Science Foundation and the Falconwood Corporation. Although various collecting methods have been employed during that survey, the single ovigerous female *Microprosthema semilaeve* from which larvae were reared was collected by hand on 18 July 2000 from BVI Station 82, Guana Island, BVI, just off North Beach, central to northeast end, in shallow water (less than 1 m), from rock and coral rubble. Collectors were T. Zimmerman, J. Martin, T. Haney, and R. Ware. The ovigerous female was photographed and assigned the photographic voucher number Vc1105; she and all of the first stage larvae have been deposited in the Natural History Museum of Los Angeles County and assigned catalog number LACM CR 00000. The live ovigerous female was maintained in seawater approximately 2 days, with larvae hatching on July 19, one day after capture of the female. Larvae and the spent parental female were preserved in 70% ethanol. Illustrations of the larvae were made using a Wild M5 stereoscope, a Wild M5 APO stereoscope, and a Nikon Labophot compound microscope, all equipped with drawing tubes.

Other Caribbean material was examined during a visit (JWM) to the U.S. National Museum of Natural History in February of 2001, including the following specimens: USNM 233997, *Microprosthema manningi* Goy & Felder (holotype); USNM 275993, *Microprosthema granatense* Criales (holotype), USNM 244439, Bahamas, *Microprosthema semilaeve* ovigerous female (non-type specimen).

Results

Size. -- Total length (tip of rostrum to posterior indentation of telson) 2.20 mm (N = 10).

Carapace (Fig. 1a, b). -- Extending posteriorly in a more or less straight line from the rostrum. Cervical groove slight but visible just posterior to large, well developed eyes. Dorsally with medial rounded invagination. Minutely punctate and minutely granulate, especially on posterolateral half. Rostrum straight, unornamented, extending to level just short of distal extremity of second peduncular article of antenna 1.

Antennae (Fig. 1d). -- Antennule (first antenna) biramous, but with inner ramus (endopod) so reduced as to appear as a single thick plumose seta. Outer (lateral) ramus (exopod) short, approximately 1/3 length of article preceding it, and with 4 plumose distal setae. More proximal articles (1 and 2) unarmed, second longer than first. Antenna (second antenna) inner ramus (endopod) short, approximately half length of exopod, and with two long, stout plumose setae; outer ramus (exopod) with curving inner border and nearly straight lateral border, bearing setae from midpoint on medial border around tip and on to distolateral edge of lateral border as shown.

Abdomen and Telson. -- Abdomen (Fig. 1b, c) with minute teeth on posterolateral borders of somites 3 and 4, and with sharp spine extending ventrally from sternal region of somite 5 (Fig. 1c). Sixth abdominal somite not distinguishable from (fused to) telson. Telson (Fig. 1e, f) broadly triangular in dorsal view. Lateral corners ending in acute tooth, followed immediately by a stout, setose articulating spine that curves dorsally and laterally. Area between tooth and spine harboring single "anomuran seta," which in some cases is actually 2 or 3 thin setae (Fig. 1f). Posterior border of telson with shallow sharp indentation medially, and with 4 long plumodenticulate setae and 1 considerable shorter plumodenticulate seta on each side of medial indentation.

Mandible (Fig. 2a). -- Broad, simple, spade-shaped, with slight tooth at dorsodistal corner. Palp lacking.

Maxilla 1 (maxillule) (Fig. 2b). -- Protopod consisting of two lobes; anterior lobe with two heavy cuspidate and serrate spines and three plumodenticulate setae; posterior lobe with two stout spines, two plumodenticulate setae, and one heavier seta extending posteriorly from lower margin. Palp lacking.

Maxilla 2 (maxilla) (Fig. 2c). -- Palp bearing 1 subterminal and 2 terminal plumose setae. Protopod subdivided into 3 large enditic lobes, with setation 4, 3, and 4 (proximal to distal). Scaphognathite poorly developed, with 2 to 4 plumose setae and usually a stronger setose "posterior process."

Maxilliped 1 (Fig. 2d). -- Endopod weakly 3-segmented, with setation 2, 2, 4. Exopod (palp) unsegmented, with 4 distal plumose setae. Protopod weakly 2-segmented; basal article with two plumodenticulate setae; distal article subdivided into 3 lobes, with setation 3, 2, 2; some setae distinctly stronger and more spinulose than others, especially noticeable on posteriormost lobe of second article.

Maxilliped 2 (Fig. 2e). -- Basis with 4 setae arranged 1, 1, 2. Endopod 5-segmented, with setation 2, 1, 0, 2, 1 + 5. Exopod 2-segmented, with setation 1, 5.

Maxilliped 3 (Fig. 2f). -- Very similar to maxilliped 2. Basis with 3 setae occurring singly. Endopod 5-segmented, with setation 2, 1, 0, 1, 4. Exopod (palp) weakly two segmented, with setation 1, 4.

Pereiopod 1 (Fig. 2e). -- Endopod small, bearing 3 terminal, 1 subterminal, and 1 basal plumose setae. Exopod with numerous crenulations and bumps, 2-segmented, with 2 setae on either articles

Remarks

There are currently four described species of *Microprosthema* reported from the Caribbean and/or western Atlantic: *M. semilaeve* (von Martens, 1872), *M. manning* Goy and Felder, 1988; *M. looensis* Goy and Felder, 1988; and *M. granatense* Criales, 1997 (see review by Criales, 1997). The description of a fifth species is currently in press (Martin, in press). The species *Microprosthema inornatum*, described by Manning and Chace (1990) from Ascension Island, South Atlantic, could potentially be in the Caribbean as well, because species of stenopodideans tend to have a relatively long larval duration (J. Goy, unpublished data). Additionally, we are aware of another undescribed species of *Microprosthema* from the Dry Tortugas (J. Goy, unpublished).

Confirming the identification of the adult parental female from Guana Island from which larvae were obtained proved more difficult than we anticipated. The coloration of the adult was a striking red and white, matching closely with the color description of *M. semilaeve* provided by Manning (1961) and befitting the common name "crimson coral shrimp" bestowed on it by Williams et al. (1989). However, the chelipeds of the parental female from Guana Island are more delicate and lack the large dactylar tooth as compared to "typical" *M. semilaeve* in the holdings of the USNM. Additionally, the chelae possessed a layer of fine, short, plumose setae on the inner face of the propodus. Comparison with specimens or illustrations of "true" *M. laevis* proved to be difficult, as that species has not been illustrated other than by Rankin (1898, side view of whole animal), Holthuis (1946, scaphocerite only), and Rodriguez (1980, partial views of carapace and abdomen). Thus, although commonly reported in the literature, this species lacks a thorough modern description. For the purposes of this report we are assuming that the crimson and white coloration is specific to this species, and thus we are referring our Guana Island specimen, and its larvae, to *Microprosthema semilaeve*.

First stage larvae of *Microprosthema semilaeve* described herein are morphologically very similar to the larvae described by Raje and Ranade (1978) for an Indian Ocean species of *Microprosthema* (which was erroneously attributed to *M. semilaeve*). Differences include the mandible, which in *M. semilaeve* appears broadly rounded and not as toothed as in the figure provided by Raje and Ranade (1978; their fig. 1d), and overall less setose appendages in the Indian Ocean larva. The first and second abdominal somites of the Indian Ocean species bear ventral projections not evident in our specimens. Finally, there are slight differences in the setal counts of some of the articles of the mouthparts and of the endopod of the first pereiopod, although these slight discrepancies might be simply differences in perceiving the appendages or variation within a batch of larvae.

Of the various stenopodidean larvae described from Bermuda plankton by Gurney and Lebour (1941), their larvae A, B, and C are most similar to ours. Raje and Ranade (1978) also felt that larvae A and B of Gurney and Lebour were most similar to their description of *Microprosthema* larvae from the Indian Ocean, and noted that B was "closer to *Microprosthema* than any other species described." However, Raje and Ranade also noted differences between their Indian Ocean larvae and both larvae A and B of Gurney and Lebour (1941). Gurney and Lebour (1941) thought that larva B, the most common larval type encountered by them off Bermuda, was possibly an undescribed species of the genus *Stenopus* (recall that the genus *Microprosthema* was not established at that time), and later in the paper they state note that "it seems probable that species A, B, C, E, and F do not belong to the genus *Stenopus*." Our description of larvae of *Microprosthema semilaeve* (Von Martens) differs from their larvae A and B in having a shorter rostrum, a straight (rather than recurved) spine on the sternum of abdominal somite 5, and no postorbital spines. Thus, we cannot with certainty assign any of their descriptions to larval stages of *Microprosthema* as currently understood.

Acknowledgements

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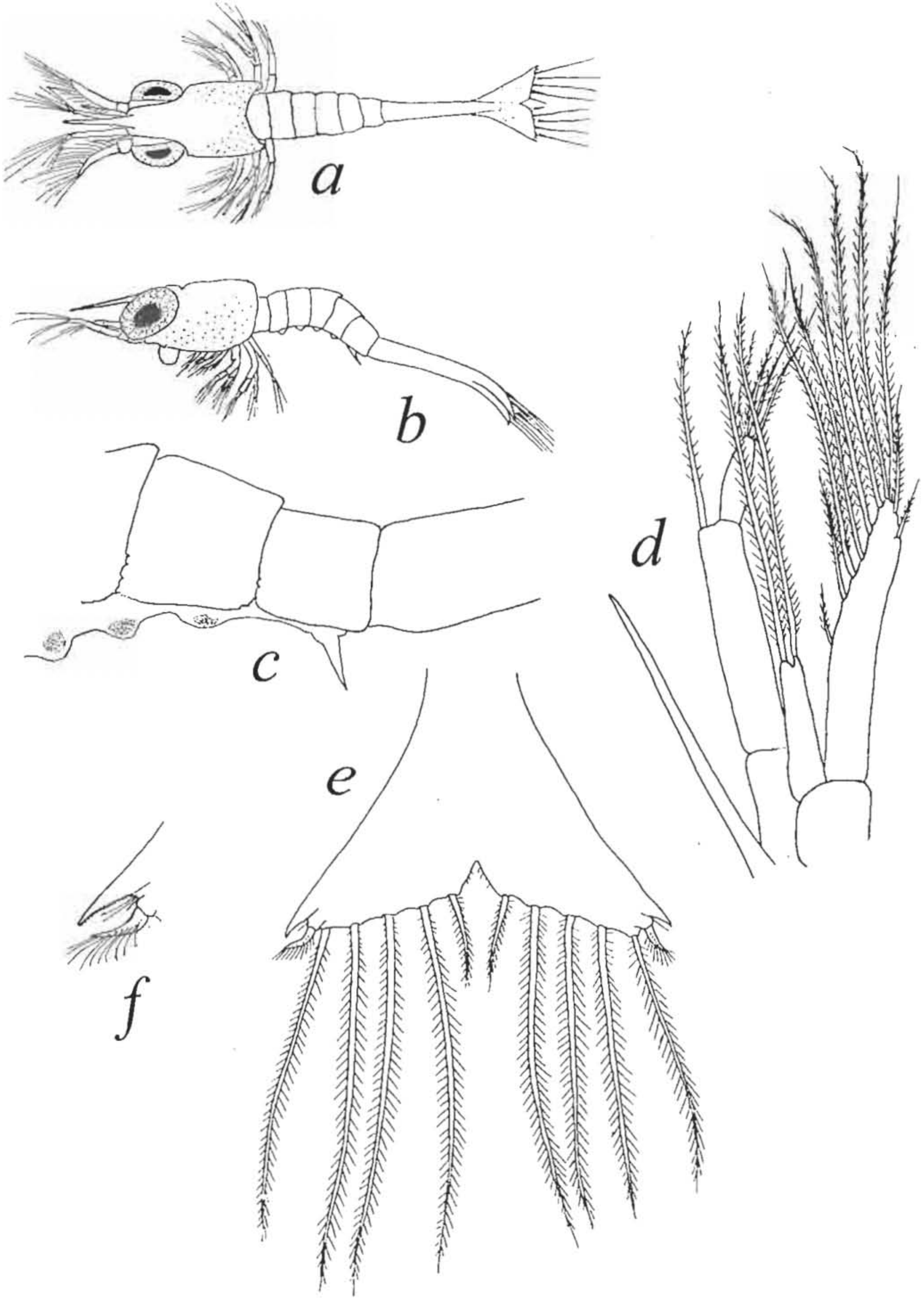
Figure Legends

Figure 1. First zoeal stage of the stenopodidean shrimp *Microprosthema semilaeve* (von Martens, 1872) from an ovigerous female collected off Guana Island, BVI, Caribbean Sea. a, entire larva, dorsal view. b, same, lateral view. c, higher magnification of abdominal somites 3-5 and anterior of somite 6 (still fused to telson at this stage), showing acute spine extending from sternum of somite 5. d, rostrum (r), antennule (first antenna) (a1), and antenna (second antenna)(a2) in dorsal view, drawn in situ. e, telson, dorsal view. f, higher magnification of posterolateral spines of telson, dorsal view. Scale bars = xxxxxxx.

Figure 2. First zoeal stage of the stenopodidean shrimp *Microprosthema semilaeve* (von Martens, 1872), mouthparts and first pereiopod. a, mandible. b, maxillule (first maxilla). c, maxilla (second maxilla). d, first maxilliped. e, second maxilliped. f, third maxilliped. g, first pereiopod. Scale bars = xxxxxxx.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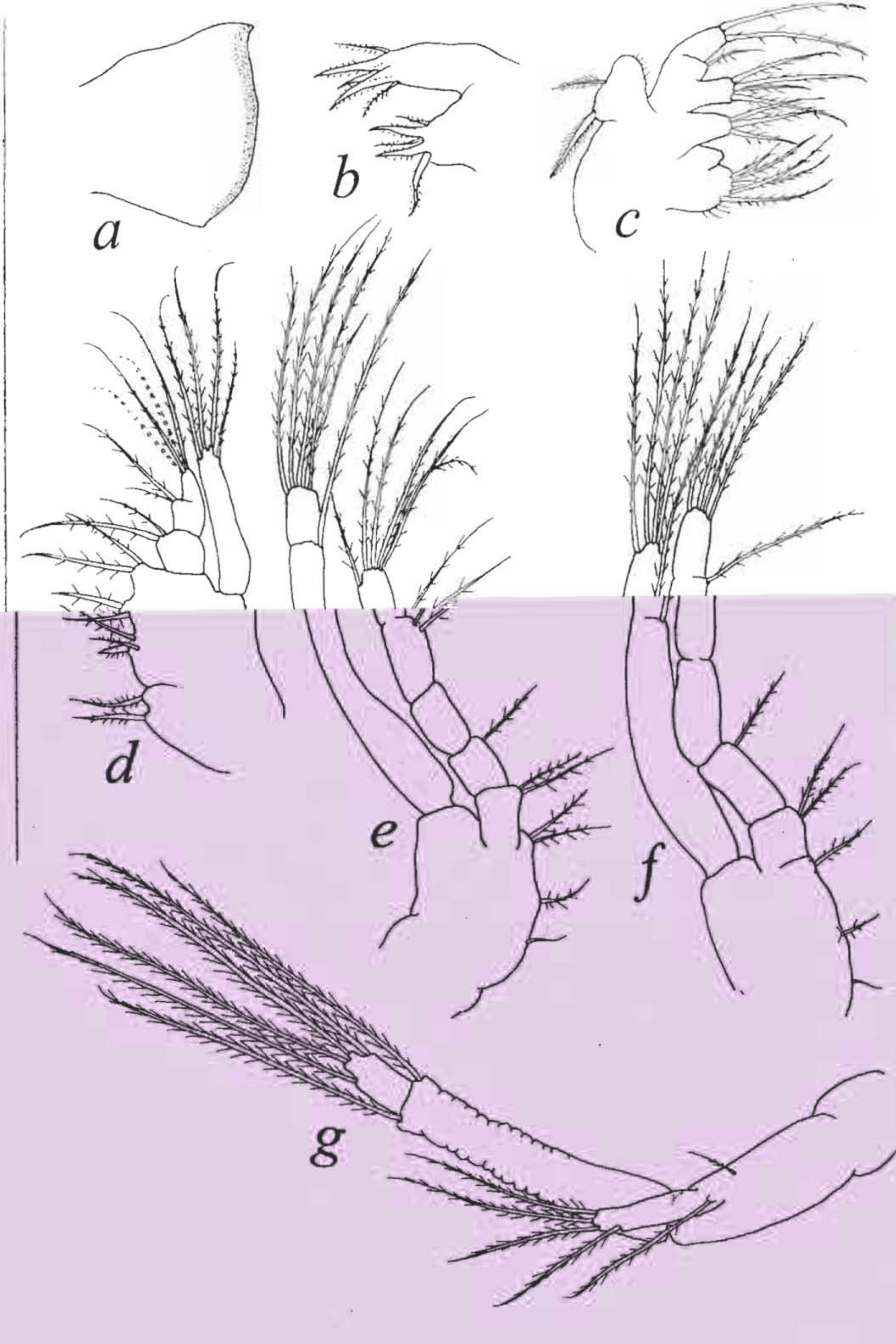
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Microprosthema jareckii, a new species of stenopodidean shrimp (Crustacea: Decapoda: Stenopodidea: Spongicolidae) from Guana Island, British Virgin Islands

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Abstract. -- A new species of the stenopodidean shrimp genus Microprosthema, M. jareckii, is described from two specimens collected off the coast of Guana Island, British Virgin Islands. The species differs from known congeners by the shape and spination of the rostrum, spination of the carapace, shape of the third pereiopod, dentition of the mandibular palp, and coloration (the new species is completely white). The new species is compared to all other known species of Microprosthema in the Caribbean.

Relatively few species of stenopodidean shrimps have been reported from the Caribbean and western Atlantic. Published reports include three species of the genus *Stenopus* Latreille, 1819 (*S. hispidus* (Olivier, 1811), *S. scutellatus*, Rankin, 1898; and *S. spinosus*), one species of *Richardina* A. Milne Edwards, 1881 (*R. spinicincta* A. Milne Edwards 1881, known in the western Atlantic from a single specimen [Goy 1982] although numerous unpublished records exist; J. Goy, pers. comm.), one species of *Spongiocaris* Bruce & Baba, 1973 (*S. hexactinellicola* Berggren, 1993) (now known from the Bahamas, Dry Tortugas, and Puerto Rico; Berggren 1993, and J. Goy, unpublished data), two species of *Odontozona* Holthuis, 1946 (*O. striata* Goy, 1981 and *O. libertae* Gore,_1981) (described by Goy 1981 and Gore 1981, respectively), and four species of *Microprosthema* Stimpson, 1860. The known species of *Microprosthema* are *M. semilaeve* (von Martens, 1872); *M. manningi* Goy & Felder, 1988; *M. looense* Goy & Felder, 1988; and *M. granatense* Criales, 1997 (see Criales 1997 for a review and key). Two other stenopodidean species, *Odontozona anaphorae* and *Microprosthema inornatum*, both described by Manning & Chace (1990) from Ascension Island, South Atlantic, could potentially be here, as species of stenopodideans tend to have a relatively long larval duration. Criales (1997) lists *M. inornatum* among the known western Atlantic species of *Microprosthema*, although to our knowledge it is known only from the type locality (Ascension Island, eastern South Atlantic). Additionally, we are aware of at least two other undescribed species of *Microprosthema* and several unpublished records of *Richardina spinicincta* (J. Goy, unpublished data), and the first occurrence of the genus

Paraspongicola de Saint Laurent and Cléva, 1981, in the Atlantic has recently been reported based on specimens from Caribbean Venezuela (Rodriguez Q. & Goy, in press). Below I describe a new species of Microprosthema from Guana Island, British Virgin Islands.

Materials and Methods

The specimens reported below were collected during the course of a biodiversity survey of the cryptic marine invertebrates of Guana Island, British Virgin Islands, led by T. L. Zimmerman and J. W. Martin and funded by grants from the U.S. National Science Foundation and the Falconwood Corporation. Various collecting methods were employed during that survey, including light traps, hand collecting, and arrays of artificial reef matrices (ARMs). The ARMs consisted of four slabs of concrete, each approximately 30 x 50 x 6 cm, containing holes of different sizes. The concrete slabs were set upon a basket filled with coral rubble, and the basket was set into the substrate so that the bottom concrete slab was roughly level with the sea floor. These arrays were deployed at a depth of 30 feet (10 m) at 8 different locations around Guana Island, and at two locations in shallower water, in the summer of 1999 and were collected one year later. The two specimens of the new species of Microprosthema were collected from the ARM deployed off of Monkey Point, Guana Island, when that ARM was harvested on 20 July 2000. Other Caribbean material was examined during a visit to the U.S. National Museum of Natural History in February of 2001, including the following specimens: USNM 233997, Microprosthema manningi Goy & Felder, 1988 (holotype); USNM

275993, Microprosthema granatense Criales, 1997 (holotype), USNM 244439, Bahamas, Microprosthema semilaeve von Martens, ovigerous female (non-type specimen). Both specimens of the new species have been deposited in the Crustacea collections of the Natural History Museum of Los Angeles County.

Results

Family Spongicolidae Schram, 1986

Genus Microprosthema Stimpson, 1860

Microprosthema jareckii, new species

Figs. 1-5

Material Examined. -- One male (holotype, LACM CR 00000), one female (paratype, LACM CR 00000), BVI Station 46C, 22 July 2000, ARM at Monkey Point, 30 feet, SCUBA, morning dive. Coll. T. Zimmerman, R. Ware, H. Haney, J. Martin. Photographic voucher numbers: Vc1314 (male), Vc1316 (female).

Habitat. -- Known only from Monkey Point, Guana Island, British Virgin islands, from an artifical reef matrix, 30 feet (10 m) depth. The surrounding seafloor was predominantly hard bottom with scattered coral heads, coral rubble, and sea fans, and occasional pockets and channels of sand.

Description. -- Carapace (Figs. 1, 3a, b) with relatively few short dorsal and dorsolateral spines (as compared to other members of the genus), all of which are directed anteriorly, and with numerous distally plumose setae giving the animal an overall "fuzzy" appearance. Cervical groove present but weak, with sharp spines just posterior to groove on dorsal and dorsolateral regions, and terminating at level of strong hepatic spine. Carapace spines more numerous and better developed on anterolateral (branchiostegal) regions. Antennal and orbital spines strong, acute, well developed. Rostrum large, extending to level of distal end of antennular peduncle, well developed, strongly curved downward, ventrally with one small subterminal tooth, dorsally with series of 5 teeth (excluding acute tip of rostrum), continuing posteriorly (with additional teeth) along well defined carina that extends back to cervical groove.

Eyes (Fig. 3a, b) with cornea slightly smaller in diameter than eyestalk; eyestalk with small spines just proximal to, and extending slightly laterally over, cornea.

Abdomen (Figs. 1, 3c) smooth, lacking transverse ridges. Abdominal somites 1-3 pleura terminating in rounded point bearing 3 setae (close up illustration, Fig. 3c), somites 4-6 more rounded. Pleura of somites 1-3 each bearing 2 or 3 teeth on anterior and posterior borders; those on anterior border more acute than those on posterior border.

Antenna 1 (Fig. 4a, b) with large slightly curved stylocerite extending only to distal end of its own (basal) article, and with one smaller tooth on distal end of second article and pair of teeth on distalmost article of peduncle. Flagellar articles (Fig. 4b) heavily setose, with setae arising more or less circularly around each article, giving the flagella a bushy overall appearance (Fig. 2b).

Antenna 2 (Fig. 4c) with sharp teeth on all peduncular articles. Scaphocerite reaching well beyond tip of rostrum (tip of rostrum in dorsal view extending about 1/3 length of scaphocerite), strongly curved on medial border, nearly straight on lateral border. Lateral border with 4 sharp teeth in addition to sharp distolateral tooth at corner.

Mandible (Fig. 4d) on left side (right side not examined) with smooth, sharp, blade-like cutting edge, posterior side strongly concave (left side of Fig. 4d). Anterodistal corner of cutting edge marked by extremely long sharp tooth; posterodistal corner with shorter, subtriangular tooth. Mandibular palp composed of three articles, second of which bears two strong spines, one at approximate midlength and one near distal articulation with terminal article. Terminal article lanceolate, broadest at midlength, tapering to acute tip and bearing scattered setae as illustrated.

Maxilla 1 (Fig. 4e) with heavy, serrate spines on upper endite and scattered simple and plumose setae on lower endite. Palp with two articles, distalmost of which bears 2 short terminal setae. Maxilla 2 (Fig. 4f) endites strongly bilobed, with setation (proximal to distal) 10 + 5, 8 + 13. Blade of scaphognathite not examined.

Maxilliped 1 (Fig. 4g) with unsegmented endopod bearing 13 long plumose setae on curved anterolateral border. Basipodite long and wide, bearing numerous short setae, relatively straight along medial border and broadly curved on anterolateral border. Coxopodite small, approximatley 1/5 length of basipodite and unsegmented. Expopod long and slender, with numerous plumose setae increasing in number distally and with minute crenulations beginning just distal to somewhat abrupt bend and continuing to tip. Epipod divided into equally sized distal and proximal lobes, neither with any setation.

Maxilliped 2 (Fig. 4h) with 4-segmented endopod. Dactylus lanceolate and densely setose on medial border. Propodus slightly shorter than dactylus and with dense medial setation similar to dactylus. Carpus approximately same length as propodus, triangular, with distal end broader, lacking dense setation but with 7-10 long, simple dorsodistal setae. Merus subrectangular, with 13 or 14 long simple setae spaced regularly on minute cuticular projections along medial border and with short simple setae on anterolateral border.

Maxilliped 3 (Fig. 4i, j) endopodite strongly developed, 5-segmented. Dactylus elongate-triangular. Propodus longer than dactylus, with dense setae along medial border and with distal dense setal brush ("setiferous organ" of some workers); four long simple setae proximal to this brush on medial border. Carpus approximately equal in length to propodus, with strong distolateral spine extending beyond distal border of segment, and with 7 long, simple setae arising from slight cuticular protrusions along medial border. Merus slightly longer than carpus, with 4 strong spines along lateral border; distal-most such spine extending to midlength of carpus. Ischium longer than merus, with 8 spines along lateral border, increasing in size distally, and with single anterodistal spine on medial border. Exopod long, slender, reaching (excluding setation) just past midlength of endopodal merus, with numerous plumose setae beginning at approximate midlength of exopod, increasing in number toward tip.

Pereiopod 1 (Fig. 5a) short, stout, spinose. Dactylus unremarkable, approximately half length of propodus (including fixed finger). Propodus slightly swollen basally, with obvious cleaning brush on inner surface; setae of cleaning brush recessed centrally. Carpus wiwth 6 heavy spines along outer (lateral) border and with cleaning brush on distomedial border, probably opposing brush of propodus when pereiopod is flexed. Merus with two stout spines on medial border and 4 spines, increasing in size distally, along lateral border, plus single sharp distolateral tooth. Entire appendage with scattered distally plumose setae on all articles except dactylus.

Pereiopod 2 (Fig. 5b) longer and more slender than pereiopod 1, lacking propodal-carpal cleaning brush. Chelipedal fingers with small regularly spaced teeth along cutting edges; tips of fingers with clusters of simple setae. Carpus longer than any other article, with series of 5 heavy spines along outer (lateral) border. Merus with two stout spines on medial border and 4 stout spines along lateral border. Scattered distally plumose setae on all articles except dactylus.

Pereiopod 3 (Fig. 5c) extremely large, heavy. Merus wiwth two stout spines on inner (medial) border, one at approximate midlength and one at approximate 3/4 length of merus. Carpus triangular in dorsal view and in cross section; dorsal surface slightly excavate, widening distally into shallow trough; lateral border of carpus with 4 stout spines and distolateral tooth; medial border with three small spines and cluster of short spines on distomedial border. Propodus deep, centrally thick but narrowing to bladelike carina dorsally (dorsal crista), with minute serrulations on dorsal border and ventral border, fading to smooth along ventral border of fixed finger; cutting edge of finger with large triangular tooth at base. Dactylus with minute serrulations on proximal third of upper (dorsal) surface; cutting edge with large triangular tooth opposite and just distal to similar tooth on propodal finger. Dactylar and propodal fingers slightly overlapping when chela closed. Entire chela high (dorsal to ventral) but thin (medial to lateral); inner surface of chela slightly concave, with chela curved inward toward front of animal.

Pereiopods 4 and 5 (Fig. 5d, e) long, slender, similar to one another, with short, bifurcated dactylus; ventral branch of dactylus shorter, approximately half length of dorsal branch. Propodus undivided , with series of 15 (P4) to 17 (P5) short, sharp movable spines spaced regularly along ventral border. Carpus longer than merus, which is longer than propodus. P4 with three setae arising from slight ventral protrusion and with scattered simple setae dorsally; only 2 such setae (plus one seta not arising from a protuberance) see on P5.

Pleopods (not illustrated) as for the genus (Holthuis, 1946), with first pleopod uniramous and pleopods 2-5 biramous; all pleopods lacking appendices.

Telson and uropods (Fig: 3d) broad, strongly deflexed, not visible or only partly visible in dorsal view in life (Figs. 1, 2a, 3c); telson approximately equal in length to uropods. Exopod with 5-7 small teeth on lateral margin and terminating in acute tooth on distolateral corner; distal border smoothly rounded, with rounded border not exceeding length of distolateral tooth, continuing dorsally to form interior (medial) border. Endopod similar, with fewer teeth on lateral border and with rounded posterior border clearly extending beyond length of distolateral tooth. Both endopod and exopod heavily setose on posterior and medial borders. Telson subtriangular, with strong lateral teeth at approximate midlength. Dorsal surface with 4 teeth at anterior third and two longitudinal rows of three spines each. Lateral edges terminating distally in small acute tooth. Posterior border slightly curved, with small tooth at midpoint, and heavily setose.

Color (see Fig. 2) of both specimens was completely white and slightly translucent (Fig. 2a, b). The only color discernable other than white was a yellowish central area under the carapace, caused by the hepatopancreas showing through the carapace. There were no other colors on any of the body parts.

Etymology. -- I am pleased to name this new species after Henry and Gloria Jarecki, in appreciation for their concern for the preservation and conservation of our natural world, and especially for their vision in establishing a protected nature preserve on Guana Island, BVI.

Remarks. -- Of the previously described species of Microprosthema known from the Caribbean and western Atlantic, the new species is most similar in coloration to M. manningi and M. looensis, both of which were described by Goy & Felder (1988). Goy & Felder (1988) described coloration in M. manningi as being "whitish to pale tan; antennae, abdomen and appendages white, abdomen and pereiopods sometimes edged in tan or pale magenta." Coloration in M. looensis was described by them as "carapace and abdomen whitish tan; antennae, telson, uropods, and all appendages white." Specimens of M. looensis held in captivity later appeared completely white (J. Goy, personal observation). Thus, all three of these species are predominantly white or whitish. However, an abundance of morphological characters serve to distinguish M. jareckii from M. manningi and M. looensis. Spination of the carapace in M. manningi is much more uniform than in M. jareckii, and the cervical groove is indistinct. The carapace spines of M. looensis are numerous and mostly blunt, rather than acute as in M. jareckii, the chela of the third pereiopod lacks the dorsal crista, the rostrum is shorter and ventrally unarmed, and all of the pereiopods are unique in being covered with short setae (see Goy & Felder 1988: fig. 7).

The new species shares with M. manningi the unusual and strikingly similar character of stout spines on the middle article of the mandibular palp (not known for any other species in the genus), and the more commonly encountered dorsal crista on the third pereiopod. However, the cutting edge of the mandible of M. jareckii is more similar to that of M. looensis in possessing a long acute process on the dorsodistal angle.

Coloration of M. granatense, currently known only from the southern Caribbean, was not noted by Criales (1997). However, M. jareckii is easily distinguished from M. granatense by the complete absence of spines on pereiopods 1 and 2, but a more spinose pereiopod 3, in M. granatense, as well as by differences in the spination of the carapace, relative width of the scaphocerite, subdivision of the propodus of pereiopods 4 and 5, relative height of the propodus of pereiopod 3, and spination of the third maxilliped.

Comparison of the new species to the widespread and commonly reported species Microprosthema semilaeve proved to be more difficult than expected, as that species has not been illustrated other than by Rankin (1898, side view of whole animal), Holthuis (1946, scaphocerite only), and Rodriguez (1980, partial views of carapace and abdomen). Although the color notes provided by Manning (1961) are quite detailed, I have not been able to locate the specimen on which that note was based (Manning did not mention a repository, and I did not see any specimens of M. semilaeve from his collection site among the specimens at the USNM). Thus, although commonly reported in the literature (the species is referred to as the "crimson coral shrimp" in the list of decapod common names assembled by Williams et al. 1989), this species (M. semilaeve) lacks a thorough modern description. For the purposes of this report I am assuming that the crimson and white coloration described by Manning (1961) is specific to this species, and thus color pattern is one obvious difference between M. jareckii (completely white) and Microprosthema semilaeve (mostly brilliant red). Additionally, Goy & Felder (1988) examined 78 specimens of M. semilaeve and noted (among other characters) that in all specimens examined the "carpi and propodi of the third maxillipeds lack spines" (not true in M. jareckii, which bears 4 very heavy spines on this article; see Fig. 4i, j), the "merus of the first pereiopod lacks spines" (in contrast there are 7 heavy spines present on the merus of P1 in M. jareckii; see Fig. 5a), and the "second pereiopod bears only 1-2 meral spines" (6 present in M. jareckii, Fig. 5b). Therefore, even without the difference in coloration, these obvious morphological differences confirm that Microprosthema jareckii is distinct from M. semilaeve, at least as defined and understood by Goy & Felder (1988). A thorough redescription of M. semilaeve would seem an obvious next step in our understanding of Caribbean stenopodidean shrimps.

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Figure Legends

Fig. 1. *Microprosthema jareckii* new species, holotype male, LACM CR 00000. This is an artifical "composite view, composed of separate illustrations drawn at the same scale and later pieced together to show relative sizes of the carapace, abdomen, and appendages (especially the third pereiopod).

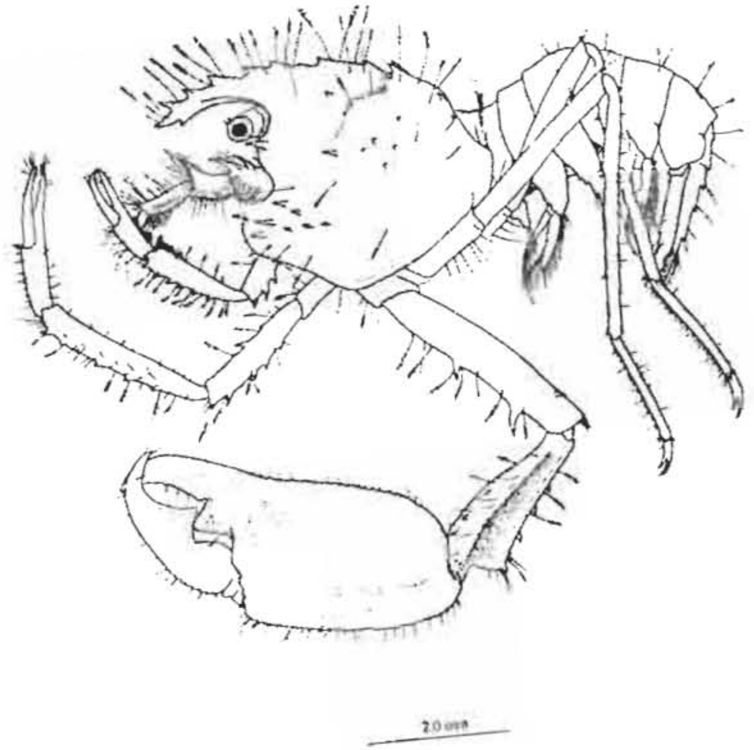
Fig. 2. *Microprosthema jareckii* new species, black and white photographs (made from color 35 mm photographic slides, our photographic voucher number Vc1314) of live holotype male (LACM CR 00000), taken in small aquarium on Guana Island, BVI. a, dorsal view. b, lateral view. Photographs by T. L. Zimmerman.

Fig. 3. *Microprosthema jareckii* new species, holotype male, LACM CR 00000, carapace, abdomen, tailfan (telson plus uropods). a, carapace, lateral view. b, carapace, dorsal view. c, abdomen, lateral view, with tip of pleuron of abdominal somite 3 magnified to lower left (arrow). d, telson and uropods. Scale bar = 2.0 mm for a-c, 1.0 mm for d.

Fig. 4. *Microprosthema jareckii* new species, holotype male, LACM CR 00000, antennae and mouthparts, left side. a, antenna 1, ventral view. b, section of distal articles of antenna 1 flagellum showing setation. c, base of antenna 2 and scaphocerite, dorsal (left) and ventral (right) views. d, mandible, inner (left figure) and outer view of same mandible. e, maxilla 1. f, endites of maxilla 2. g, first maxilliped. h, second maxilliped.

i, third maxilliped (illustrated at different magnification from g and h). j, higher magnification of distal 4 articles of third maxilliped (same appendage as in i, but reversed to show other side) with only selected setae illustrated. Scale bar on left = 0.5 mm for figures . . . Scale bar on right = 1.0 mm for X and 2.0 mm for XX.

Fig. 5. Microprosthema jareckii new species, holotype male, LACM CR 00000, left side pereiopods. a, pereiopod 1, with higher magnification of chela and distal part of carpus at lower right (arrow). b, pereiopod 2, with higher magnification of chela at lower left (arrow). c, pereiopod 3, dorsolateral view. d, pereiopod 4, with dactylus and propodus magnified below (arrow). e, pereiopod 5, with dactylus and part of propodus magnified (arrow). Scale bar = 1.0 mm for all figures except for close up views in a, b, d, and e, where it = 2.0 mm.



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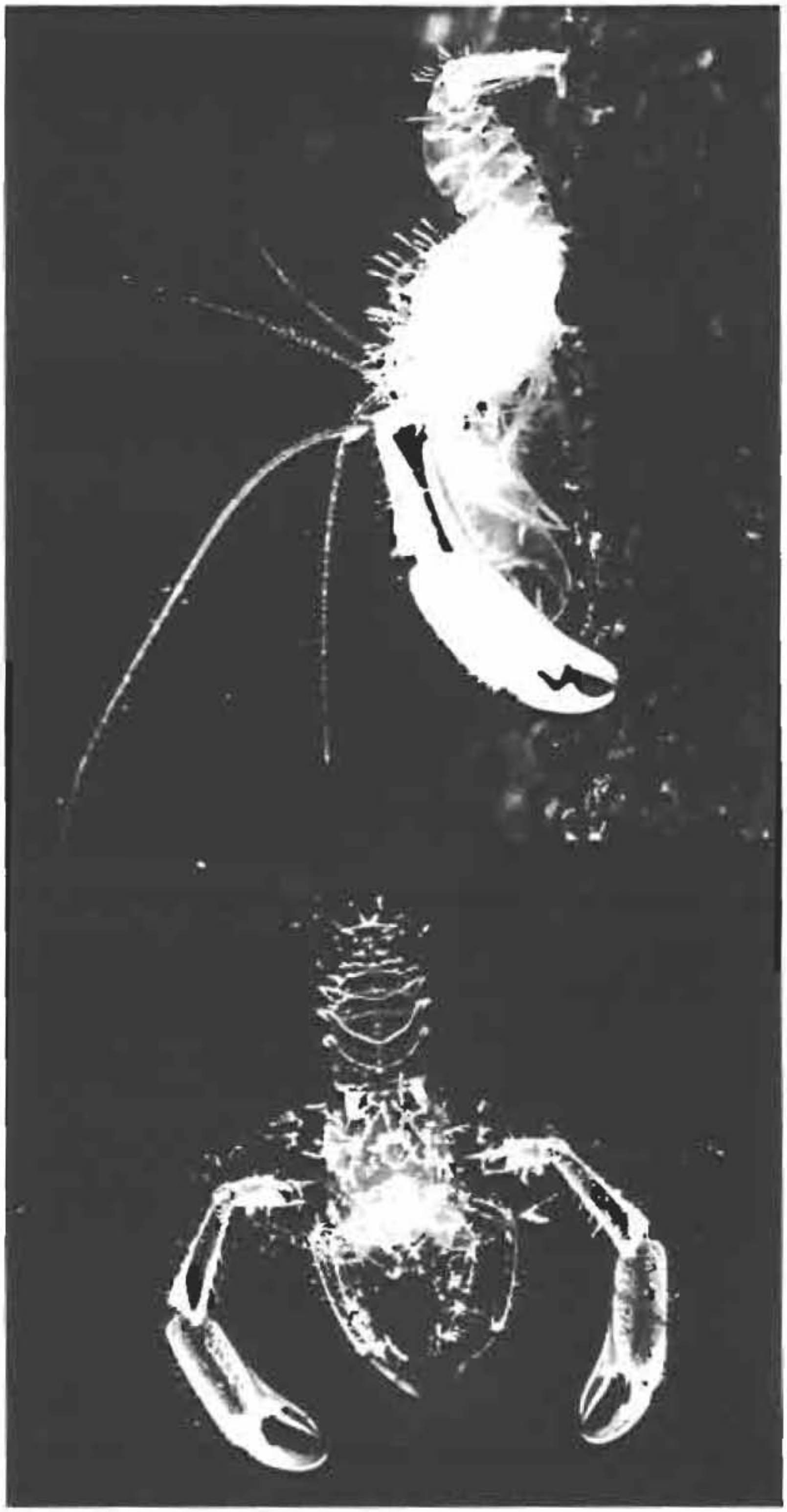

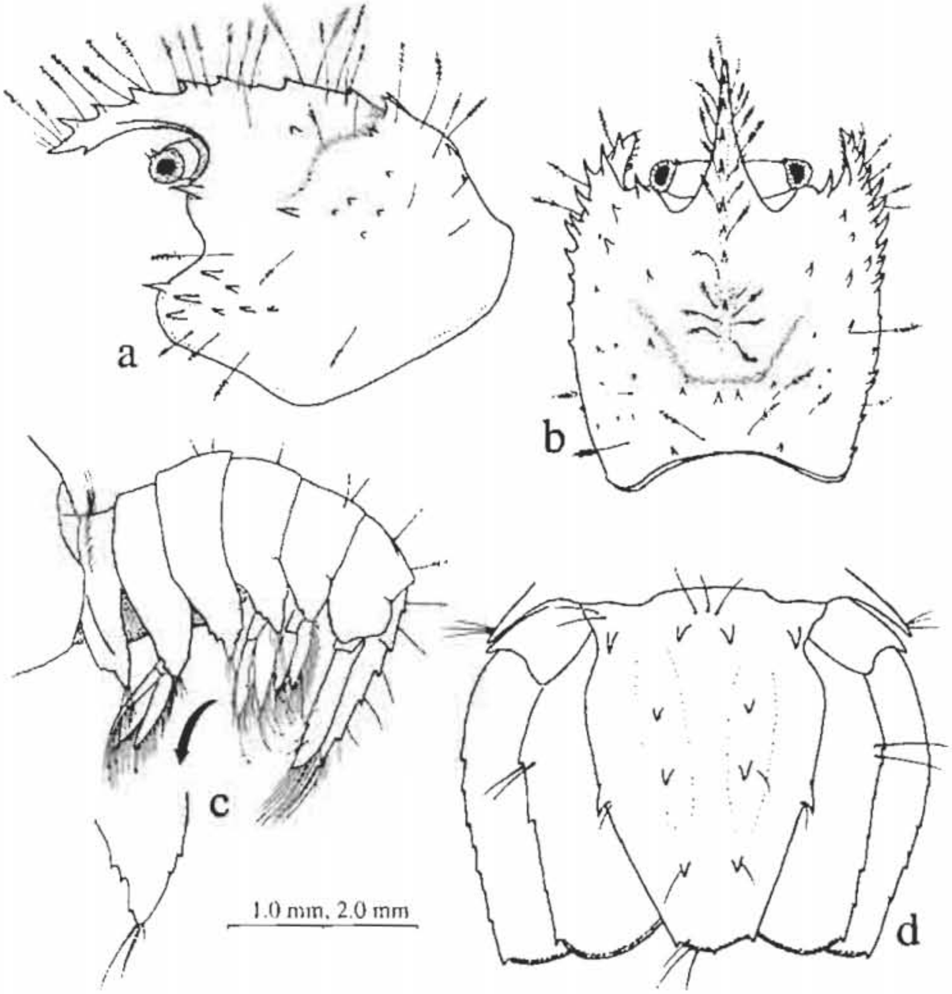
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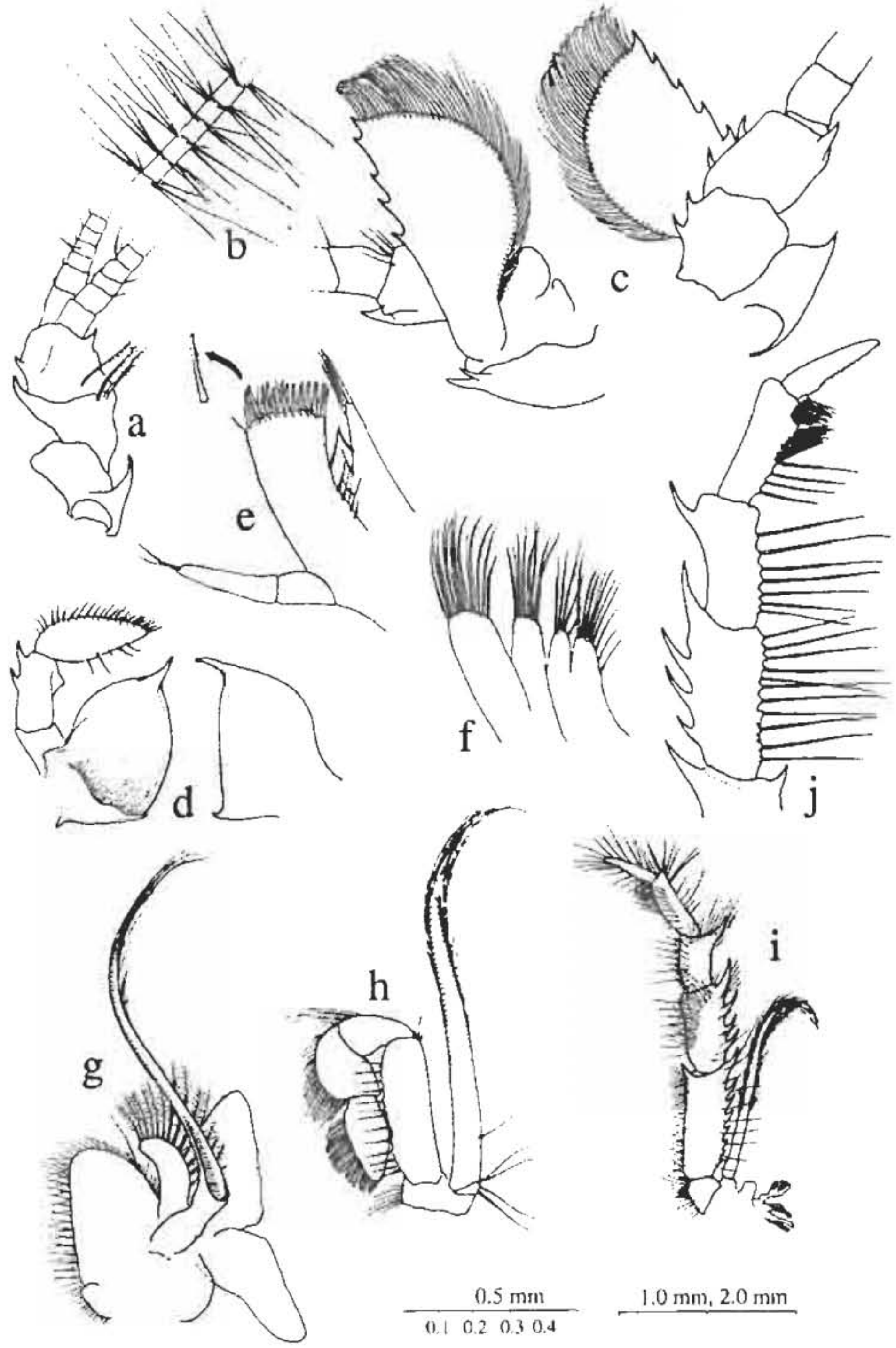
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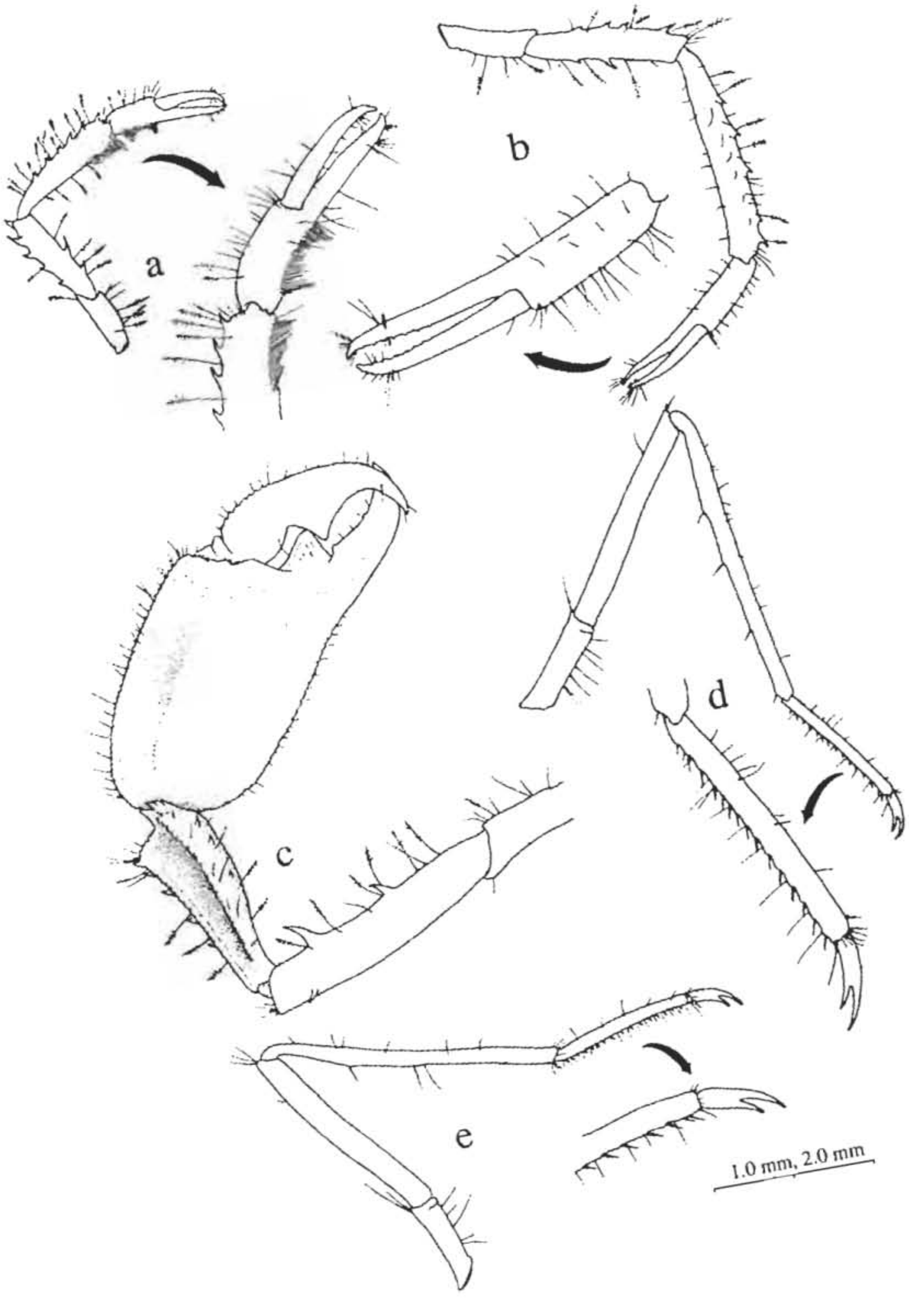
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