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**SIPUNCULAN DIVERSITY AT TWIN CAYS, BELIZE  
WITH A KEY TO THE SPECIES**

**BY**

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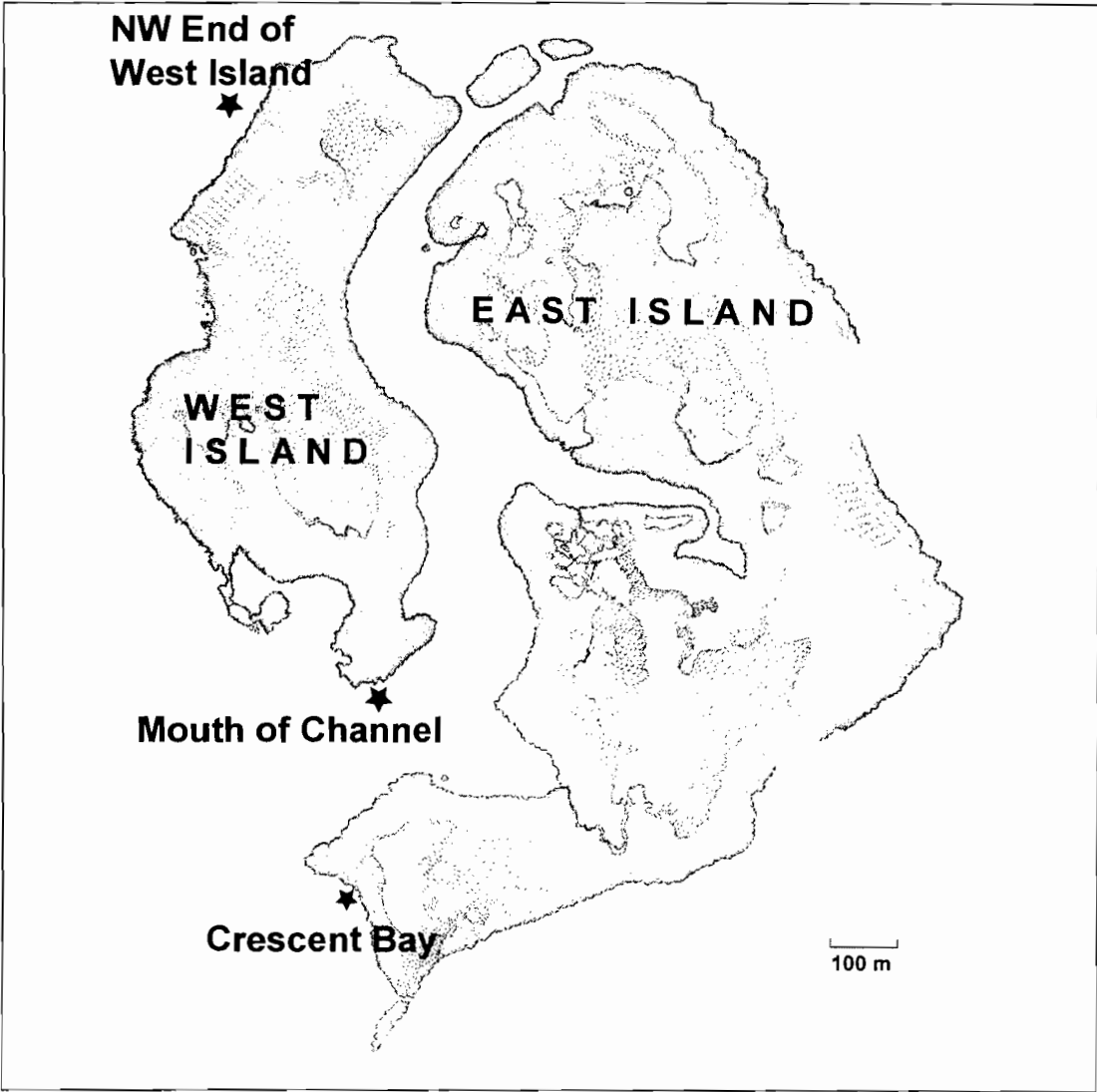


Figure 1. Index map showing the location of collection sites

# SIPUNCULAN DIVERSITY AT TWIN CAYS, BELIZE WITH A KEY TO THE SPECIES

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ANJA SCHULZE<sup>1</sup> and MARY E. RICE<sup>1</sup>

## ABSTRACT

We collected the following six species of Sipuncula in three intertidal and shallow subtidal sites around Twin Cays from April 18-24, 2003: *Golfingia elongata* (Keferstein, 1862); *Siphonosoma cumanense* (Keferstein, 1867); *Sipunculus nudus* Linnaeus, 1766; *Aspidosiphon (Paraspidosiphon) fischeri* ten Broeke, 1925; *Aspidosiphon (Paraspidosiphon) laevis* de Quatrefages, 1865; and *Aspidosiphon (Paraspidosiphon) parvulus* Gerould, 1913. Of these, *Golfingia elongata* and *Aspidosiphon parvulus* were the most common ones, both collected from mangrove and *Thalassia* root mats. The distribution of *Golfingia elongata* seemed patchy. *Sipunculus nudus* and *Siphonosoma cumanense* were found in low density in consolidated sand flats. In total, 14 sipunculan species are reported from Carrie Bow Cay and surrounding cays. We include a key to all the species found in the area.

## INTRODUCTION

Sipuncula are common inhabitants of tropical shallow waters but due to their cryptic habitats are often underrepresented in faunal surveys. They inhabit coral rubble, mangrove and seagrass roots, sand and occasionally mollusc shells. Morphologically, they are recognizable by an unsegmented trunk region and a retractable introvert, usually bearing an array of tentacles. They range in size from a few millimeters to about 30 cm.

We here report 14 species from the surroundings of Carrie Bow Cay and provide a key to their identification. Six of these species have been collected around Twin Cays and are described in more detail. This paper complements a previous account of Sipuncula from the Carrie Bow Cay area which focused on hard-substrate species (Rice and Macintyre, 1979).

## COLLECTING METHODS

Between April 18 and 24, 2003, we sampled three areas around Twin Cays to study sipunculan diversity (Fig. 1). All sample sites were in the intertidal or shallow subtidal zone (up to 1 m depth) within approximately 20 m of the mangroves. Owing to

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evaporation, rainfall and freshwater runoff from the island, water temperature and salinity fluctuate greatly at these sites (Ferraris et al., 1994).

Sipunculans were retrieved by digging as deep as 30 cm into the substrate and subsequent sieving of the substrate using a sieve with 3 mm-mesh size. Sipunculan worms were separated from the roots and other fauna, collected in sealed containers and kept alive for up to one week in clean containers with regular water changes.

The following three types of substrate were sampled:

*Substrate 1:* Dense mangrove root mats with algal cover of variable thickness (*Caulerpa*, *Cladophora*, *Halimeda*).

*Substrate 2:* *Thalassia* stands with small interspersed sandy patches, *Thalassia* roots usually intertwined with mangrove root mats and some algal cover.

*Substrate 3:* Patches of consolidated sand; algal cover negligible.

## SPECIES ACCOUNTS

### Family Sipunculidae

#### *Sipunculus nudus* Linnaeus, 1766 (Fig. 2A)

*Diagnosis.* Distinct bands of circular and longitudinal musculature (24-34 longitudinal muscle bands). A short introvert without hooks but with large papillae and lamellate tentacles. Four introvert retractor muscles. Brain with sponge-like anterior processes.

*Comments.* The only recovered specimen was approximately 7.5 cm in length (*S. nudus* is commonly larger, up to 30 cm).

*Distribution and habitat.* Cosmopolitan in temperate, subtropical and tropical waters, mostly less than 30 m deep. The only other known occurrence of *S. nudus* from the direct vicinity to mangroves is in Puerto Rico (pers. obs. M. E. Rice). Substrate type at Twin Cays: 2.

#### *Siphonosoma cumanense* (Keferstein, 1867) (Fig. 2B)

*Diagnosis.* Large, elongate species (up to 40 cm long) with anastomosing longitudinal and circular muscle bands. Number of longitudinal muscle bands: 18-24. Typically forms several tight constrictions along its body, or breaks into pieces, when retrieved from its substrate. Short introvert with pronounced papillae. Tentacles long and digitiform.

*Comments.* We only retrieved three specimens around Twin Cays. In comparison, in the Aldabra Atoll, Indian Ocean, *S. cumanense* represents up to 8.6% of the total biomass in intertidal soft substrates with algal and/or *Thalassia* cover (Hughes and Gamble, 1977).

*Distribution and Habitat.* Widespread in the Caribbean and Western Atlantic. Also common in Western Pacific, Indian Ocean and Red Sea. The other known occurrence in the vicinity of mangroves is in Puerto Rico (pers. obs. M. E. Rice). Substrate type at Twin Cays: 2, 3.

Family Golfingiidae

*Golfingia elongata* (Keferstein, 1862) (Fig. 2C).

*Golfingia cylindrata.* - Ferraris et al. 1994: Figs. 5, 6, 7 d, pp. 397-406.

*Diagnosis.* Slender worm with short introvert and simple crown of tentacles. Body wall musculature smooth, not divided into bands. 8-10 rows of hooks on introvert. No prominent papillae.

*Comments.* At Twin Cays, *G. elongata* inhabits the upper layers of the mangrove root mats. Specimens are similar to the roots in color and texture and often difficult to detect. Twin Cays specimens were 20-30 mm in trunk length. The occurrence of the species was patchy.

*G. elongata* is an osmoconformer that remains unaffected by large and repeated changes in salinity but apparently can only tolerate relatively short exposure to increased water temperatures (Ferraris et al, 1994). The only other report of a *Golfingia* species (unidentified) in the vicinity of mangroves is from the Pacific coast of Columbia (Cantera et al., 1999).

Few morphological features distinguish *G. elongata* from its congeners. It is possible that the Twin Cays specimens actually represent a different species than the ones recorded from deep, cold water. Comparisons of DNA sequence data are desirable.

*Distribution and Habitat.* Widespread in Atlantic and Pacific from arctic to tropical waters from intertidal to 590 m depth. Substrate type at Twin Cays: 1, 2.

Family Aspidosiphonidae

*Aspidosiphon (Paraspidosiphon) fischeri* ten Broeke, 1925 (Fig. 3A).

*Paraspidosiphon fischeri.* - Rice and Macintyre, 1979: Table 22.

*Diagnosis.* The dorsal anal shield, a characteristic feature of the genus, is round and has indistinct borders. Longitudinal body wall musculature in bands. *A. fischeri* has approximately 18 strongly anastomosing longitudinal muscle bands.

*Distribution and habitat.* Widespread in the Caribbean, usually in rock. Also known from the Pacific coast of Panama, Ecuador, James and Hood Islands and the Galápagos Islands. Substrate type at Twin Cays: 2.

*Aspidosiphon (Paraspidosiphon) parvulus* Gerould, 1913 (Fig. 3B).

*Diagnosis.* The anal shield is indistinctly set off from the trunk and bears spine-like papillae around its edge. Anal and caudal shields are dark.

*Comments.* The Twin Cays specimens are consistent with the description of *Aspidosiphon spinoscutatus* Fischer, 1922, a species that was later fused with *Aspidosiphon (Paraspidosiphon) parvulus* by Cutler (1994). Visual comparisons of the Twin Cays specimens with specimens from the Indian River lagoon, however, suggest that there are subtle differences. As in *Golfingia elongata*, comparison of DNA sequence data is desirable.

*Distribution and Habitat.* Western Atlantic and Caribbean. Generally inhabitant of rocks. Substrate type at Twin Cays: 1, 2.

*Aspidosiphon (Paraspidosiphon) laevis* de Quatrefages, 1865 (Fig. 3C)

*Paraspidosiphon speciosus.* – Rice and Macintyre, 1979: Table 22, p. 317.

*Diagnosis.* Solid anal shield with 10-15 longitudinal grooves; 25-35 longitudinal muscle bands can usually be seen through the body wall.

*Distribution and habitat.* Widespread in the Caribbean, Atlantic, Central and Indo-West Pacific; generally inhabitant of rocks. Substrate type at Twin Cays: 1, 2.

Additional sipunculan species from the vicinity of Carrie Bow Cay:

*Antillesoma antillarum* (Grübe and Oersted, 1858).

*Apionsoma misakianum* (Ikeda, 1904).

*Aspidosiphon elegans* (Chamisso and Eysenhardt, 1821).

*Aspidosiphon brocki.* – Rice and Macintyre, 1979: Figs. 138, 139 b, c, pp. 311, 313-319, Table 22; Rice, 1970: Figs. 1, 2, pp. 1618-1620.

*Aspidosiphon (Paraspidosiphon) steenstrupii* Diesing, 1859.

*Paraspidosiphon steenstrupi.* – Rice and Macintyre, 1979: Figs. 138, 139 e, pp. 311, 313-319, Table 22.

*Lithacrosiphon cristatus* Sluiter, 1902.

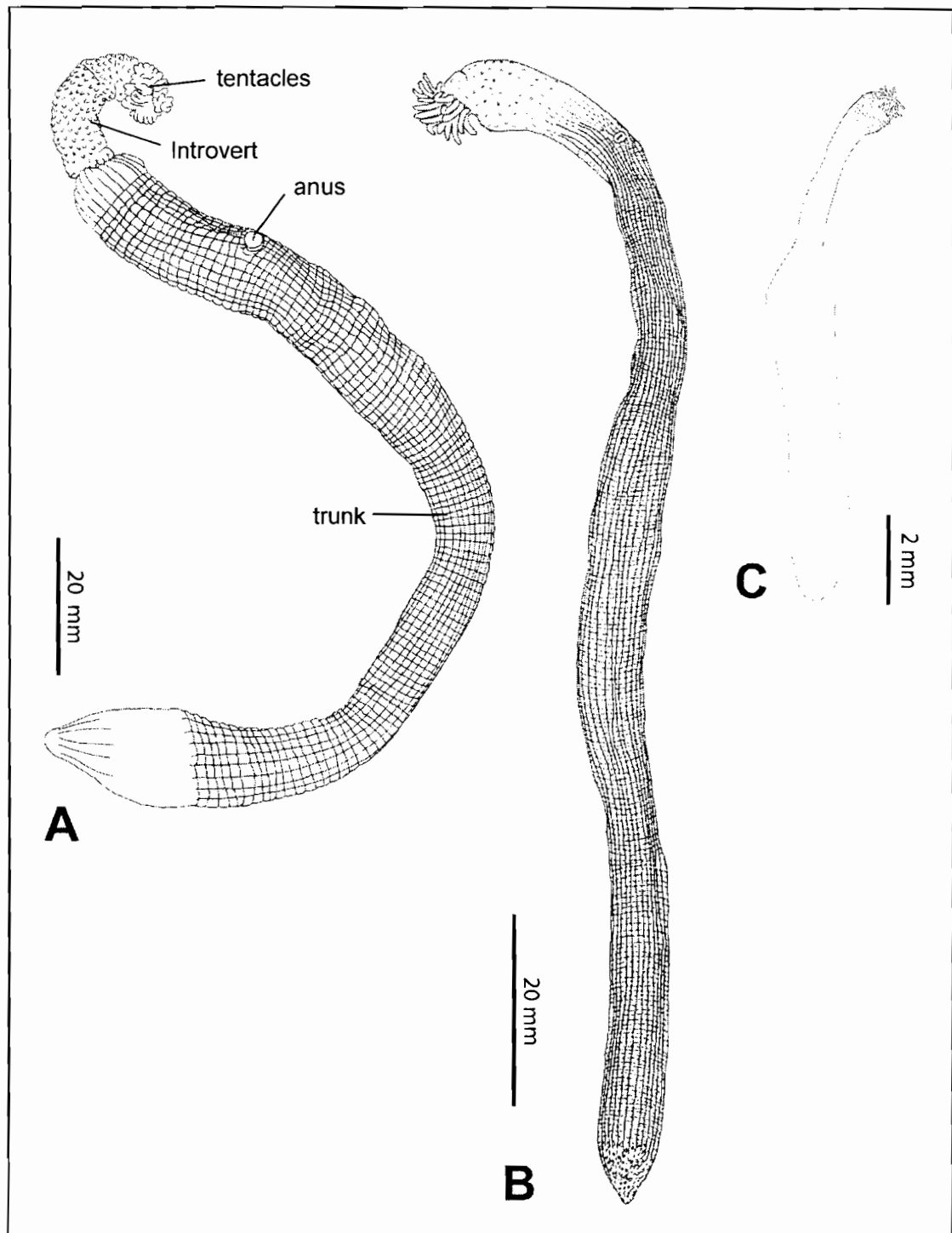
*Lithacrosiphon alticonus.* – Rice and Macintyre, 1979: Figs. 138, 139 a; pp. 311, 313-320, Table 22.

*Phascolion gerardi* Rice, 1993.

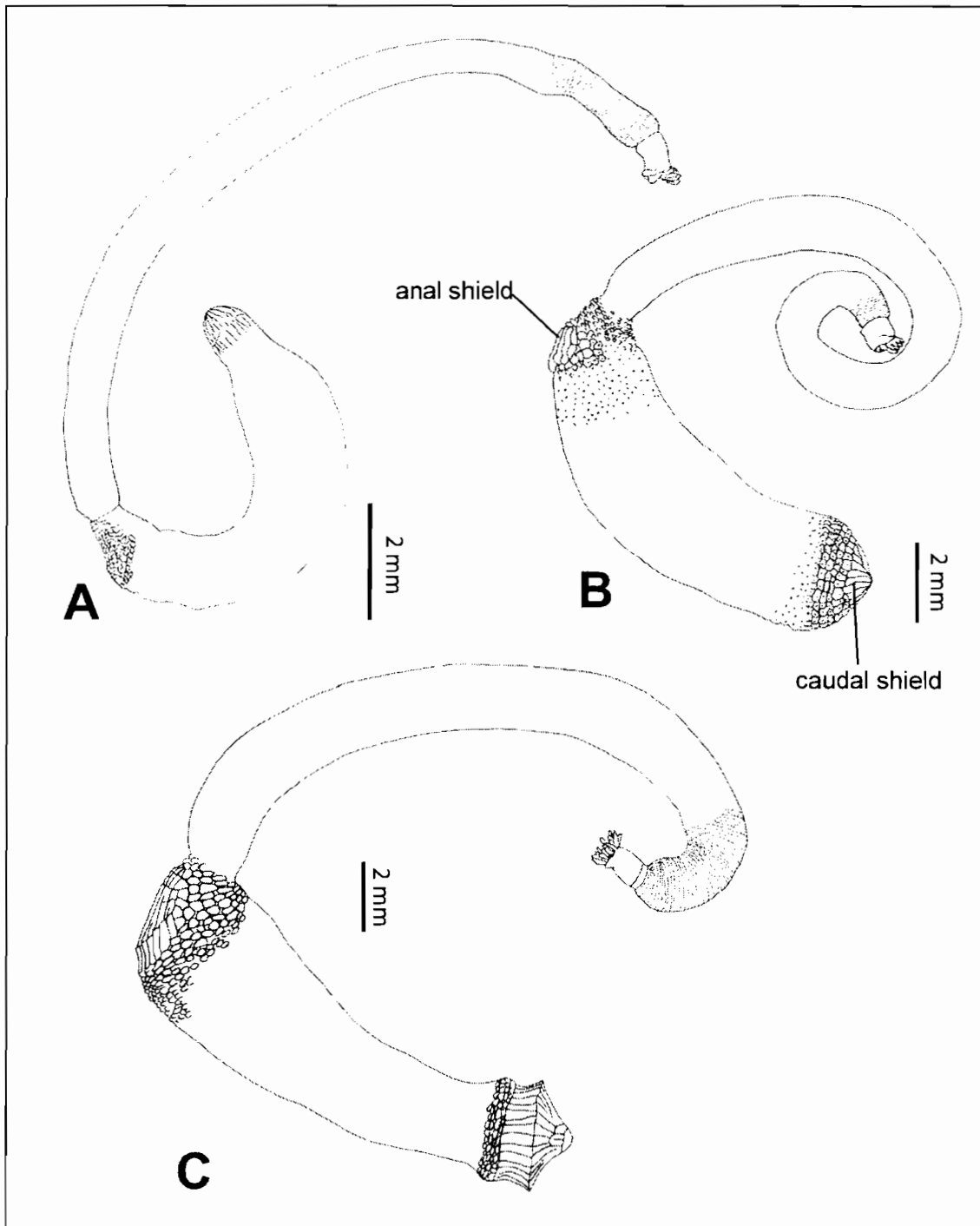
*Phascolosoma nigrescens* Keferstein, 1865.

*Phascolosoma varians.* – Rice and Macintyre, 1979: pp. 316-317, Table 22

*Phascolosoma perlucens* Baird, 1868.



**Figure 2.** Sipuncuncula from Twin Cays. A) *Sipunculus nudus*. B) *Siphonosoma cumanense*. C) *Golfingia elongata*.



**Figure 3.** Sipuncula from Twin Cays. A). *Aspidosiphon (Paraspidosiphon) fischeri*. B). *Aspidosiphon (Paraspidosiphon) parvulus*. C). *Aspidosiphon (Paraspidosiphon) laevis*.



## KEY TO THE SIPUNCULA IN THE VICINITY OF CARRIE BOW CAY

1. Large (usually > 50 mm); longitudinal and circular musculature in bands; hooks absent.....2
  - longitudinal musculature in bands or continuous; circular musculature continuous, hooks present or absent.....3
2. Body wall with 24-34 longitudinal muscle bands; lamellate tentacles; introvert with triangular papillae pointing posteriorly.....*Sipunculus nudus*
  - body wall with less than 24 longitudinal muscle bands, digitiform tentacles.....*Siphonosoma cumanense*
3. Anal shield present.....4
  - anal shield absent.....9
4. Anal shield distinctly cone-shaped, often overgrown with coralline algae.....*Lithacrosiphon cristatus*
  - anal shield more or less flat.....5
5. Longitudinal musculature in bands.....*Paraspidosiphon*, 6
  - Longitudinal musculature continuous.....*Aspidosiphon elegans*
6. Anal and caudal shield distinct and with regular grooves.....*Aspidosiphon (P.) laevis*
  - Anal shield without longitudinal grooves.....7
7. Anal shield with spinelike papillae around its edge.....*Aspidosiphon (P.) parvulus*
  - Anal shield without spinelike papillae.....8
8. Anal shield round with indistinct borders; caudal shield indistinct.....*Aspidosiphon (P.) fischeri*
  - Anal and caudal shields distinct; caudal shield with irregular grooves; numerous papillae on trunk, especially in anterior and posterior regions, composed of multiple polygonal plates.....*Aspidosiphon (P.) steenstrupii*
9. Longitudinal muscle bands absent.....10
  - longitudinal muscle bands present.....12
10. Body wall smooth; dark, hooks present in 8-10 rows.....*Golfingia elongata*
  - Trunk with papillae.....11
11. Trunk with numerous, small papillae, especially at posterior end; hooks present and in about 60 rows.....*Apionsoma misakianum*
  - hooks scattered; introvert about 3x as long as trunk; numerous, prominent papillae on trunk; anus midway on the introvert.....*Phascolion gerardi*
12. Hooks absent; long, digitiform tentacles, body covered with conical papillae.....*Antillesoma antillarum*
  - Hooks present, trunk usually with darkly pigmented bands.....13
13. Introvert with 100 or more rows of hooks.....*Phasolosoma nigrescens*
  - 15-25 rows of hooks; reddish, conical, posteriorly directed preanal papillae.....*Phasolosoma perlucens*

## DISCUSSION

All six sipunculan species found at Twin Cays are widespread throughout the Caribbean and beyond. All of them have been reported from shallow, warm water but

seem to be opportunistic with respect to suitable habitat. The ability to withstand large fluctuations in temperature, salinity and oxygen concentration probably enables them to live in close vicinity to mangroves and in the mangrove root mats. However, if the *Golfingia elongata* specimens from Twin Cays prove to be genetically distinct from the deep-water *G. elongata*, they might represent a separate species associated with the dense mangrove root mats.

*Sipunculus nudus* and *Siphonosoma cumanense* generally inhabit semipermanent burrows in consolidated sand banks. Accordingly, they were found in the more sandy areas with less algal cover around Twin Cays. The *Aspidosiphon* (*Paraspidosiphon*) species are generally inhabitants of rocks. The dense network of mangrove roots, *Thalassia* roots and algal cover may provide a similarly protected habitat.

Surveys of mangrove-associated invertebrate fauna often include sampling of the prop roots of the trees but not the extensive fine root mats in the immediate vicinity. Sipunculan worms seem to have a patchy occurrence in the root mats, often resulting in unsuccessful sampling attempts. More extensive sampling of similar habitats throughout the Caribbean will reveal whether the sipunculan fauna of the Twin Cays mangroves is representative of the region.

It is notable that *Phascolosoma arcuatum* (Gray, 1828), a species that commonly inhabits brackish mangrove swamps around the high tide line in the Indo-West Pacific and the Indian Ocean (Green, 1975a, b; Green and Dunn, 1976, 1977), has never been reported from the Caribbean.

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Smithsonian Marine Station at Fort Pierce  
Contribution Number 610

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