SHALLOW-WATER ECHINODERMS FROM BRITISH HONDURAS, WITH A DESCRIPTION OF A NEW SPECIES OF *OPHIOCOMA* (OPHIUROIDEA)

DENNIS M. DEVANEY
Bernice P. Bishop Museum, Honolulu, Hawaii 96818

ABSTRACT

Collections made along the offshore reefs (atolls) and cays of British Honduras in March 1969 reveal 31 additional echinoderm species to three previously known from shallow waters. Specimens were collected from shore to depths over 60 meters by skin- and SCUBA-diving. One crinoid, three asteroids, 20 ophiuroids, one holothuroid, and five echinoids are among the newly recorded fauna. Except for a new species, the other echinoderms are known from additional West Indian localities.

Among the ophiuroids, a new species in the genus *Ophiocoma* is described; another, *Ophiolimna littoralis* Koehler, is recognized as a member of the family Ophiodermatidae; the genus *Ophiozona* Lyman (family Ophiuridae) is reduced to the synonymy of *Ophiolepis* Müller & Troschel; a polynoid worm, *Hermenia verruculosa* Grube, is considered a possible commensal on *Ophiocoma pumila*; and sponge hosts for several ophiotrichid brittlestars are tentatively identified.

An appendix describes the stations and collection sites and includes species collected at each.

The first report on echinoderms from British Honduras to my knowledge was that by Boone (1928), which described the echinoderms collected by the PAWNEE I, research ship of Mr. Harry Payne Bingham, which visited the region in April 1925. Three sea stars and eight brittle stars were taken "north of Glover Reef" at a depth of 484 fathoms, while one crinoid was taken "near English Cay" at 190 fathoms. In addition to these deep-water forms, two shallow-water echinoids, *Eucidaris tribuloides* and *Meoma ventricosa*, were taken at Glover Reef. Only *E. tribuloides* is common to Boone's report and the present study, due certainly to the differences in depth at which the two collections were made.

John & Clark (1954) reported the echinoderms collected during the 1937-38 ROSAURA Expedition. The sea star *Luidia clathrata* (Say) and brittle star *Amphipholis gracillima* (Stimpson) were dredged in Belize Harbor, British Honduras, at a depth of 6 meters. In addition, three sea stars, four brittle stars, two sea urchins, and one sea cucumber were recovered by trawl, north of Turneffe Islands, at a depth of about 500 fathoms.

Stoddard's (1962) report on the British Honduras atolls, based on field-

Manuscript accepted March 1973.

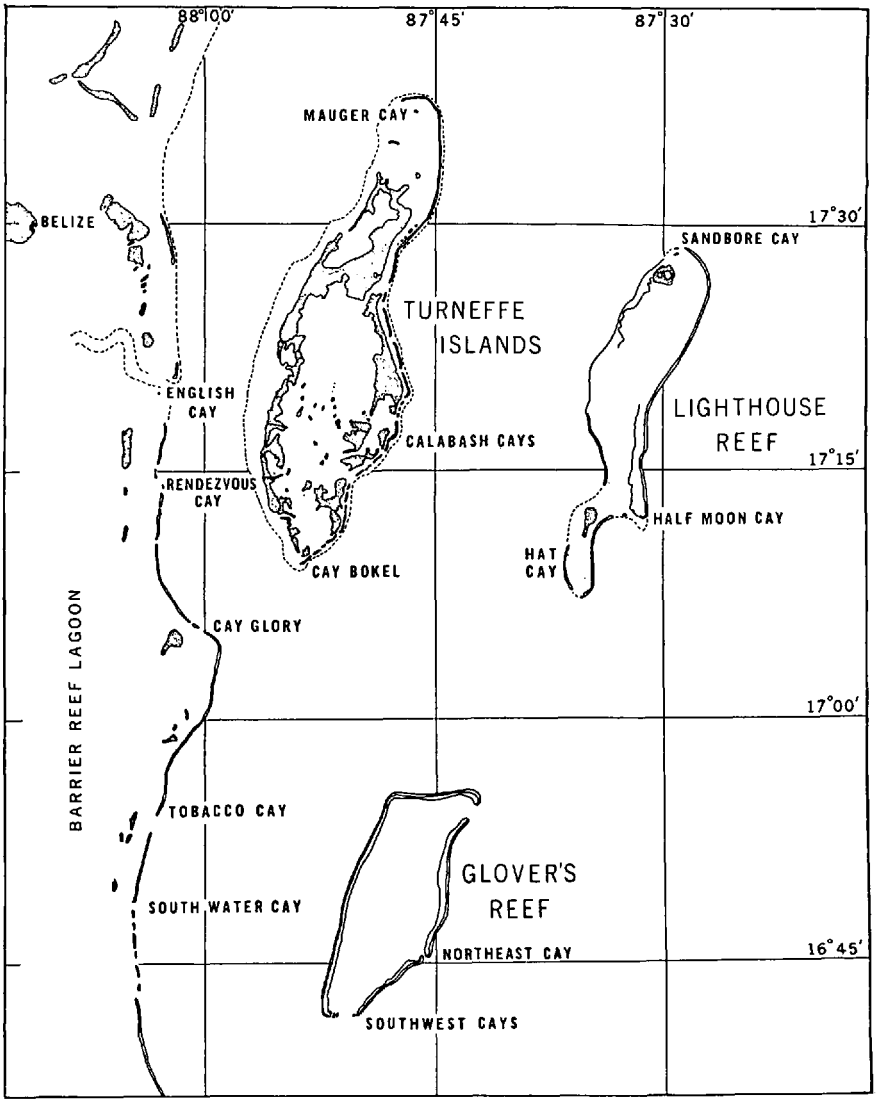

FIGURE 1. Location of British Honduran atolls. (Reproduced with permission of *Atoll Research Bulletin*, from Stoddard [1962].)

work during the 1959-60 Cambridge Expedition and subsequently in 1961, includes brief remarks on echinoderms in his ecological zonation comparisons (pp. 21, 33, 67, 87, and 104).

The echinoderms from British Honduras recorded in this paper were

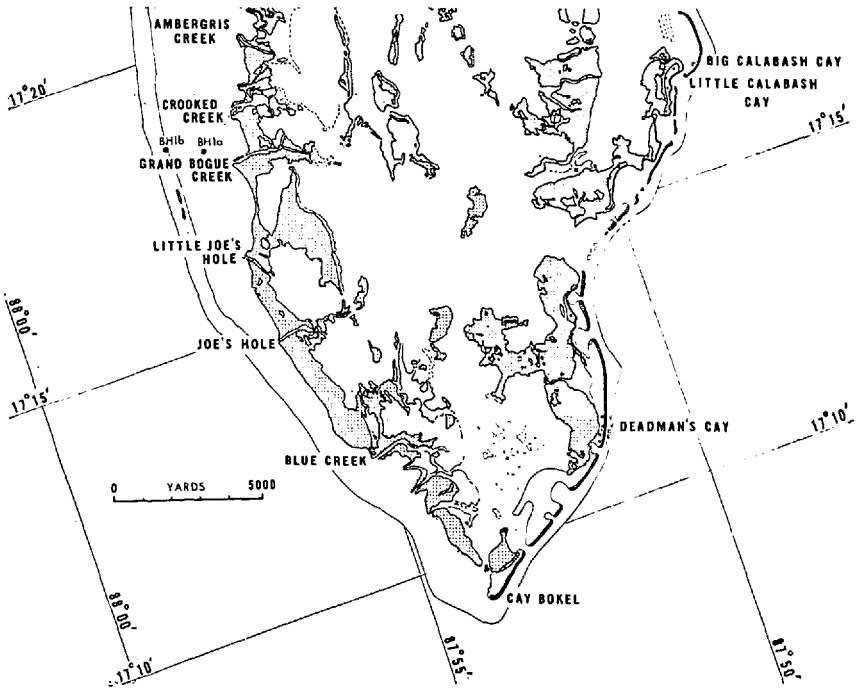

FIGURE 2. Southern tip of Turneffe Islands, British Honduras. (After Stoddard, 1962.)

collected from March 5 to March 14, 1969. Collections were made by the author along the atolls (reefs) and cays which occur off the coast (Fig. 1). The author participated as a Smithsonian representative[1] on a marine biological expedition financed by Mr. Seward Johnson and Mr. Edwin Link. Mr. Johnson provided transportation on his yacht "Ocean Pearl" for collecting around Turneffe Islands. Subsequently, Mr. Link made his research vessel SEA DIVER available as a laboratory and base of field operations.

Specimens were collected from the littoral zone to depths over 200 feet (60 meters). SCUBA was employed for collections in excess of 30 feet. The west side of Turneffe Islands, near Amber Head (Station BH 1, Fig. 2), the southwestern and southeastern sides of Lighthouse Reef (Stations BH 2, 3, 4, 5, 6, 7, Fig. 3), and the southeastern tip of Glover's Reef (Stations BH 8 and 9, Fig. 4) were surveyed for specimens.

[1] Visiting Research Associate, 1968-69.

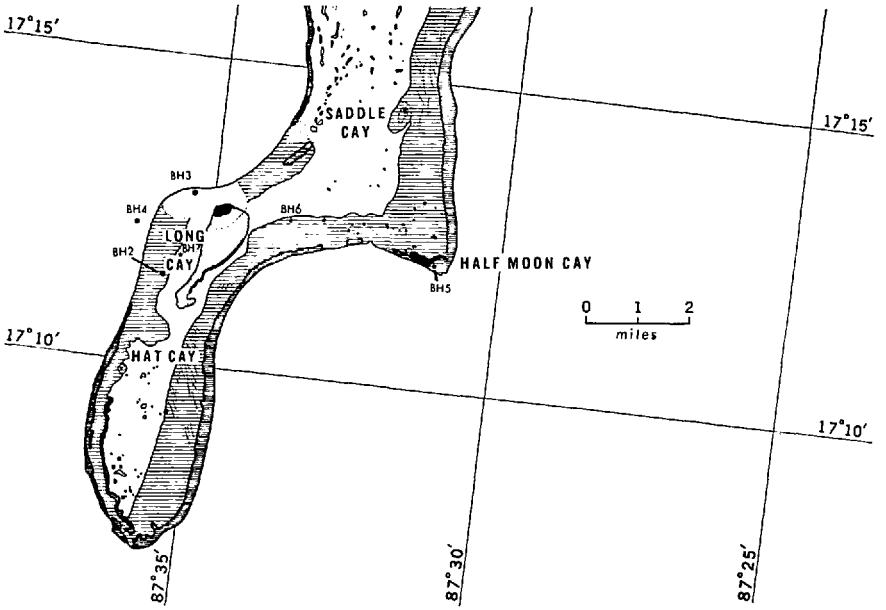

FIGURE 3. Southern portion of Lighthouse Reef, British Honduras. (After Stoddard, 1962.)

The present collection includes one crinoid, three asteroids, 20 ophiuroids, one holothuroid, and six echinoids. A taxonomic list is given below. Only one species, an ophiuroid, is described as being new; the other echinoderms have been reported from additional West Indian localities (for distributional reviews see H. L. Clark, 1933; Parslow & Clark, 1963).

With the exception of the holotype of the new species of *Ophiocoma* described below, which is deposited in the National Museum of Natural History, Smithsonian Institution (USNM), the other specimens collected and listed in this report are deposited in the Marine Zoology section of the Bernice P. Bishop Museum (BPBM), Honolulu, Hawaii.

ACKNOWLEDGMENTS

The opportunity to visit British Honduras was made possible by the Office of Oceanography and Limnology, Smithsonian Institution, Washington, D. C. Dr. Klaus Ruetzler, National Museum of Natural History, kindly determined the sponge hosts which harbored several ophiotrichid brittle stars, and Dr. Marian Pettibone, National Museum of Natural History, identified the polynoid worm associated with *Ophiocoma pumila*.

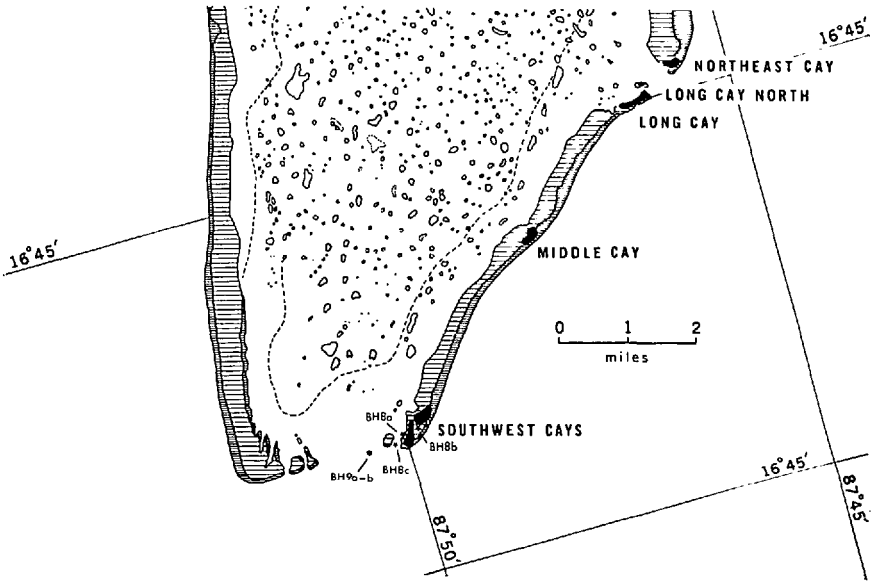

FIGURE 4. Southern portion of Glover's Reef, British Honduras. (After Stoddard, 1962.) (Editor's Note: Southern-most latitudinal coordinate should be designated 16°40'; not 16°45'.)

LIST OF SHALLOW-WATER ECHINODERMS KNOWN FROM BRITISH HONDURAS

CRINOZOA
CRINOIDEA
Nemaster rubiginosa (Portalès)
ASTEROZOA
ASTEROIDEA
**Luidia clathrata* (Say)
Astropecten duplicatus Gray
Oreaster reticulatus (Linnaeus)
Linckia guildingi Gray
OPHIUROIDEA
Ophiomyxa flaccida (Say)
**Amphipholis gracillima* (Stimpson)
Ophiactis savignyi (Müller & Troschel)
Ophiothrix (*Acanthophiothrix*) *suensoni* Lütken
O. (*Ophiothrix*) *angulata* (Say)
O. (*O.*) *lineata* Lyman
O. (*O.*) *oerstedi* Lütken
Ophionereis reticulata (Say)
Ophiocoma echinata (Lamarck)
O. paucigranulata, sp. nov.

* Recorded by John & Clark (1954).

O. pumila Lütken
O. wendti Müller & Troschel
Ophioderma appressum (Say)
O. brevicaudum Lütken
O. cinereum Müller & Troschel
O. phoenium H. L. Clark
O. rubicundum Lütken
Ophioderma sp.
Ophiurochaeta littoralis (Koehler)
Ophiolepis impressa Lütken
O. paucispina (Say)

ECHINOZOA
HOLOTHUROIDEA
Euapta lappa (Müller)
ECHINOIDEA
Eucidaris tribuloides (Lamarck)
Diadema antillarum (Philippi)
Tripneustes ventricosus (Lamarck)
Lytechinus variegatus (Leske)
Echinometra viridis Agassiz
Moira (Moira) atropos (Lamarck)
†*Meoma ventricosa* (Lamarck)

Class CRINOZOA
Subclass CRINOIDEA
Family Comasteridae

1. *Nemaster rubiginosa* (Pourtalès)

Antedon rubiginosa Pourtalès, 1869: 356.
Nemaster rubiginosa: H. L. Clark, 1933: 7, 8, 9 (key), 10.

Locality and Material.—Sta. BH 4, outside reef beyond reef flat, 40-50 feet, two specimens.

Remarks.—The larger specimen has 17 arms, the smaller, 12. Many individuals were noted with arms waving slowly and bodies concealed in crevices and under ledges on coral outcroppings.

Class ASTEROZOA
Subclass ASTEROIDEA
Family Astropectinidae

2. *Astropecten duplicatus* Gray

Astropecten duplicatus Gray, 1840: 181.—H. L. Clark, 1933: 15 (key), 17-19.

Localities and Material.—Sta. BH 8a, near shore on sand, shoreward side of eel grass beds, 3-4 feet, one specimen, R/r = 56/14 mm.—Sta. BH 8c,

† Recorded by Boone (1928).

in shallow water with turtle (*Thalassia*) and sea grass (*Syringodium*) mixed and sand patches, one specimen, R/r = 42/12 mm.

Remarks.—Specimen from Sta. BH 8c, in alcohol, brown above with supramarginals tan in color.

Family Oreasteridae

3. *Oreaster reticulatus* (Linnaeus)

Asterias reticulata Linnaeus, 1758: 661.
Oreaster reticulatus: H. L. Clark, 1933: 15 (key), 22.

Localities and Material.—Sta. BH 7, on lagoon bottom with turtlegrass (*Thalassia*) and fine coral sand, 10 feet, three specimens (one collected).—Sta. BH 8a, on sandy bottom with seagrass (*Syringodium*), 20 feet, one specimen, R/r = 121/60 mm.

Remarks.—Two of the specimens from Sta. BH 7 were reddish above when observed, the other specimen, yellowish. The specimen from Sta. BH 8a was yellowish brown alive.

Family Ophidiasteridae

4. *Linckia guildingi* Gray

Linckia guildingi Gray, 1840: 284.—H. L. Clark, 1921: 67; 1933: 15 (key), 24-25.

Localities and Material.—Sta. BH 3, near edge of reef flat between lagoon and deep water, 0-3 feet, two specimens; largest, R/r = 55/6 mm, smallest, R/r = 25/4 mm.—Sta. BH 8b, sand pockets and coral rubble, 1 foot, one specimen, R/r = 22/3 mm.

Remarks.—It may be difficult to distinguish between small specimens of *Linckia guildingi* and *Ophidiaster guildingi*, based upon H. L. Clark's (1933) key and his description of these two West Indian species, without comparative specimens of each species available. It is difficult to decide in some cases whether or not the plates of the arms are arranged in a regular longitudinal series. Far more explicit are the key characters which H. L. Clark used in his 1921 paper. Characters which are helpful in separating the two species include:

1. *O. guildingi*, but not *L. guildingi*, has at least one papular series below the inferomarginal row of arm plates.
2. *O. guildingi* has a single madreporite, normally; in *L. guildingi* more than one is often present.
3. *L. guildingi*, but not *O. guildingi*, may have granules occurring on the inner surface of the arm furrow, although these do not separate the furrow spines in *L. guildingi*.

I take exception to Clark's key character for *L. guildingi*, which states: "the intermarginal poriferous areas not in a continuous series" (1921: 64). In the British Honduras specimens, this area is definitely in a longitudinal series, although not in a continuous series, since the ossicles separate each papular area.

One might consider the frequency of autotomy as a possible method of separating the above two species: in *L. guildingi*, self division appears to be quite common, but apparently not so in *O. guildingi*. The former species thus often appears with unequal arms or in a comet condition.

The larger of the two specimens from Sta. BH 3 has two madreporites, six rays (three fully formed, two only partially formed, and one beginning), and the color is rather uniform brownish gray, not variegated; the smaller specimen has two madreporites, five rays (three fully formed, two of which are adjacent, while one is separated by two newly formed rays), the color is variegated with the basic color purple of two shades. The specimen from Sta. BH 8b has two madreporites, six rays (four normal and two adjacent, regenerating), the color being dark brown aborally.

Subclass OPHIUROIDEA

Family Ophiomyxidae

5. *Ophiomyxa flaccida* (Say)

Ophiura flaccida Say, 1825: 151.
Ophiomyxa flaccida: H. L. Clark, 1919: Pl. 1, figs. 1, 2 (color); 1933: 41.

Localities and Material.—Sta. BH 2 or 3, around corals and under coral-lines, one specimen, d.d. 17 mm.—Sta. BH 8b, under coral rubble on sand pockets, 3 feet, one specimen, d.d. 16.5 mm.—Sta. BH 9b, 40-50 feet, two specimens, d.d. 9 and 24 mm.—Sta. BH 8c, 3-20 feet, one specimen, d.d. 12 mm.

Remarks.—The specimens at hand ranged from yellow, yellow green, green, to reddish purple in color.

Family Ophiactidae

6. *Ophiactis savignyi* (Müller & Troschel)

Ophiolepis savignyi Müller & Troschel, 1842: 95.
Ophiactis savignyi: H. L. Clark, 1933: 38 (key), 59-60.

Locality and Material.—Sta. BH 9b, associated with sponge, 40-50 feet, five specimens, d.d. 4 to 7 mm.

Remarks.—All five specimens are pentamerous, without indication of fissiparity.

Family Ophiotrichidae

7. *Ophiothrix* (*Acanthophiothrix*) *suensoni* Lütken

Ophiothrix suensoni Lütken, 1856: 16; 1859: Pl. 4, figs. 2a-e.—H. L. Clark, 1933: 38 (key), 62.

Ophiothrix (*Acanthophiothrix*) *suensoni*: A. M. Clark, 1967: 638 (fig. 1j), 643, 648.

Localities and Material.—Sta. BH 1b, found on sponges (see below), seven specimens, d.d. 1.5 to 10.5 mm.—Sta. BH 2 or 3, 6-15 feet, associated with sponge, two specimens, d.d. 4 and 4.5 mm.—Sta. BH 4, found on sponge, 40-50 feet, four specimens, d.d. 2 to 10 mm.—Sta. BH 9b, 40-50 feet, one specimen, d.d. 8 mm.

Remarks.—Three of the four lots of specimens were found associated with sponge hosts. Two sponge hosts for the specimens from Sta. BH 1b were identified as *Spongia digitalis* Lamarck and *Spongia vasculum* Lamarck, both species being revised by Felix Wiedenmayer, in publication presently (Klaus Ruetzler, pers. commun.). The sponge host for the specimens from Sta. BH 4 was tentatively identified by Dr. Ruetzler from fragments as *Xestospongia muta* (Schmidt).

Ophiothrix (*A.*) *suensoni* was reported by H. L. Clark (1933) as living "altogether on gorgonians" (p. 62). Fontaine (1953) also mentioned the occurrence of this species "on the branches of alcyonarians" (p. 202) in his notes on Jamaican brittle stars. A careful search was made for ophiuroids on gorgonians during my visit to British Honduras and, even though these alcyonarians are common in the areas visited, no commensal brittle stars were observed. Yet *Ophiothrix* (*A.*) *suensoni* is common on sponge hosts in that part of the Caribbean.

8. *Ophiothrix* (*Ophiothrix*) *angulata* (Say)

Ophiura angulata Say, 1825: 145.

Ophiothrix angulata: H. L. Clark, 1933: 38-39 (key), 60-61.

Ophiothrix (*Ophiothrix*) *angulata*: A. M. Clark, 1967: 646.

Localities and Material.—Sta. BH 1b, 6-15 feet, associated with sponge(s), six specimens, d.d. 0.7 to 2.5 mm.—Sta. BH 4, under limestone boulder, one specimen, d.d. 4 mm.—Sta. BH 8c, shallow to 20 feet, one specimen, d.d. 5 mm.

Remarks.—The young specimens from Sta. BH 1b were taken together with *Ophiothrix* (*A.*) *suensoni* and *O. lineata* from one or two sponge species (see above).

9. *Ophiothrix (Ophiothrix) lineata* Lyman

Ophiothrix lineata Lyman, 1860: 201.—H. L. Clark, 1933: 38 (key), 62-63.
Ophiothrix (Ophiothrix) lineata: A. M. Clark, 1967: 647.

Locality and Material.—Sta. BH 1b, 6-16 feet, one specimen, d.d. 8.5 mm.

Remarks.—As mentioned above, this species, together with *O. (A.) suensoni* and *O. (O.) angulata,* was found associated with one or the other types of sponges (see above for determinations). According to H. L. Clark (1933: 62), *Ophiothrix lineata* was considered "confined to southern Florida and the Tortugas." He raised doubt at that time regarding A. H. Clark's (1921) record of this species, which was based on one specimen taken at Barbados from gorgonians and corals, primarily because many specimens of *Ophiothrix suensoni* were also taken at the same place. The occurrence of both *O. suensoni* and *O. lineata* from similar habitats (sponges) at the same location in British Honduras, however, suggests that A. H. Clark might have been correct in his determination.

According to H. L. Clark (1933: 62) "all the specimens of *lineata* . . . were found in the interior of large sponges, *Siphonochalina* and similar forms."

In the present specimen from Br. Honduras, the arm spines are blunt tipped, glassy, with a rose hue. The radial shields show granules or low stumps in a single row along the interradial border and a few centrally placed.

10. *Ophiothrix (Ophiothrix) oerstedi* Lütken

Ophiothrix oerstedi Lütken, 1856: 15.—H. L. Clark, 1933: 33 (key), 63.
Ophiothrix (Ophiothrix) oerstedi: A. M. Clark, 1967: 647.

Localities and Material.—Sta. BH 2 and/or 3, associated with sponge or around coral and under coralline algae, 6-15 feet, nine specimens, d.d. 1.5 to 8 mm.—Sta. BH 4, 40-50 feet, one specimen, d.d. 4 mm.—Sta. BH 6, at base of *Millepora* hydrocoral, three specimens, d.d. 4, 6, and 9 mm.—Sta. BH 8b, under coral rubble on sand pockets, 1-2 feet, two specimens, d.d. 9 and 9.5 mm.—Sta. BH 8c, shore to 20 feet, three specimens, d.d. 5 to 9 mm.—Sta. BH 9b, 40-50 feet, four specimens, d.d. 3 to 8 mm.

Remarks.—In contrast to the epizoic nature of the other three species of *Ophiothrix* mentioned above, *O. oerstedi* appears to be more common on or within the benthic substratum, concealed at the base of corals or within and under limestone boulders. The ground color of the Br. Honduras specimens is a fairly dark green or blue, and narrow light transverse bands on the arm plates are a constant feature.

Family Ophionereidae

11. *Ophionereis reticulata* (Say)

Ophiura reticulata Say, 1825: 148.
Ophionereis reticulata: H. L. Clark, 1933: 39 (key), 64.—A. M. Clark, 1953: 67-68, 73, Pl. 1, figs. 1-2, Text-fig. 3a.

Localities and Material.—Sta. BH 2 and/or 3, 6-15 feet, six specimens, d.d. 6 to 11 mm.—Sta. BH 4, under coral boulders, 40-50 feet, one specimen, d.d. 7 mm.—Sta. BH 5, under or within coral boulders on sand, three specimens, d.d. 2 to 12 mm.

Remarks.—One specimen from Sta. BH 2 or 3 was observed with a polynoid commensal on one of its arms. Unfortunately the polynoid was lost, but it closely resembled the figures and description of *Harmothoe lunulata*, as reported by Millott (1953), which was associated with the same host.

Family Ophiocomidae

12. *Ophiocoma echinata* (Lamarck)

Ophiura echinata Lamarck, 1816: 543.
Ophiocoma echinata: H. L. Clark, 1933: 39 (key), 65-66.—Devaney, 1970: 33, 34, 36.

Localities and Material.—Sta. BH 2 and/or 3, 6-15 feet, six specimens, d.d. 5 to 18 mm.—Sta. BH 5, under or within coral boulders on sand, 1-2 feet, four specimens, d.d. 7 to 24 mm.—Sta. BH 8b, under coral rubble on sand, 1 foot, two specimens, d.d. 19 and 25 mm.

13. **Ophiocoma paucigranulata**, sp. nov.

Figs. 5-8

Etymology.—paucus (L.), few; *granulum* (L.), grain. In reference to the reduction in disc granulation.

Type-Locality.—Sta. BH 3, northwest side of Long Cay (17°13′0″ N, 87°35′32″ W), 1-6 feet, near edge of deep-water drop-off; holotype (USNM No. E11594), d.d. 12 mm; paratype (BPBM No. W1977), d.d. 7 mm.

Description of Holotype.—Disc diameter 12 mm. Upper side of disc (Fig. 5) with flat imbricated scales and only a single row of small rounded granules along the upper interradial margin of disc, reaching base of arms but not passing across base; granules continuing from upper side down around edge of disc adjacent to arm and continuing with some interruption to a row of granules along the interradial margin of the genital aperture;

FIGURE 5. *Ophiocoma paucigranulata*, upper side of holotype.

granules along genital aperture beginning from base of the oral shields; in two cases, a single granule also in space between first lateral arm plate and widest part of the oral shield. A part of each radial shield exposed and a few granules occurring at their distal ends. Oral interradial scales slightly tumid and imbricated with marginal series perpendicular to those on upper side of disc and somewhat raised above level of upper disc scales (disc granules lie adjacent to marginal series of scales).

Oral shields (Fig. 6) longer than broad (1.8 : 1.5 mm), somewhat

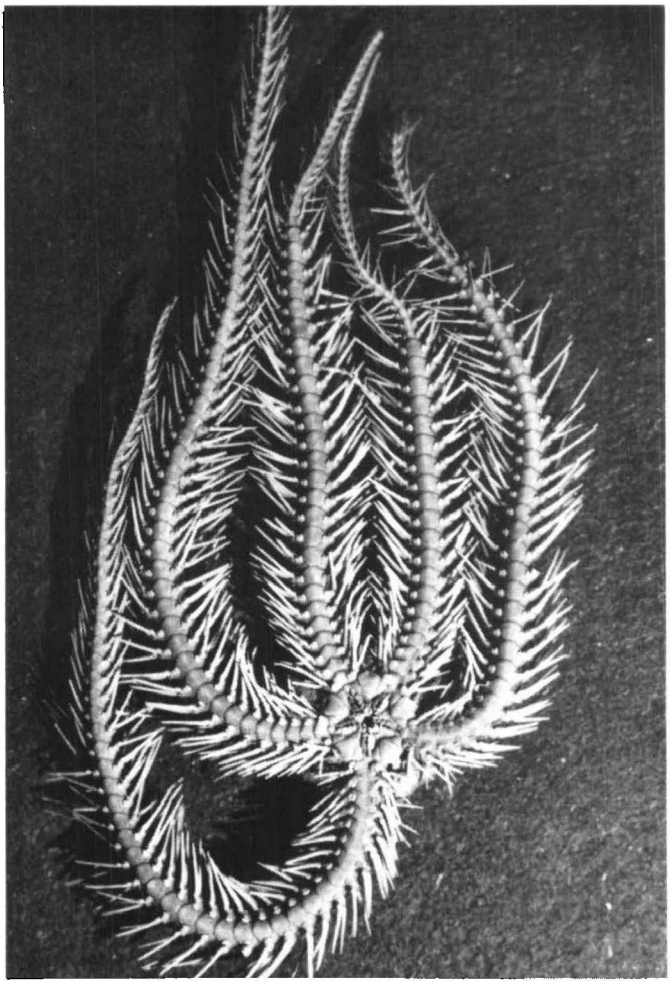

FIGURE 6. *Ophiocoma paucigranulata*, lower side of holotype.

convex with depression in center of distal part; greatest breadth distal to middle, narrowing inward; madreporite shield with more extended distal region. Adoral shields triangular with radial margin rounded or convex where it abuts against buccal tentacle scale; outer radial angle in contact with ventral shield; adorals not meeting in front of oral shield.

Three or four oral papillae on each side of jaw angle; outer papilla widest with rounded distal margin; inner two or three papillae more elongate and tapering; one or two smaller papillae or granules at apex of jaws,

outside of dental papillae. Buccal tentacle scale contiguous with both adoral and ventral shields, projecting under part of outer oral papilla.

Seven or eight dental papillae on each jaw, placed in two or three rows; teeth with hyaline tips.

Lower arm plates broader than long, in contact for more than half of arm length; beyond the disc, distal half of plate broadly rounded with proximal border about one-third maximum breadth of plate; arm plates excavated laterally beneath tentacle scales.

Upper arm plates in contact and broader than long, until midway along arm length; having broadly rounded distal border, tapering back sharply so that exposed proximal border is only one-third maximum breadth of plate; plates becoming relatively longer than broad on distal part of arm.

Lateral arm plates separated from each other for most of arm length, carrying long tapering spines with exception of upper spine on first two segments which is compressed and shorter than lower spines; upper arm spines on other segments longest, nearly circular in cross section, while lower spines somewhat compressed laterally; all elongate, tapering to blunt point; an even number of spines on each side of segment; upper spine up to four or five segments in length (4.5 to 5.5 mm) in middle of arm; lower spines in series diminish in length and thickness; length of arm spines on tenth and eighteenth segments (from the disc edge):

Spine	Segment 10		Segment 18
upper	4.6 mm	5.5 mm	5.2 mm
	4.2 mm	3.8 mm	3.8 mm
to			
	3.7 mm	3.4 mm	3.5 mm
lower	3.6 mm	3.4 mm	

Number of arm spines on each side of first ten segments with following sequence: 3 3 4 4 5 6 5 5 5 4 (on four sides examined); or 3 3 4 5 5 5 5 5 5 4 (on one side examined); or 3 3 4 5 6 5 5 5 5 4 (on one side examined). Beyond segment 10, four spines found as far as segment 18 quite regularly, and then dropping to three spines on rest of arm segments to end of arm.

Two tentacle scales regularly well out on arm: for two arms, a total of 58 and 57 arm segments with two scales out to segments 53 and 42, respectively; inner scale is slightly longer and narrower than outer scale; both have rounded tip.

Pigmentation: basic color (dried) brown with light line down center of upper arm plates becoming most noticeable on distal arm segments and only faint on proximal segments; line about one-sixth total breadth of proximal upper arm plates but one-half total breadth of distal plates, while remaining about same width throughout; otherwise upper part of disc

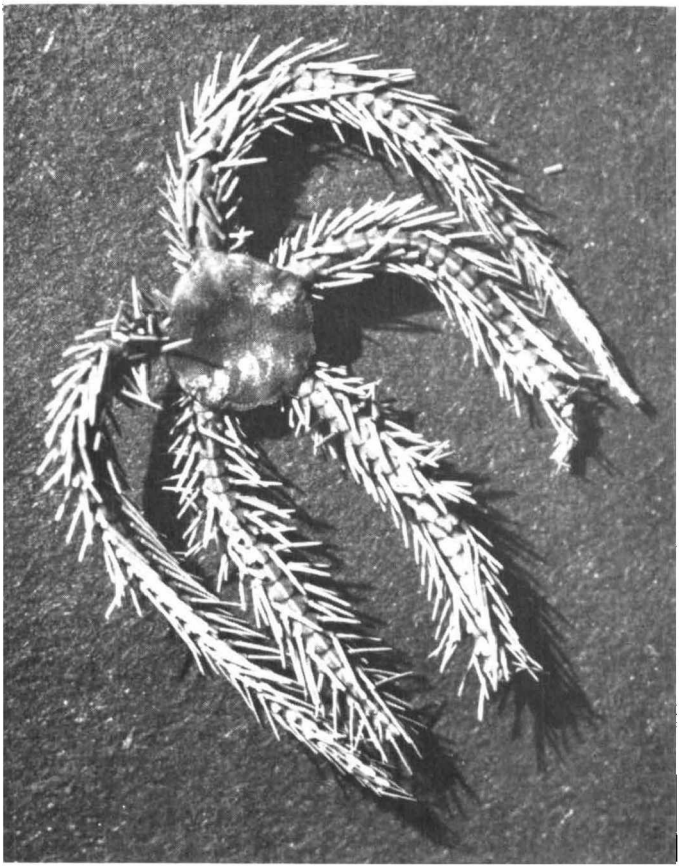

FIGURE 7. *Ophiocoma paucigranulata*, upper side of paratype.

including scales and granules as well as arms quite uniform chocolate brown, although 10 very faint lighter bands do appear to radiate from center of disc out to disc edge; upper side of arm spines brown, only slightly lighter than arm plates; lower side of disc showing rather coarse scales with fine punctuations of dark brown; same minute punctuations evident on exposed part of oral plates and between oral and adoral shields; lower side of arm spines also showing small dark spots becoming nearly light annuli with thin dark and wider light areas up to tip of spine; tentacle scales also punctuated; lower arm plates lighter brown than upper arm plates and showing faint light central line more pronounced toward end of rays; tube feet reddish orange; mouth parts basically tan with small dark brown punctuations, or speckles.

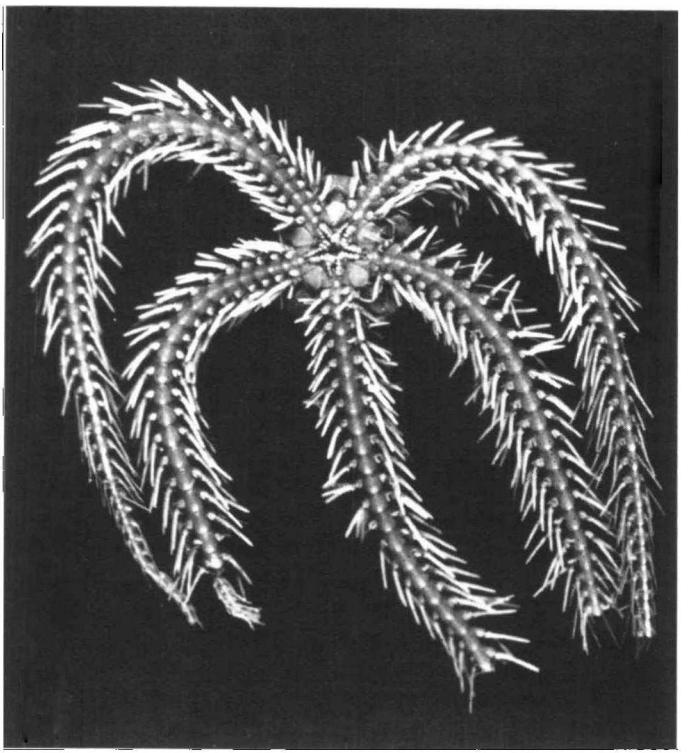

FIGURE 8. *Ophiocoma paucigranulata*, lower side of paratype.

Comparison with Paratype, and Variations.—The paratype (d.d. 7 mm) is slightly more than half the size of the holotype, thus offering an indication of growth changes and intraspecific variation (Figs. 7-8).

A. GRANULES: There are no granules on the upper side of the disc and orally only one or two granules occur interradially at the bases of two oral shields.

B. TENTACLE SCALES: Three arms were examined and two tentacle scales occur on the following segments: segments 1 to 38 (arm with total of 51 segments); segments 1 to 31 (arm with total of 51 segments); and segments 1 to 31 (arm incomplete, only 39+ segments). Comparing this with the holotype, it is clear that both the number of arm segments and the number of segments with two tentacle scales increase with size.

C. ARM SPINES: The sequence, or number of arm spines on each side of particular segments of the arm, was determined for six arm sides: the first 11 segments have 3 3 4 4 5 4 4 4 4 4 4 on five sides, and 3 3 4 4 5 4 4 4 4 4 3 on one side; three spines followed from the twelfth segment

to the end of the arm. This sequence reflects the smaller size of the paratype (on only one segment do five spines appear and four spines occur only as far as segment 12, *vs.* 18 in the holotype).

The length of the arm spines from one side of the tenth segment beyond the disc measured 2.6 mm, 2.0 mm, 1.8 mm, from upper to lower, respectively, and resembled those of the holotype in shape, being somewhat laterally compressed and tapering to a blunt point; the upper spine of segments one to three (beneath the disc) is much more compressed and not tapering.

D. ORAL AND DENTAL PAPILLAE: It is difficult to tell whether there are three or four oral papillae on each side, since sometimes the inner papilla may best be considered one of the dental papillae, the distinction without dissection not being clear. Regardless, the outer papilla is the largest, similar to the condition noted for the holotype. One to three granular papillae also occur at the apex of the jaw above the level of the dental papillae and rest on the oral plate. There are between five and six dental papillae on each dental plate. The teeth show the hyaline tips.

E. ORAL AND ADORAL SHIELDS: The oral shields are similar in shape to those of the holotype except smaller (length 1.1 mm, breadth 0.9 mm). The adorals lie along most of the inner radial margin of the oral shield, but leave a gap at its proximal end.

F. PIGMENTATION: The only major difference from the holotype concerns the median arm stripes. In the paratype, the upper stripe is more pronounced, especially on the proximal part of the arm (Fig. 7). A faint, rather broad medial stripe is also apparent on the lower arm plates, but with an evident light spot on the middistal part of each plate (Fig. 8). There is little evidence of the dark and light annulations of the lower part of the arm spines, although the minute dark punctuations are evident on the lower disc scales and mouth parts. The tube feet are red, as for the holotype.

Relationships and Distribution.—Ophiocoma paucigranulata represents the first known member of the Pica group of *Ophiocoma* outside the Indo–West Pacific region. It is allied most closely to *O. longispina*, known from southeastern Polynesia, in the sequence, shape, and size of the arm spines, as well as shape of the upper and lower arm plates.

The regular arrangement of the arm spines, with the length of the upper spines being the greatest,[2] tapering and elongate, plus the presence of two tentacle scales on many segments are features common to *O. longispina* and *O. pusilla* in the Pica group (Devaney, 1970).

---

[2] In my 1970 paper (Smithson. Contrib. Zool. *51*: 19), in the diagnosis of the Pica group, it was mistakenly stated "second or third spine in row longest"; this feature is frequently characteristic of *O. pica* alone in the group, whereas *O. longispina*, *O. pusilla*, and now *O. paucigranulata* typically have the upper spine the longest.

Ophiocoma paucigranulata is easily distinguished from other West Indian species of *Ophiocoma*. It can be separated from the two species in the Scolopendrina group (*O. echinata* and *O. wendti*) because it has the same number of arm spines on each side of the arm segments beyond the disc, instead of the alternating sequence noted for the Scolopendrina group (Devaney, 1970). The lack of two tentacle scales on all but a few proximal segments quickly distinguishes *O. pumila* from *O. paucigranulata*; there is also entirely different disc granulation and pigmentation.

The reduction in disc granulation to a peripheral location, both on the upper and lower sides of the disc, is a remarkable feature of the adults of any species of *Ophiocoma*. The absence of disc granules occurs especially in small specimens of the Scolopendrina group (Devaney, 1970) and might lead one to consider that even the largest specimen of *O. paucigranulata* is a juvenile. This appears unlikely, considering that the other three species in the Pica group, to which *O. paucigranulata* is most closely related, have extensive disc granulation at a size from at least 4 mm. Further, there is no evidence that disc granules had been accidentally removed.

Examination of the oral and dental plates of the type-specimens is withheld, since dissection would damage their external features.

The two specimens were mixed with other brittle stars before it was realized that they represented a new species. My notes state that at Station BH 3 there were "many *O. pumila* under coral slabs (not associated with algae) and a few *O. wendti* in coral heads with some *O. echinata* and other species." The two specimens of *O. paucigranulata* were found sorted with *O. wendti* and may have been collected from a coral habitat with that species.

14. *Ophiocoma pumila* Lütken

Ophiocoma pumila Lütken, 1856 (part): 13.—H. L. Clark, 1933: 39 (key), 67 (part).—Parslow & Clark, 1963: 27, 38-42, Fig. 11a-f.—Devaney, 1970: 10 (larva, Fig. 16), 28, 29 (key), 30-32.

Localities and Material.—Sta. BH 1b, under coral, 6-15 feet, two specimens, d.d. 6 and 8.5 mm.—Sta. BH 3, around coral and under limestone boulders, 1-3 feet, 22 specimens, d.d. 6 to 15 mm.—Sta. BH 5, probably from seaweed, 1-2 feet, one specimen, d.d. 2 mm; under or within coral boulders on sand, windward reef, four specimens, d.d. 11 to 13 mm.— Sta. BH 8c, in crevices of *Porites* coral, four specimens, d.d. 8 to 11 mm.— Sta. BH 9b, 40-50 feet, one specimen, d.d. 3 mm.

Remarks.—Many of the specimens collected at Sta. BH 3 were ripe and spawned between 6 and 6:30 P.M., March 7, 1969. Larval development was followed and carried through 40 days at the Smithsonian Institution,

although no metamorphosis occurred. A photograph of the 13-day-old larva and notes on the larval skeleton have been presented (Devaney, 1970). Enough information was gathered from the fertilized egg and larval skeleton to indicate that the Pumila group of *Ophiocoma* can be distinguished from the Pica and Scolopendrina groups on the basis of premetamorphic characters.

It was anticipated that changes prior to metamorphosis could be documented to help clarify and evaluate the relationship between *O. pumila* and *Ophiocomella ophiactoides*, but these studies were not successful. However, attempts to find the typically hexamerous *O. ophiactoides* at Br. Honduras proved unsuccessful. The apparent absence of this species and presence of adult and juvenile individuals of *Ophiocoma pumila* support the conclusion, based on morphological criteria, that the two taxa are separate (Parslow & Clark, 1963; Devaney, 1970). The hexamerous specimens described by Lütken (1856) originally, and by H. L. Clark (1933) subsequently as *O. pumila* are considered to be *Ophiocomella ophiactoides*.

One specimen from the Br. Honduras collection (Sta. BH 3) was found with a polynoid worm on it. The ophiuroid had transversely banded brown and white arms and the polynoid was similarly banded on its upper side. The dorsal side of the polynoid was also covered with papillae similar in size and color to the disc granules of the ophiuroid. These two characters gave the polynoid a cryptic appearance against the ophiuroid. The polynoid was identified as *Hermenia verruculosa* Grube by Dr. Marian Pettibone. Ebbs (1966) reviewed the status of this polynoid species, including habitat records. According to his review, Treadwell (1911) observed this species within the interstices of coral rocks in the Dry Tortugas region. Ebbs recovered two specimens from coral debris in the area of Margot Fish Shoal off southeastern Florida. According to existing records, *H. verruculosa* has a wide West Indian distribution.

15. *Ophiocoma wendti* Müller & Troschel

Ophiocoma wendti Müller & Troschel, 1842: 99.—Devaney, 1970: 34 (key), 35, 37.

Non *Ophiocoma wendti*: Koehler, 1907: 327, Pl. xiii, fig. 38.—H. L. Clark, 1921: 129.

Ophiocoma riisei Lütken, 1856: 14.—H. L. Clark, 1921: 128; 1933: 39 (key), 66-67.

Localities and Material.—Sta. BH 2 and/or 3, within or under shallow coral, five specimens, d.d. 12.5 to 15 mm.—Sta. BH 5, under or within limestone boulders on sand, four specimens, d.d. 2 to 17 mm.—Sta. BH 8b, under coral rubble on sand, 1 foot, two specimens, d.d. 9 and 20 mm.—Sta. BH 8c, within crevices of *Porites* coral, one specimen, d.d. 15 mm.—Sta. BH 9b, 40-50 feet, two specimens, d.d. 6.5 and 13 mm.

Remarks.—Devaney (1970) synonymized *O. riisei* Lütken with *O. wendti*. This species is fairly common in many West Indian shallow-water locations, whereas Indo–West Pacific records of *O. wendti* refer to other species (Devaney, 1970).

The 2-mm specimen from Sta. BH 5 differs from the larger specimens in lacking disc granules and having a dark-colored disc contrasting sharply with much lighter pigmented arms. These are considered juvenile features.

Family Ophiodermatidae

16. *Ophioderma appressum* (Say)

Ophiura appressa Say, 1825: v, 151.
Ophioderma virescens Lütken, 1859: 194-195, Pl. 1, figs. 4a-d.
Ophioderma appressum: H. L. Clark, 1933: 40 (key), 68.—Ziesenhenne, 1955: 188 (key), 200.

Localities and Material.—Sta. BH 2 and/or 3, 6-15 feet, three specimens, d.d. 8 to 14 mm.—Sta. BH 4, one specimen, d.d. 11 mm.—Sta. BH 5, under or within coral or limestone boulders on sandy bottom, 1-2 feet, four specimens, d.d. 7 to 15 mm.—Sta. BH 8b, in coral rubble under sand pockets, five specimens, d.d. 12 to 15 mm.—Sta. BH 8c, in fine algae at base of turtle and eel grass on sand about 25 yards off shore, two specimens, d.d. 4.5 and 5 mm; in or under coral, one specimen, d.d. 10 mm.

Remarks.—Many of the specimens I have examined of *Ophioderma appressum* from Br. Honduras, Bermuda, and Barbados show a portion of the adoral shields without granular covering. Even the smallest specimens, from Sta. BH 8c, have the adoral shields partially uncovered. Lyman (1865: 34) mentioned that a portion of the adoral shields between the oral and ventral shields is free of granules. In Ziesenhenne's (1955) key to the species of *Ophioderma*, however, *O. appressum* is placed among those species in which the adoral shields are not exposed.

Two color-forms already noted (Lütken, 1859: 195; Pl. 1, figs. 4a, d; Koehler, 1913: 353) were observed in the Br. Honduras material (Fig. 9).

17. *Ophioderma brevicaudum* Lütken

Ophioderma brevicaudum Lütken, 1856: 8.—H. L. Clark, 1933: 40 (key), 69.

Localities and Material.—Sta. BH 2 or 3, approx. 3-5 feet, one specimen, d.d. 4.5 mm.—Sta. BH 8b, under coral rubble on sand pockets, 1 foot, two specimens, d.d. 13 and 14 mm.

Remarks.—One of the two specimens from Sta. BH 8b shows several of the proximal upper arm plates fragmented irregularly. This same feature was noted on a 17-mm specimen from Barbados (Bishop Museum Cat. No.

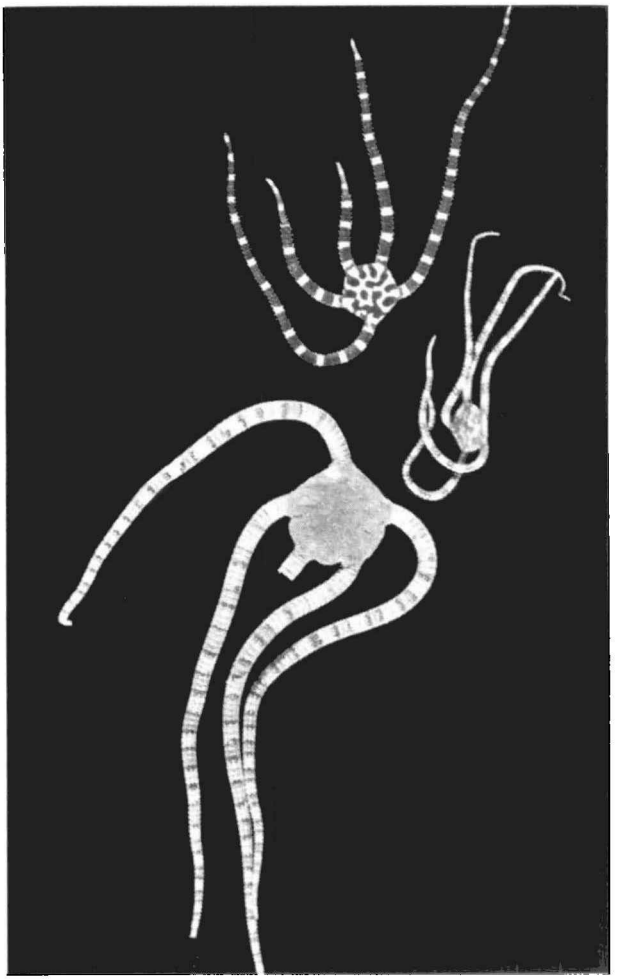

FIGURE 9. Color patterns in *Ophioderma appressum* from Sta. BH 2 and/or 3.

W1763), while a second specimen from the same lot, with a d.d. of 15 mm, did not have the plates fragmented.

A maximum of eight and nine arm spines was noted on proximal segments of the Br. Honduras specimens from Sta. BH 8b, while nine or 10 were noted on the Barbados specimens. The small specimen from Sta. BH 2 or 3 had a maximum of only six arm spines.

The small specimen from Sta. BH 2 or 3 is referred to *O. brevicaudum* on the basis of the greater coarseness of the granules after comparison

with similar-sized specimens of *O. appressum* from Sta. BH 8c. Not only is the granulation of the disc coarser, but, at this small size, *O. brevicaudum* has granules covering four of the five oral shields and most of the ventral shields. Also a few granules occur on the upper surface of the distal arm plates. In contrast, the small specimens of *O. appressum* lack granules on the oral or ventral shields, and no granules were found on the arms.

In addition, the upper arm plates of the small specimens of *O. brevicaudum* are relatively narrower than on similar-sized specimens of *O. appressum*, with the result that the arm spines on each side of the same segment are more nearly in contact on the upper side of the arm.

The disc of the small specimen is nearly all white, in contrast to the arms with broad light and dark bands.

18. *Ophioderma cinereum* Müller & Troschel

Ophioderma cinereum Müller & Troschel, 1842: 87.—H. L. Clark, 1933: 40 (key), 70.—Ziesenhenne, 1955: 187 (key), 192.
Ophioderma antillarum Lütken, 1859: Pl. 1, figs. 1a-c.
Ophiocryptus hexacanthus H. L. Clark: 1915a: 64.

Localities and Material.—Sta. BH 1b, under coral, 6-15 feet, two specimens, d.d. 8 and 11 mm.—Sta. BH 2 and/or 3, 6-15 feet, three specimens, d.d. 16 to 20 mm.—Sta. BH 8b, under coral rubble on sand, 1 foot, four specimens, d.d. 23 to 25 mm.

Remarks.—This species has the radial shields exposed, the adoral shields covered, and has only two arm spines on each side of segment one.

The specimens of *Ophioderma cinereum* I have examined show a dark border around the exposed part of each radial shield. Ziesenhenne (1955) did not consider this character wholly reliable, however.

In his key to the species of *Ophioderma*, Ziesenhenne placed *O. cinereum* with those species in which the upper arm plates were divided into numerous smaller plates. However, Lyman (1865: 28) noted that in small specimens of *O. cinereum* the upper arm plates are regular and unbroken. The smaller specimen (d.d. 8 mm) from Sta. BH 1b has all the upper plates complete. In addition, a 6-mm specimen from Galeta Island (Atlantic side of the Panama Canal) has none of the upper arm plates fragmented. A 16-mm specimen from Puerto Rico in the Bishop Museum (Cat. No. W1675) also has the upper arm plates complete. The Br. Honduras specimens of *O. cinereum*, larger than 10 mm, all show the upper arm-plate fragmentation, especially in the proximal part of the arm. It appears, then, that arm-plate fragmentation is characteristic of many specimens of *O. cinereum* larger than 10 mm, yet subject to some variation, and is commonly absent in smaller specimens of that species.

19. *Ophioderma phoenium* H. L. Clark

Ophioderma phoenium H. L. Clark, 1918: 333, Pl. 6, figs. 1-2; 1919: Pl. 3, fig. 1 (color); 1933: 40 (key), 71.—Ziesenhenne, 1955: 187 (key), 192.

Localities and Material.—Sta. BH 2 or 3, 6-15 feet, two specimens, d.d. 8 and 20 mm.

Remarks.—The two specimens from Br. Honduras agree quite closely with previous descriptions. Like *O. cinereum*, this species has the radial shields exposed, the adoral shields covered, and has only two arm spines on each side of segment one. The radial shields are much lighter color, similar to the arms, than the reddish disc, which is also minutely flecked with a lighter color. The larger specimen shows no sign of upper arm-plate fragmentation common in specimens of *O. cinereum* of that size.

Previous reports of *O. phoenium* include Tobago Island, British West Indies, and Caledonia Bay, Panama (Ziesenhenne, 1955).

20. *Ophioderma rubicundum* Lütken

Ophioderma rubicundum Lütken, 1856: 8; 1859: Pl. 1, figs. 2a-c.—H. L. Clark, 1933: 40 (key), 71.—Ziesenhenne, 1955: 187 (key), 197.

Localities and Material.—Sta. BH 2 and/or 3, 3-15 feet, four specimens, d.d. 5.5 to 18.5 mm.—Sta. BH 4, under coral boulder, 40-50 feet, three specimens, d.d. 4 to 16.5 mm.—Sta. BH 8c, 5-20 feet, two specimens, d.d. 7 and 16 mm.—Sta. BH 9b, 40-50 feet, five specimens, d.d. 6 to 12 mm.

Remarks.—The adult stages of this species are characterized by having most or all radial shields exposed. Small specimens (less than 6 mm) frequently have the radial shields covered by granules. The 14 specimens collected at Br. Honduras were compared with four specimens collected by the author in August-September 1969 at Bermuda. Unlike Bermuda, where *O. rubicundum* was found only at depths below 100 feet, the Br. Honduran material was collected at depths from 5 to 50 feet. Table 1 lists the Br. Honduran and Bermudan specimens of *O. rubicundum* by size and gives the data relating size and the degree of exposure of the radial shields.

In addition, there is an increase in the number of arm spines which is positively correlated with increase in the size of individuals of *O. rubicundum*. In Table 2, the change in sequence of the number of arm spines is compared for different-sized specimens.

In Ziesenhenne's (1955) key to the species of *Ophioderma, O. rubicundum* is considered in the couplet with *O. panamense* as having "10 to 12" arm spines. My analysis above suggests that only rarely do more than 10 arm spines occur, and then only in the larger specimens. Nine or 10

TABLE 1

Ophioderma rubicundum, EXPOSURE OF RADIAL SHIELDS RELATED TO SIZE

Disc diameter (mm)	Location and depth	Radial shields
4	BH 4, 40-50 ft	None exposed
4.5	Bermuda, 140-150 ft	None exposed
5.5	BH 2/3, 3-15 ft	2 exposed, 8 covered
5.5	Bermuda, 120-125 ft	9 partially exposed, 1 almost covered
6	Bermuda, 140-145 ft	9 covered, 1 exposed
6	BH 9b, 40-50 ft	5 covered, 5 partially exposed
7	Bermuda, 140-145 ft	all (10) exposed
7	BH 8c, 5-10 ft	all (10) exposed
8	BH 9b, 40-50 ft	all (10) exposed
10	BH 9b, 40-50 ft	all (10) exposed
11	BH 9b, 40-50 ft	all (10) exposed
12	BH 9b, 40-50 ft	2 exposed, 8 covered
12	BH 4, 40-50 ft	all (10) exposed
13	BH 2/3, 3-15 ft	all (10) exposed
15	BH 2/3, 3-15 ft	all (10) exposed
16	BH 8c, 5-10 ft	7 nearly completely exposed, 3 partially exposed
16.5	BH 4, 40-50 ft	all (10) exposed
18.5	BH 2/3, 3-15 ft	all (10) exposed

spines are most common, more frequently beyond the disc's edge. Lütken (1856: 8) noted 10 arm spines for the type of *O. rubicundum*, having a d.d. of 16 mm.

21. *Ophioderma* sp.

Locality and Material.—Sta. BH 9a, under coral head on sandy bottom, 175 feet, one specimen, d.d. 5 mm.

Remarks.—This specimen belongs to that group of *Ophioderma* in which the radial, oral, and adoral shields are exposed at a small size. The specimen comes closest to *O. pallidum* Verill and *O. rubicundum* Lütken, following Ziesenhenne's 1955 key to species of *Ophioderma.* However, several features make it impossible to place it with either of these species. In contrast to *O. pallidum*, known from 110 to 200 fathoms off Havana, Cuba, the present form has the adoral shields almost completely bare, and there is no evidence of the naked scales along the arm bases next to the genital openings which characterizes *O. pallidum.* However, the Br. Honduran specimen has oral shields that are quite large, broader than

TABLE 2

SEQUENCE OF NUMBERS OF ARM SPINES, *Ophioderma rubicundum*

Specimen	Segment 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A. BH 4 (d.d. 4 mm)*	2	3	4	5	5	5	5	5	5	5	5	5	5	5	4	4	4	
	3	3	4	5	5	5	5	5	5	5	5	5	5	5	4	4	4	
	2	3	4	5	5	5	5	5	5	5	5	5	5	5	5	4	4	
B. Bermuda (d.d. 6 mm)†	2	3	4	5	6	6	6	6	6	6	6	6	6	6	6	5	5	5
	3	3	4	5	6	6	6	6	6	6	6	6	6	6	5	5	5	5
C. Bermuda (d.d. 9 mm)‡	3	3	4	5	6	7	7	7	7	7								
	3	4	5	5	6	7	7	7	7	7								
	3	4	4	5	6	7	7	7	7	7								
	3	3	5	5	6	7	7	7	7	7								
	3	3	5	5	6	7	8	7	7	7								
	3	3	5	5	6	7	7	7	7	7								
	3	3	4	5	6	7	7	7	7	7								
	3	4	5	5	6	7	7	7	7	7								
	3	3	4	5	6	7	7	7	7	7								
	3	3	4	5	6	7	7	7	8	7								
D. BH 2/3 (d.d. 13 mm)§	4	4	4	5	6	7	9	10	9	10	10	9						
	3	4	4	5	6	7	9	10	10	9	9	9						
	4	4	5	5	6	7	9	9	10	10	9	9						
	4	4	5	5	6	7	9	9	10	9	10	9						
	4	4	5	5	6	7	9	9	9	9	9	9						
E. BH 2/3 (d.d. 15 mm)‖	4	4	5	6	6	7	9	11	10	11	10	11						
	4	4	5	6	6	7	9	11	10	10	10	10						
	4	4	5	6	6	7	9	10	11	10	10	10						
	4	4	5	6	6	7	9	10	10	10	10	10						
	4	4	5	5	6	8	9	10	10	10	10	10						

* A. BH 4 (d.d. 4 mm): Three sides examined from three different arms.
† B. Bermuda (d.d. 6 mm): Three sides examined; beyond middle of arm, number of spines dropped to four.
‡ C. Bermuda (d.d. 9 mm): Seven spines were found as far as segments 18 to 22, beyond which the number dropped to six, five, and four farther out on the arm; a maximum of eight spines was noted on segments 7 and 9.
§ D. BH 2/3 (d.d. 13 mm): Nine spines continued as far as segments 16 to 22, then irregularly with eight, beyond which the number dropped to seven, six, five, and four farther out on the arm; note that 10 spines occurred only on segments 8 to 11, and irregularly.
‖ E. BH 2/3 (d.d. 15 mm): A maximum of 11 spines was noted between segments 8 and 12 (also in one case on segment 19); 10 spines occurred out to segments 14 to 20, then dropped to nine, eight, seven, six, five, and four farther out on the arm.

TABLE 2 (Continued)

Specimen	Segment																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
F. BH 2/3 (d.d. 18.5 mm)**	4	4	5	6	6	7	8	9	10	10	10	9	11	10	10			
	3	4	4	6	6	7	8	10	10	11	10	10	10	10	10			
	4	4	5	6	6	7	8	10	10	10	10	10	10	10	10			
	4	4	5	6	6	8	8	10	10	10	10	10	10	10	10			
	4	4	5	5	6	7	8	9	10	10	9	10	10	10	10			
	4	4	5	5	6	7	8	10	10	10	10	10	10	10	10			

** F. BH 2/3 (d.d. 18.5 mm): Again, a maximum of 11 arm spines, but only noted twice, on segments 10 and 13; 10 spines occurred well beyond segment 20 in most cases, although one side had 10 spines only as far as segment 15 before dropping to nine; farther out on the arm, the number of spines was reduced to four near the arm tip.

long, and subcordate, as well as having arms relatively long and tapering (five to six times the disc diameter) and a pigmentation similar to that of *O. pallidum.*

The specimen was compared with a 4.5-mm specimen of *O. rubicundum* from Sta. BH 4. At this size, *O. rubicundum* has the radial shields frequently covered, or, if exposed, not nearly as much as for the unidentified specimen from Sta. BH 9a. Furthermore, the oral shields are relatively smaller and without as great a width-to-length ratio in the small specimen of *O. rubicundum.*

The present specimen has three arm spines on all sides of segment one.

22. *Ophiurochaeta littoralis* (Koehler)

Ophiolimna littoralis Koehler, 1913: 370, Pl. 21, figs. 1-3; 1914: 111.
Ophiotreta littoralis: H. L. Clark, 1915b: 216; 1919: 56; 1933: 34 (in key), 43.—Parslow & A. M. Clark, 1963: 26.
Ophiurochaeta littoralis: Matsumoto, 1917: 316-317.

Localities and Material.—Sta. BH 4, off reef edge beyond reef flat, 40-50 feet, three specimens, d.d. 3 to 6 mm.—Sta. BH 9a, open water on seaward edge with steep slope, 160 feet, one specimen, d.d. 4 mm.

Remarks.—Matsumoto (1915: 86) separated both *mixta* and *littoralis* from *Ophiolimna* in the family Ophiacanthidae and erected the new genus *Ophiurochaeta* for the two species, placing the genus in the family Ophiodermatidae. In 1917, Matsumoto (pp. 101-102) considered Lyman's (1878) *Ophiochaeta* (?) *mixta* (referred to *Ophiolimna* by Verrill, 1899) and Koehler's (1913) *Ophiolimna littoralis* "not genuine *Ophiolimna*" differing by having: (a) more oral papillae, the outermost one being small

and stretching inward above the next papilla; (b) well-developed lower arm plates, fully in contact with one another; and (c) presence of two tentacle scales, of which the outer one overlaps the base of the lowest arm spines.

Matsumoto (1917) further compared *Ophiurochaeta* with the ophiacanthid genus *Ophiotreta*, since H. L. Clark (1915b: 351) had considered the two genera synonymous but without explanation. H. L. Clark (1933) and others working with the Caribbean ophiuroid fauna have continued to use the name *Ophiotreta littoralis* for the West Indian ophiuroid, although Matsumoto's reasons for removing both *mixta* and *littoralis* appear sound.

Matsumoto examined only *mixta* in establishing *Ophiurochaeta*, and included *littoralis* on the basis of Koehler's original description and figures. One of the most important features which Matsumoto found, suggesting that *mixta* belonged in the Ophiodermatidae, was the presence of three (triple) peristomial plates, characteristic of ophiodermatids but unknown in ophiacanthid brittle stars.

In 1963, Murakami reported on the dental and oral plates of many representative ophiuroid genera and families. He found that representatives of the seven genera of Ophiodermatidae he examined had the dental plate divided into a series of ossicles by transverse fissures (Murakami, 1963: Pl. II, figs. 42-55). Although a similar condition is found in some of the euryalid and ophiomyxid ophiuroids, the divided dental plate is practically unknown in other ophiuroid groups. Only one ophiacanthid, *Ophiophthalmus normani*, was reported with the dental plate divided (in this case only a single transverse oblique division is seen through one of the tooth fossae dividing the plate into two pieces) (Murakami, 1963: Pl. II, fig. 20). This latter type of division of the dental plate is quite unlike that in the ophiodermatids, where nearly parallel division planes pass between the tooth fossae to divide the plate into three or more pieces. Unfortunately, Murakami did not look at the dental plate of either *mixta* or *littoralis*.

Thanks to the generosity of Maureen Downey at the National Museum of Natural History, I was able to examine three of Koehler's original specimens of *Ophiolimna littoralis* (Koehler, 1914: 111) from Cuba (USNM No. 33991). One of these specimens (d.d. 8.5 mm), with the disc partially torn, was dissected to reveal the peristomial and dental plates and was compared with a 5-mm specimen from Br. Honduras (Sta. BH 4).

PERISTOMIAL PLATES: These are double and quite large in the Br. Honduras specimen; there is a small notch at the outer margin where the two plates are joined; although no third medial plate was noted in one angle, a small irregular bit of calcification was observed. The Cuban specimen also has two large plates with a small indented outer margin where

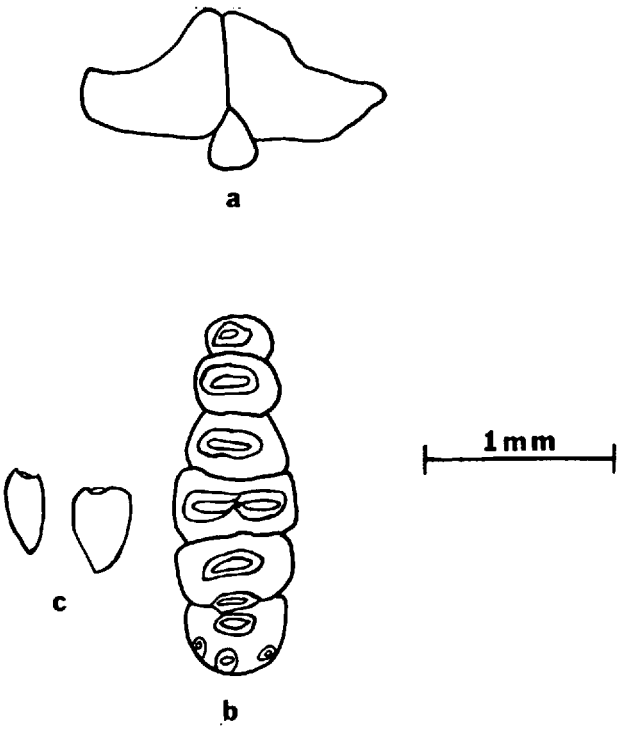

FIGURE 10. *Ophiurochaeta littoralis* (Koehler): a, peristomial plates of 8.5-mm specimen (USNM No. 33991); b, dental plate of same; c, oral teeth of same.

the two plates meet; however, at this point there is a small medial piece occupying the indentation (Fig. 10,a); it is obviously a third peristomial piece.

The discrepancy between the peristomial plates of the two specimens probably is due to differences in size (the small third medial piece not yet being developed in the Br. Honduras specimen), or a small medial piece may have been removed during treatment with hypo solution upon dissection.

Only one other genus of Ophiodermatidae, *Distichophis* Ely, monotypic from the Hawaiian Islands, has been characterized by having a pair of peristomial plates. It was shown recently (Devaney, in press), on the basis of a 4-mm specimen of *Distichophis clarki*, that the third (medial) peristomial plate is indeed present, but only in three of the five angles.

There is a considerable difference in the disposition of the peristomial plates figured by Matsumoto (1917: Pl. VI, fig. 2) for *Ophiurochaeta*

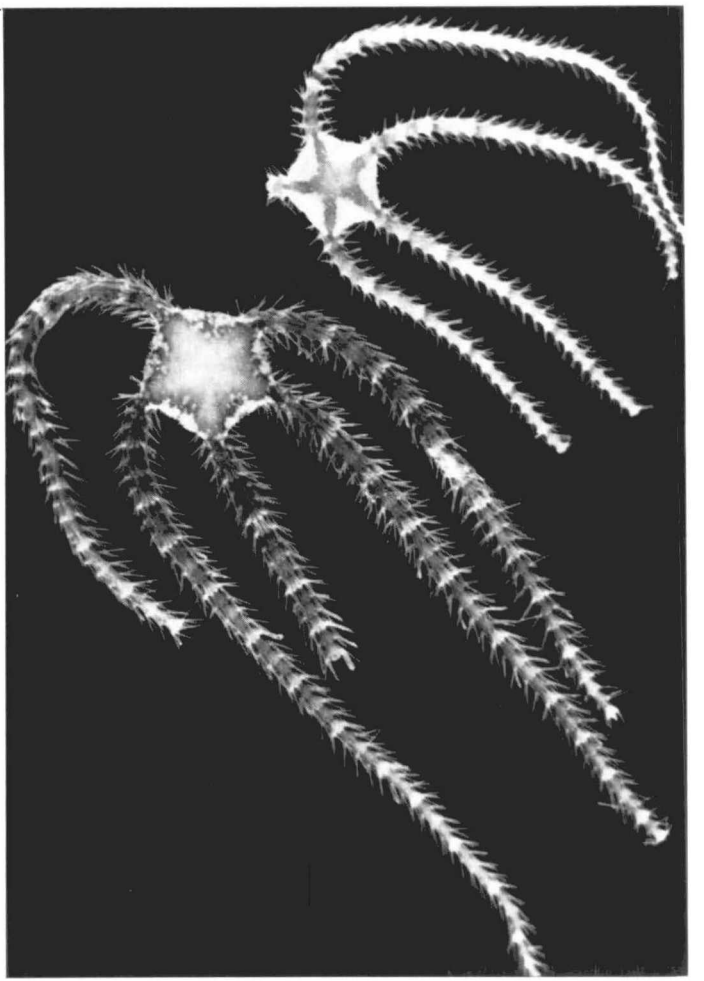

FIGURE 11. *Ophiurochaeta littoralis*, upper side, from Sta. BH 4.

mixta and those revealed in the present dissections of *O. littoralis*. In *O. mixta*, the medial peristomial plate is the largest and extends between the lateral pieces, separating them, a unique feature of any known ophiodermatid. In *O. littoralis*, however, the typical ophiodermatid condition is noted, with the medial piece smaller than the lateral pieces and excluded from the inner angle (Fig. 10,a).

DENTAL PLATE: The dental plate of the Br. Honduran specimen is composed of three or four separate pieces joined together. The oral piece has two lateral depressions, probably for infradental papillae. None of

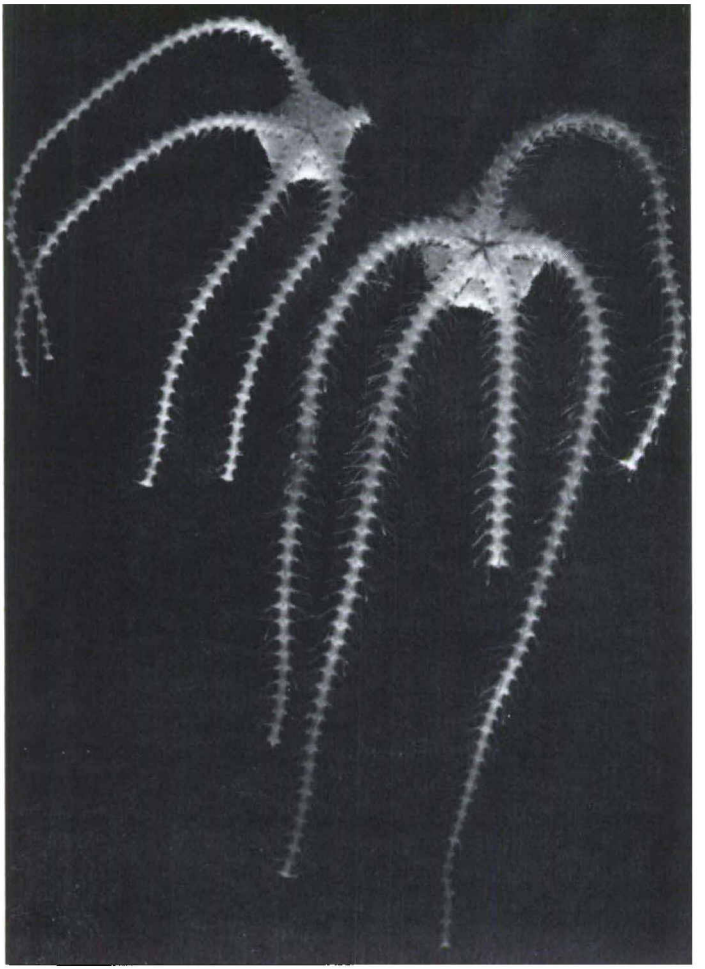

FIGURE 12. *Ophiurochaeta littoralis*, lower side, from Sta. BH 4.

the individual pieces is perforated completely, and each piece except the oralmost has a median elongate fossa with a narrow, raised midsection. The Cuban specimen has a dental plate composed of five or six pieces joined together (Fig. 10,b). The oral piece has three lateral depressions for infradental papillae and a larger central fossa for the oral tooth. There also is a fossa between the oral and next piece. Each piece has otherwise a single fossa which does not perforate the plate. The individual pieces making up the dental plate are very thin and concave on their proximal sides. The teeth orally taper to a pointed tip (Fig. 10,c).

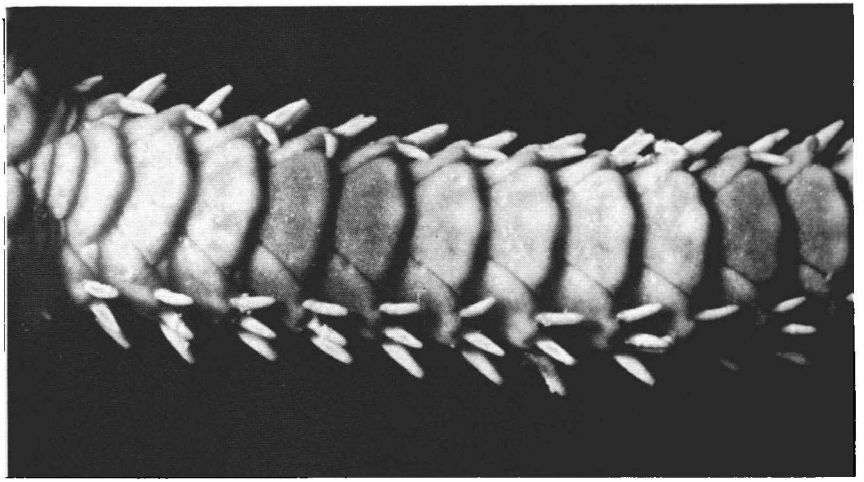

FIGURE 13. *Ophiolepis impressa* Lütken, upper arm near disc, from Sta. BH 2 and/or 3 (d.d. 9 mm).

In addition to the internal features described above, I have compared several external features of the Br. Honduran and Cuban specimens.

PIGMENTATION: There is a certain amount of variability in the color of the Br. Honduran specimens. In two of the three specimens from Sta. BH 4 there is a distinct, darker star-shaped pattern on the disc, while the other specimen has most of the disc dark, with only a little of the interradial area lighter (Fig. 11). The specimen from Sta. BH 9a resembles the latter. There is a definite degree of banding, light and dark on the upper sides of the arms as well. The lower sides of the arms and mouth region are very light (Fig. 12).

The three Cuban examples examined are dry. The larger specimen (d.d. 10 mm) has three or four lighter areas near the center of the disc, which is otherwise tan with a few meandering light lines to the edge. The upper sides of the arms with the lateral sides of the arm plates are brownish, leaving a nearly complete light line down the center. The two smaller specimens (dd. 7.5, 8 mm), with a star-shaped, brownish pattern, are similar to the Br. Honduran specimens. Their arms appear indistinctly banded.

LOWER ARM PLATES: Generally only one to three of the proximal lower arm plates are in contact with each other; farther out, the lateral plates separate these. The larger Cuban specimen has one ray in which the proximal part of the lower arm plates is nearly in contact with the distal border of the adjacent plate; in the other rays, the plates are just separated. Matsumoto (1917: 316) characterized *Ophiurochaeta* as having both the

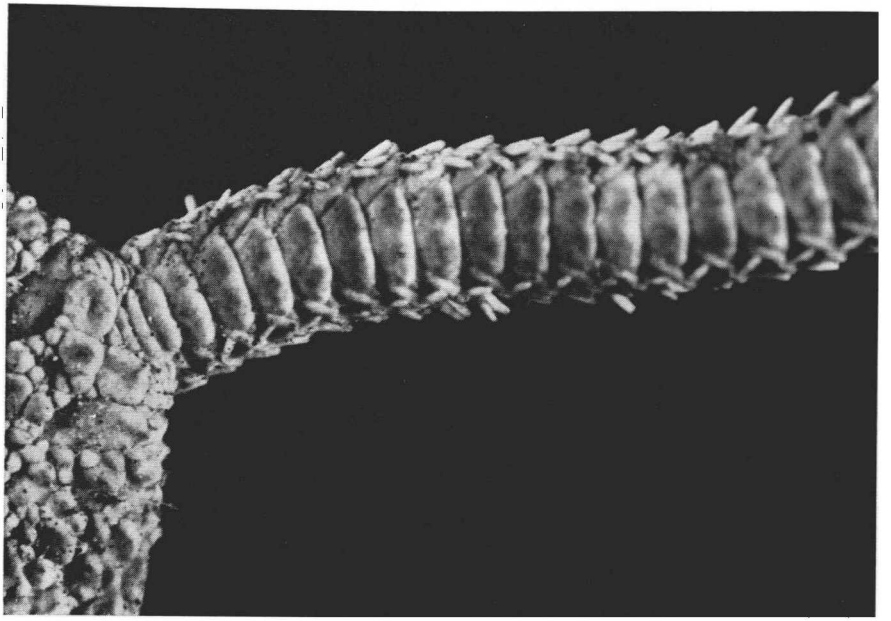

FIGURE 14. *Ophiolepis impressa* Lütken, upper arm near disc (USNM No. 1085, d.d. 13.5 mm).

upper and lower arm plates "well developed, fully in contact with one another." Based on the above examination of *O. littoralis*, this description must be modified.

ADORAL SHIELDS: In the 10- and 8-mm specimens from Cuba, the adoral shields are slightly separated within by the oral shield, while the 7.5-mm specimen has them in contact in three of the five areas. In all the Br. Honduran specimens the adoral shields are in contact within. Separation of the adoral shields appears to be a function of increase in size in this species.

ARM SPINES: The arm spines and disc spinules of the specimens I examined, instead of being solid, are somewhat fragile and distinctly hollow, with a well-developed lumen. The delicate nature of the spines, minutely serrate and with a translucent cast, is quite evident in the specimens from Br. Honduras. The larger specimens from Cuba show the spines more opaque, although their thin walls and lumens are evident where they are broken.

Triple peristomial plates, a divided dental plate, and the outer tentacle scale overlapping the base of the lower spine are good reasons for considering *O. littoralis* in the family Ophiodermatidae. At the present time,

it seems best to consider Koehler's species in the genus *Ophiurochaeta*. For the time being, I am considering *O. mixta* and *O. littoralis* congeneric, although a major difference occurs in the nature of the peristomial plates.

Ophiurochaeta mixta is known from the Cuban region in depths from 160 to 242 fathoms (Lyman, 1878: 222). *O. littoralis* was reported by Koehler (1913) from St. Thomas Sound on the basis of three specimens (d.d. 3 to 4.5 mm) and four specimens (d.d. 7 to 10 mm) from "La Havanus" (presumably Cuba). The present records extend the distribution of this species to Br. Honduras, at depths from 40 to 160 feet.

Family Ophiuridae

23. *Ophiolepis impressa* Lütken

Ophiolepis impressa Lütken, 1859: 101, Pl. II, figs. 3a-b.
Ophiozona impressa: Lyman, 1865: 64, Fig. 4.—Matsumoto, 1917: 298, 389.—H. L. Clark, 1933: 41 (key), 73.

Localities and Material.—Sta. BH 2 and/or 3, around coral and under coralline algae, 6-15 feet, five specimens, d.d. 9 to 14 mm.—Sta. BH 4, beneath or within coral, 40-50 feet, one specimen, d.d. 11 mm.—Sta. BH 5, beneath coral or limestone boulders, 1-2 feet, three specimens, d.d. 11-13 mm.—Sta. BH 8b, under coral rubble on sand, 1 foot, one specimen, d.d. 11.5 mm.

Remarks.—All specimens examined reveal small supplementary upper arm plates located along the distal-lateral edge of the upper arm plate adjacent to the lateral arm plates (Fig. 13). In other respects, the specimens show the characteristics noted by Lütken (1859) and Lyman (1865).

Lyman transferred *O. impressa* together with the tropical Eastern Pacific species, *Ophiolepis pacifica* Lütken, to a new genus, *Ophiozona*, based solely on the supposed absence of the supplementary upper arm plates. Matsumoto (1917) redefined and restricted the genus *Ophiozona* to these two species after a large number of additional taxa had been included (most of which were transferred to *Ophiozonella* and *Haplophiura* by Matsumoto).

Three specimens of *Ophiolepis impressa* from the USNM collections were made available for study (No. 1080, d.d. 10 mm; No. 1085, d.d. 14.5 and 11 mm). These were among the specimens examined by Lyman (1865: 66) from St. Thomas, West Indies, when he established *Ophiozona*. The specimens are from the type-locality, collected by A. H. Riise. Small, but distinct, supplementary upper arm plates are evident (Figs. 14, 15).

In addition, two specimens of *O. pacifica* from the Gulf of California were loaned by Capt. F. C. Ziesenhenne at the Allan Hancock Foundation (AHF No. 522.1, d.d. 11 mm; No. 522.2, d.d. 11.5 mm). These specimens also revealed the supplementary upper arm plates (Fig. 16).

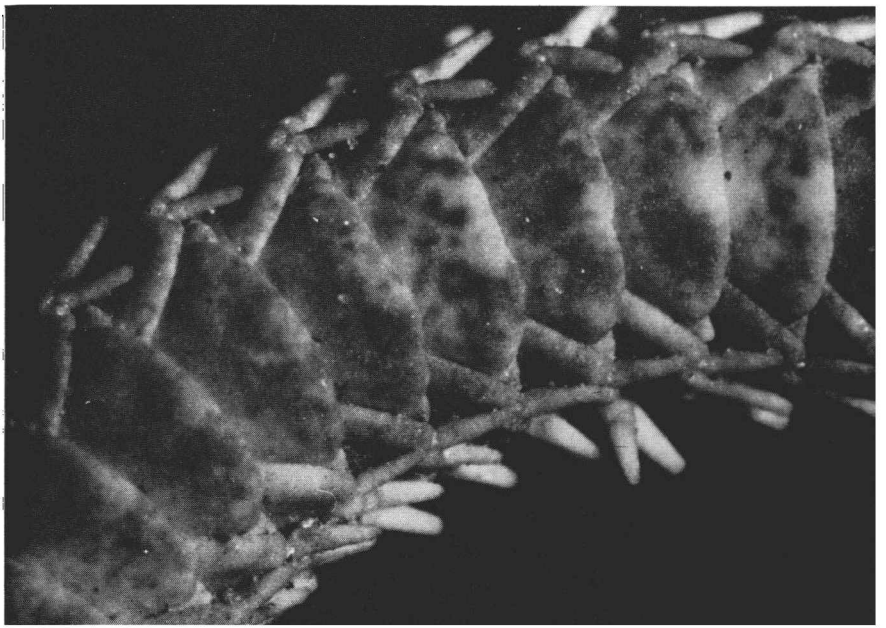

FIGURE 15. *Ophiolepis impressa* Lütken, upper arm near disc (USNM No. 1085, d.d. 13.5 mm).

The above results lead me to reject Lyman's genus *Ophiozona* and reduce it to synonymy under *Ophiolepis*, since there are no criteria which can be used to separate the two taxa and *Ophiolepis* has priority.

24. *Ophiolepis paucispina* (Say)

Ophiura paucispina Say, 1825: 149.
Ophiolepis paucispina: H. L. Clark, 1933: 41 (key), 74.

Localities and Material.—Sta. BH 2 or 3, one specimen, d.d. 3.5 mm.—Sta. BH 5, under or within coral and limestone, on sandy bottom, one specimen, d.d. 4 mm.

Class ECHINOZOA
Subclass HOLOTHUROIDEA
Family Synaptidae

25. *Euapta lappa* (Müller)

Synapta lappa Müller, 1850: 134.
Euapta lappa: H. L. Clark, 1933: 99 (key), 118.

Locality and Material.—Sta. BH 8b, no details, one specimen.

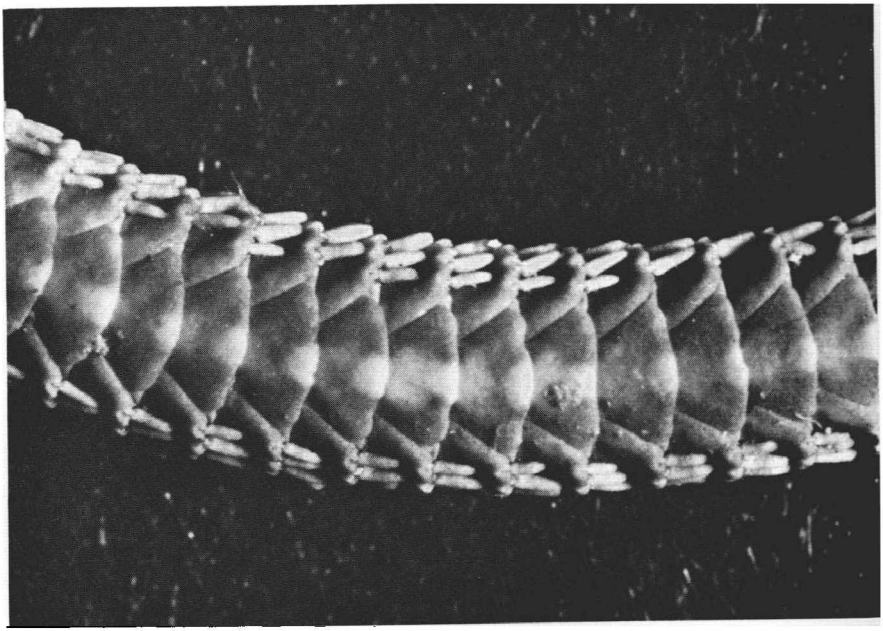

FIGURE 16. *Ophiolepis pacifica* Lütken, upper arm near disc (Allan Hancock Foundation No. 522.1, d.d. 11 mm).

Subclass ECHINOIDEA

Family Cidaridae

26. *Eucidaris tribuloides* (Lamarck)

Cidarites tribuloides Lamarck, 1816: 56.
Eucidaris tribuloides: H. L. Clark, 1933: 75 (key), 76.

Localities and Material.—Sta. BH 3, no details, five specimens.—Sta. BH 5, no details, four specimens.—Sta. BH 7, within sponge on turtle grass, *Thalassia*, four specimens.—Sta. BH 8b, under coral rubble and boulders, two specimens.

Family Diadematidae

27. *Diadema antillarum* (Philippi)

Cidaris (*Diadema*) *antillarum* Philippi, 1845: 355.
Centrechinus antillarum: H. L. Clark, 1933: 75 (key), 78.
Diadema antillarum: Mortensen, 1940: 269, Pls. XLVII, fig. 8, XLIX, fig. 5, LVII, figs. 1-8, LVIII, figs. 1-6, LXXIII, fig. 21, LXXIV, figs. 4-8.

Remarks.—No specimens were collected, but numerous individuals were observed in the field. Stoddard (1962: 21) mentioned that "sea-urchins

(*Diadema*) are scattered in the turtle grass" on the reef flat in the east reef area of Turneffe Islands.

Family Toxopneustidae

28. *Tripneustes ventricosus* (Lamarck)

Echinus ventricosus Lamarck, 1816: 44.
Tripneustes esculentus (Leske): H. L. Clark, 1933: 75 (key), 81-82.—Fontaine, 1953: 3 (key), 5 (with figure).
Tripneustes ventricosus: Mortensen, 1943: 490-498, Pls. XXXIII, fig. 4, XXXVI, figs. 1-4, XXXVII, figs. 3, 11-12, XXXVIII, figs. 5-8, LVI, figs. 3, 6, 7, 9, 15-17.

Locality and Material.—Sta. BH 8b, one specimen, test diameter, 29 mm.

29. *Lytechinus variegatus* (Leske)

Cidaris variegatus Leske, 1778: 85.
Lytechinus variegatus: H. L. Clark, 1933: 75 (key), 80-81.

Localities and Material.—Sta. BH 3, in shallow water near edge of reef flat, one specimen, test diameter, 17 mm.—Sta. BH 8c, in shallow water near shore, two specimens, test diameter, 17 and 25 mm.

Remarks.—Variability in pigmentation was noted. The specimen from Sta. BH 3 has the primary spines light green, and the test with light purple and darker purple along the interradial suture lines. The larger specimen from Sta. BH 8c has the spines white with only faint purple along the interradial suture lines; the smaller specimen has the spines green with dark purple interradial suture lines.

Family Echinometridae

30. *Echinometra viridis* Agassiz

Echinometra viridis Agassiz, 1863: 22.—H. L. Clark, 1933: 75, 84-85.

Localities and Material.—Sta. BH 3, one specimen.—Sta. BH 8b, noted on some of the submerged mangrove stems, 1-2 feet, none collected.—Sta. BH 8c, two specimens.—Sta. BH 9a, 75 feet, one small specimen.—Sta. BH 9b, 40-50 feet, one specimen.

Remarks.—Several of the specimens were examined and showed the presence of five pore-pairs per arc. The two specimens from Sta. BH 8c were measured as follows (in millimeters):

Test length	Test width	Test height
17	15	7
23	21	10

The specimens had greenish colored spines with the tips purple.

Family Schizasteridae

31. *Moira (Moira) atropos* (Lamarck)

Spatangus atropos Lamarck, 1816: 32.
Moira atropos: H. L. Clark, 1933: 76 (key), 90.
Moira (Moira) atropos: Mortensen, 1951: 329.

Locality and Material.—Sta. BH 5, 1-2 feet, one specimen, test only: length, 15 mm; breadth, 14 mm; height, 10 mm.

SUMMARY

Review of previous records and collections during March 1969 reveals 34 shallow-water echinoderms now known from the British Honduran region of the tropical western Atlantic. *Ophiocoma paucigranulata* is new and belongs in the Pica group, whose members were previously reported only in the Indo–West Pacific (including *O. longispina, O. pica,* and *O. pusilla*). The ophiuroid genus *Ophiozona* is no longer considered valid, as both recognized species, *impressa* and *pacifica,* have supplementary arm plates and are thus clearly representatives of the genus *Ophiolepis.* The oral and dental plates, as well as external skeletal features support the decision to place *Ophiolimna littoralis* in the family Ophiodermatidae rather than Ophiacanthidae, while better considering this species in the genus *Ophiurochaeta* Matsumoto.

SUMARIO

EQUINODERMOS DE AGUAS SOMERAS DE HONDURAS BRITÁNICA, CON DESCRIPCIÓN DE UNA NUEVA ESPECIE DE *Ophiocoma* (OPHIUROIDEA)

La revisión de reportes previos y de colecciones hechas durante marzo 1969 revelan la existencia de 34 equinodermos de aguas someras ahora conocidos en la región del Atlántico occidental tropical de Honduras Británica. *Ophiocoma paucigranulata* es nueva y pertenece al grupo Pica cuyos miembros anteriormente fueron reportados sólo en el Pacífico Indo-Occidental (incluyendo *O. longispina, O. pica, O. pusilla*). El género ofiuroideo *Ophiozona* ya no es considerado válido, debido a que sus dos especies conocidas, *impressa* y *pacifica,* tienen las placas de los brazos suplementarias y son por tanto claros representantes del género *Ophiolepis.* Las placas orales y dentales, así como los caracteres del esqueleto externo, apoyan la decisión de colocar *Ophiolimna littoralis* en la familia Ophiodermatidae más bien que en Ophiacanthidae, siendo mejor considerar esta especie en el género *Ophiurochaeta* Matsumoto.

LITERATURE CITED

AGASSIZ, A.
1863. List of echinoderms sent to different institutions in exchange for other specimens, with annotations. Bull. Mus. comp. Zool. Harv., *1*(2): 17-28.

BOONE, L.
1928. Scientific results of the first oceanographic expedition of the Pawnee 1925. Echinodermata from tropical east American seas. Bull. Bingham oceanogr. Coll. *1*(4): 1-22, 8 figs, 8 pls.

CLARK, A. M.
1953. A revision of the genus *Ophionereis*. Proc. zool. Soc. London., *123*(1): 65-94, 12 figs., 3 pls.
1967. Notes on the family Ophiotrichidae (Ophiuroidea). Ann. Mag. nat. Hist., Ser. 13, *9:* 637-655, 1 fig., 2 pls.

CLARK, H. L.
1915a. A remarkable new brittle star. J. Ent. Zool., *7*(1): 64-66.
1915b. Catalogue of recent ophiurans: Based on the collection of the Museum of Comparative Zoology. Mem. Mus. comp. Zool. Harv., *25*(4): 165-376, 20 pls.
1918. Brittle stars, new and old. Bull. Mus. comp. Zool. Harv., *62*(6): 265-338, 8 pls.
1919. The distribution of the littoral echinoderms of the West Indies. Publs Carnegie Instn., *281:* 49-74, 3 pls.
1921. The echinoderm fauna of Torres Strait: Its composition and origin. Publs Carnegie Instn., *214:* vi + 223 pp., 38 pls.
1933. A handbook of the littoral echinoderms of Porto Rico and the other West Indian islands. Scient. Surv. P. Rico, *16*(1): 1-147, 7 pls.

DEVANEY, D. M.
1970. Studies on ophiocomid brittlestars. I. A new genus (*Clarkcoma*) of Ophiocominae with a re-evaluation of the genus *Ophiocoma*. Smithson. Contr. Zool., *51:* 1-41, 50 figs.

EBBS, N. K., JR.
1966. The coral-inhabiting polychaetes of the northern Florida reef tract. Part I. Aphroditidae, Polynoidae, Amphinomidae, Eunicidae, and Lysaretidae. Bull. Mar. Sci., *16*(3): 485-555, 12 figs.

FONTAINE, A.
1953. Shallow-water echinoderms of Jamaica. Part II. The brittlestars (Class Ophiuroidea). Nat. Hist. Notes, Jamaica, No. 60: 197-206, 12 figs.

GRAY, J. E.
1840. A synopsis of the genera and species of the class Hypostoma (*Asterias* Linn.). Ann. Mag. nat. Hist., Ser. 1, *6:* 175-184, 275-290.

JOHN, D. D. AND A. M. CLARK
1954. The "Rosaura" Expedition 1937-1938. 3. The Echinodermata. Bull. Br. Mus. nat. Hist. (Zool.), *2*(6): 139-162, 12 figs., 1 pl.

KOEHLER, R.
1907. Révision de la collection des ophiures du Muséum d'Histoire Naturelle de Paris. Bull. scient. Fr. Belg., *41:* 79-351, pls. 10-14.
1913. Ophiures. Zool. Jb. (Suppl.), *11*(3): 351-380, 2 pls.
1914. A contribution to the study of ophiurians of the U. S. National Museum. Bull. U. S. natn. Mus., *84:* vii + 173 pp., 17 pls.

LAMARCK, J. B. P. A. DE
1816. Histoire naturelle des animaux sans vertèbres. Ed. 1. Verdiere, Paris, *2:* 522-568 (Stellerides); *3:* 1-59 (Echinides).

LESKE, N. G.
1778. Additamenta ad Jacobi Theodori Klein Naturalem Dispositionem

Echinodermatum et Lucubratiunculam de Aculeis Echinorum Marinorum. Lipsiae, xx + 214 pp., pls. 37-53.

LINNAEUS, C.
1758. Systema Naturae. Holmiae. Ed. 10. *1:* 1-824.

LÜTKEN, C. F.
1856. Bidrag til Kundskab om Slangestjernerne. ii. Oversigt over de vestindiske Ophiurer. Vidensk. Meddr dansk naturh. Foren., 1856: 1-26.
1859. Additamenta ad historiam Ophiuridarum Beskrivelser af nye eller hidtil kun ufuldstaendigt Kjendte Arter af Slangestjerner. K. danske Vidensk. Selsk. Skr., (5), *5:* 177-271.

LYMAN, T.
1860. Descriptions of new Ophiuridae belonging to the Smithsonian Institution and to the Museum of Comparative Zoology at Cambridge. Proc. Boston Soc. nat. Hist., *7:* 193-204.
1865. Ophiuridae and Astrophytidae. Mem. Mus. comp. Zool. Harv., *1:* vi + 200 pp., 18 figs., 2 pls.
1878. Report on the dredging operations of the United States Coast Survey Steamer "Blake." II. Ophiurans and astrophytons. Bull. Mus. comp. Zool. Harv., *5*(9): 217-238, 3 pls.

MATSUMOTO, H.
1915. A new classification of the Ophiuroidea. Proc. Acad. nat. Sci. Philad., *67:* 43-92.
1917. A monograph of Japanese Ophiuroidea arranged according to a new classification. J. Coll. Sci. imp. Univ. Tokyo, *38:* 1-408, 100 figs., 7 pls.

MILLOTT, N.
1953. A remarkable association between *Ophionereis reticulata* (Say) and *Harmothoë lunulata* (delle Chiaje). Bull. Mar. Sci. Gulf Caribb., *3*(2): 96-99.

MORTENSEN, T.
1940. Monograph of the Echinoidea. III. Part 1. Aulodonta. C. A. Reitzel, Copenhagen, 370 pp. + 196 figs., 77 pls.
1943. Monograph of the Echinoidea. III. 2. Camarodonta. I. C. A. Reitzel, Copenhagen, 533 pp. + 321 figs., Atlas 56 pls.
1951. Monograph of the Echinoidea. V. Part 2. Spatangoida 2. C. A. Reitzel, Copenhagen, 593 pp. + 286 figs., 64 pls.

MÜLLER, J.
1850. Anatomische Studien über die Echinodermen. Arch. Anat. Physiol., 1850: 117-155.

MÜLLER, J. AND F. H. TROSCHEL
1842. System der Asteriden. F. Vieweg und Sohn, Braunschweig., xx + 134 pp., 12 pls.

MURAKAMI, S.
1963. The dental and oral plates of Ophiuroidea. Trans. R. Soc. N. Z., Zool., *4*(1): 1-48, 7 pls.

PARSLOW, R. E. AND A. M. CLARK
1963. Ophiuroidea of the Lesser Antilles. Stud. Fauna Curaçao, *15:* 24-50, 11 figs.

PHILIPPI, R. A.
1845. Beschreibung einiger neuen Echinodermen. Arch. Naturgesch., 1845 (1): 344-359.

POURTALÈS, L. F. DE
1869. List of the crinoids obtained on the coasts of Florida and Cuba, by the United States Coast Survey Gulf Stream Expeditions in 1867, 1868, 1869. Bull. Mus. comp. Zool. Harv., *1:* 355-358.

SAY, T.
1825. On the species of the Linnean genus *Asterias*, inhabiting the coast of the United States. J. Acad. nat. Sci. Philad., *5:* 141-154.

STODDARD, D. R.
1962. Three Caribbean Atolls: Turneffe Islands, Lighthouse Reef, and Glover's Reef, British Honduras. Atoll Res. Bull., No. 87: 1-151, 49 figs.

TREADWELL, A. L.
1911. Polychaetous annelids from Dry Tortugas, Florida. Bull. Am. Mus. nat. Hist., 30: 1-12, 29 figs.

VERRILL, A. E.
1899. North American Ophiuroidea. I. Revision of certain families and genera of West Indian ophiurans. Trans. Conn. Acad. Arts Sci., *10*(7): 301-371.

ZIESENHENNE, F. C.
1955. A review of the genus *Ophioderma* M & T. Essays in the Nat. Sci. in Honor of Capt. A. Hancock. Los Angeles: 185-201.

APPENDIX

STATION LIST AND COLLECTION SITES

March 6, 1969.

Sta. BH 1a: Off Amber Head, west side Turneffe Islands; turtle grass (*Thalassia*) abundant, diminishing toward submerged reef front; many large moundlike sponges; collected inside submerged reef front; depth, 6-10 feet.

Sta. BH 1b: Same location, but on submerged reef; isolated coral heads (*Montastrea* and *Acropora*), large cylindrical vase-shaped sponges, some expanding near top, others less tapering, many ophiotrichid brittle stars of various sizes collected from these; gorgonians also noted on outcrops on sandy bottom; depth, 10-20 feet, SCUBA employed.

Ophiothrix (A.) suensoni
Ophiothrix (O.) angulata
Ophiothrix (O.) lineata
Ophiocoma pumila
Ophioderma cinereum

March 7, 1969.

Sta. BH 2: West side of Long Cay, Lighthouse Reef (Fig. 3), in shallow area awash; with coral and rubble; sponge and gorgonian growth common in shallow sublittoral.

(*Ophiomyxa flaccida*)*
(*Ophiothrix* [*A.*] *suensoni*)
(*Ophioderma brevicaudum*)
(*Ophioderma cinereum*)

* Species in parentheses were collected either at Sta. BH 2 and/or Sta. BH 3, as the specimens and labels were placed together.

(*Ophiothrix* [*O.*] *oerstedi*)
(*Ophionereis reticulata*)
(*Ophiocoma echinata*)
(*Ophiocoma wendti*)
(*Ophioderma appressum*)
(*Ophioderma phoenium*)
(*Ophioderma rubicundum*)
(*Ophiolepis impressa*)
(*Ophiolepis paucispina*)

Sta. BH 3: Northwest side of Long Cay, Lighthouse Reef, near edge on reef flat between lagoon and deep water; depth, awash to 3 feet.

Linckia guildingi
(*Ophiomyxa flaccida*) *
(*Ophiothrix* [*A.*] *suensoni*)
(*Ophiothrix* [*O.*] *oerstedi*)
(*Ophionereis reticulata*)
Ophiocoma echinata
Ophiocoma paucigranulata
Ophiocoma pumila
Ophiocoma wendti
(*Ophioderma appressum*)
(*Ophioderma brevicaudum*)
(*Ophioderma cinereum*)
(*Ophioderma phoenium*)
(*Ophioderma rubicundum*)
(*Ophiolepis impressa*)
(*Ophiolepis paucispina*)
Eucidaris tribuloides
Lytechinus variegatus
Echinometra viridis

March 8, 1969.

Sta. BH 4: West side of Long Cay, Lighthouse Reef, off edge, beyond reef flat. Comatulids with bodies well back in crevices, but arms extended; many diademid urchins and a few echinometrids; only a single sea cucumber observed; bottom with sandy limestone-filled grooves, and corals, sponges, and gorgonians on coral spurs; depth, 40-50 feet.

Nemaster rubiginosa
Ophiothrix (*A.*) *suensoni*
Ophiothrix (*O.*) *angulata*
Ophiothrix (*O.*) *oerstedi*
Ophionereis reticulata
Ophioderma appressum
Ophioderma rubicundum
Ophiurochaeta littoralis
Ophiolepis impressa
Diadema antillarum
Echinometra viridis

Sta. BH 5: Shore area, south side of Half Moon Cay, Lighthouse Reef; lateral current strong over shallow littoral-sublittoral area; with alternate patches of sand, scoured boulders, and compacted reef flat; windward reef edge with specimens under, or within, coral or limestone boulders on sandy bottom; depth, 1-2 feet.

Ophionereis reticulata
Ophiocoma echinata
Ophiocoma pumila
Ophiocoma wendti
Ophioderma appressum
Ophiolepis impressa
Eucidaris tribuloides
Moira (*Moira*) *atropos*

March 9, 1969.

Sta. BH 6: Shallow reef area in lagoon between Long Cay and Half Moon Cay, Lighthouse Reef; partially awash at low tide, but with deeper grooves; vigorous coral and gorgonian growth, with *Acropora palmata* and *A. cervicornis*, *Porites* sp., *Millepora* sp., and *Diploria* sp. noted.

Ophiothrix (*O.*) *oerstedi*

March 10, 1969.

Sta. BH 7: Lagoon, west side of Long Cay, Lighthouse Reef; lagoon bottom with *Thalassia* and fine coral sand; large, black, moundlike sponges, several with *Eucidaris* within. Many conches (*Strombus gigas*) and bivalve clams noted; a brissid heart-urchin sighted, but not determined or collected; depth, 10-15 feet.

Oreaster reticulatus
Eucidaris tribuloides

Sta. BH 8a: Along western side of Southwest Cay II of Glover Reef (Fig. 4); a wide zone of flattened and irregular beachrock exposed with channels of water running toward shore; rock slippery with algae; along southwest coast, a sandy narrow strand from shore outward; with sand and seagrass (*Syringodium*).

Astropecten duplicatus
Oreaster reticulatus

Sta. BH 8b: Between the two southwest Cays, on the south side of Southwest Cay I and the northeast side of Southwest Cay II. This area was aptly described by Stoddard (1962: 95): "Isolated clumps of *Rhizophora* extend reefward from the main body of mangrove to partially enclose a small bay on the seaward shore; this bay is very sheltered, has a low sandy shore, and is floored with *Thalassia* and *Penicillus*." On the area near shore were zoanthid colonies and sea anemones in sand among the seagrass, also dense colonies of two species of gastropods. Farther out, low colonies of *Porites* and coral rubble were noted. Out to the reef an area of turtle grass with scattered *Tripneustes* and *Diadema*, beyond which were large boulders and broken coral heads exposed; between the lagoon and where *Tripneustes* occurs is an algal *Turbinaria* zone in rapidly flowing water; here many fireworms (*Eurythoe*?) were found under the coral rubble; *Echinometra* noted on some of the submerged roots; depth, 1-4 feet.

Linckia guildingi
Ophiomyxa flaccida
Ophiothrix (O.) oerstedi
Ophiocoma echinata
Ophiocoma wendti
Ophioderma appressum
Ophioderma brevicaudum
Ophioderma cinereum
Ophiolepis impressa
Euapta lappa
Eucidaris tribuloides
Diadema antillarum
Tripneustes ventricosus
Echinometra viridis

March 11, 1969.

Sta. BH 9a: Southwest of Southwest Cay II, Glover Reef; open water (seaward) off steep slope; hard surface with coral and sand channels; depth, to 200 feet. SCUBA.

Ophioderma sp.
Ophiurochaeta littoralis
Echinometra viridis

Sta. BH 9b: Again off slope but shallower; sand grooves and coral spurs; ophiuroids and only *Echinometra* and *Diadema* among echinoderms noted; depth, 40-50 feet. SCUBA.

Ophiomyxa flaccida
Ophiactis savignyi
Ophiothrix (A.) suensoni
Ophiothrix (O.) oerstedi
Ophiocoma pumila
Ophiocoma wendti
Ophioderma rubicundum
Echinometra viridis

March 12, 1969.

Sta. BH 8c: Southwest side of Southwest Cay II, Glover Reef; in shallow water to shore with turtle grass close to shore mixed with eel grass; many conches noted, also a few sea anemones with commensal shrimp; ophiuroids in fine filamentous algae at base of turtle and eel grass on sand about 25-50 yards from shore; sandy patches interspersed. Out and around a shallow coral knoll with considerable live coral including two species of *Acropora*. Depth, 5-15 feet.

Astropecten duplicatus
Ophiomyxa flaccida
Ophiothrix (O.) angulata
Ophiothrix (O.) oerstedi
Ophiocoma pumila
Ophiocoma wendti
Ophioderma appressum
Ophioderma rubicundum
Diadema antillarum
Lytechinus variegatus
Echinometra viridis