

# AMERICAN MUSEUM NOVITATES

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY  
CITY OF NEW YORK MAY 1, 1953 NUMBER 1617

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## SOME ANNELID AND SIPUNCULID WORMS OF THE BIMINI REGION

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The authors were privileged to spend the months of July and August, 1951, at the Lerner Marine Laboratory, Bimini, Bahamas. Grateful acknowledgment is made to Dr. Charles M. Breder, Jr., Chairman of the Department of Fishes and Aquatic Biology of the American Museum, and to Miss Priscilla Rasquin of the same department for many kindnesses in forwarding our studies. Two projects were carried out during this time: first, a study of the regenerative processes in certain species of annelids; second, a survey of the types of annelids found on the islands of the Bimini group and in the adjacent waters. It is with the second of these projects that the present paper deals. While the survey cannot be said to be complete, a great many individual localities were studied, and the types of annelids here described should present a fairly adequate idea of the more abundant and conspicuous species. Further work undoubtedly would reveal a great many additional types.

The species obtained are mentioned according to family, and comment is made on any features which seemed of outstanding interest in their occurrence as seen by us or as reported in the literature.

All the specimens described were taken and studied in the living condition. In a very few cases, only one or two specimens of a given type could be obtained, while in most cases it was possible to obtain from several to a large number of specimens.

After observation in the living condition the worms were placed in a solution of magnesium sulfate (154 gm.  $MgSO_4$  to 1 liter of distilled water) for periods of from 20 minutes to an hour and then fixed in 10 per cent formalin.

In the identification of the sipunculids we have been aided by the distinguished authority on this group, Dr. Walter Fisher, Director Emeritus of the Hopkins Marine Station at Pacific Grove, California. Our deep appreciation is due to Dr. Cazlyn Bookhout for kindly reading the manuscript and giving helpful comments from the standpoint of invertebrate zoology and of one who has worked in this region.

We wish also to express our deep appreciation to Dr. Waldo Schmitt, Chief Curator of Zoology at the United States National Museum; to Dr. Marian Pettibone of the Division of Marine Invertebrates; and to Dr. Fenner Chace of the same department at the museum for their helpful assistance in the taxonomic problems relating to the polychaete worms.

#### FAMILY POLYODONTIDAE

Members of this family are described by Treadwell (1939) as "of rare occurrence." Its members are carnivorous and, according to Chamberlin (1919, p. 85), very voracious.

In this family are by far the largest annelid worms that we have collected. There are two specimens in our collections, both from the species *Eupolydonte cornishii* Buchanan, together with their tubes. One worm is complete and over 60 cm. (2 feet) in length and has about 300 somites. The other specimen was broken and measures about 10 inches in length, with approximately 120 somites. The worm has a flattened, elongated body. Conspicuous features are the elytra, flattened leaf-like extensions occurring on somites alternating with those bearing dorsal cirri.

The worms were obtained on "the flats" at low tide. They were living in long tubes of a tough, parchment-like consistency. At the upper end of each tube a green algal plant was growing in abundance on its wall, forming a sort of crown of cylindrical, moss-like structure.

We spent a considerable amount of time looking for more of these worms on the flats, both in the Bay and at Nixon's Harbor, but without success. They are probably not very common, and the tube openings, even if present, are not easy to locate. We felt fortunate in obtaining our two specimens, as representatives of the family appear usually to be taken as small fragments (Potts, 1910).

#### FAMILY AMPHINOMIDAE

This family comprises the "bristle-worms" which have very numerous and conspicuous setae which occur in long glistening

bundles and cause the worm to resemble some types of lepidopterous larvae. The setae are easily loosened when the animal is disturbed and can be seen floating in large numbers in the collecting vessel or bucket. They pierce the skin readily and may cause a painful and irritating condition of the fingers if there is much contact with the worms. Some at least of these worms erect the setae when disturbed. An interesting feature of most genera of the family is the presence of a caruncle or longitudinal head ornament attached anteriorly to the prostomium and with its free, posterior end often extending for some distance over the anterior somites.

Treadwell (1921) states that this family is well represented in tropical and subtropical waters, generally found in rock crevices, where the individuals cling with considerable tenacity, and that they also may be found on floating logs. Using the under-water mask, we have been able to observe amphinomids crawling about on the surface of rocks 5 or 6 feet below the surface on the west side of North Bimini.

Four species of this family are represented in our collections. The first is *Eurythoe complanata*, which was found very abundantly in the interior of sponges, and is much the commonest member of this family in the West Indies. One of our specimens contained a great number of eggs, some of which were shed at the time of fixation.

The second species found is *Hermodice carunculata*. This is a large worm, one of our specimens being 105 mm. long. Treadwell (1939) mentions having in his possession one 230 mm. in length. Our largest specimen was taken from a tidal pool into which urethane had been poured to anesthetize certain fishes. The worm, previously unseen, crawled out of a crevice in the rock. Our specimens show a good preservation of their natural greenish tint in the preserving fluid.

*Hermodice carunculata* is frequently found on floating or drifting objects in warm currents. In the living worm the body is a chocolate or greenish brown and the branchiae are bright red.

*Eurythoe complanata* is more often found in rocky or coralline areas. Body color is orange with bright red branchiae. The other differences between these two species are well illustrated in recent work (Hartman, 1951a, pl. 4, fig. 2, pl. 5, fig. 1).

A third species was identified as *Chloeia viridis* Schmarda. The body form of members of the genus *Chloeia* is rather distinctive.

It is somewhat ovoid, tapering both anteriorly and posteriorly, and the width compared to length is greater than in most worm-like forms, adding to the superficial resemblance that these animals bear to some lepidopterous larvae.

In its more detailed structure, *Chloeia* is set off from the other genera here described by the fact that its gills are pinnatifid, 10 or more branches of decreasing length arising from a stout tapering central axis. In our other genera the gills are arborescent.

Two specimens of this species were taken, both by means of the night-light. They were swimming free in the waters of the bay near the pilings of the laboratory pier.

This species was described very early by Schmarda (Jamaica, 1861). It was listed by Horst (1910) as among those species of *Chloeia* sufficiently described and figured to be recognized.

A fourth species of the family Amphinomidae was taken, also with the night-light. This is a small worm, all specimens being a centimeter or less in length. The body is distinctly ovoid, segments few in number, generally about 16. The anus is dorsal in position. The caruncle is long, extending back onto the fifth somite. Dorsal cirri of the somites are reduplicated, and two are found in association with each gill. The gills begin on the fifth setigerous somite. The first pair show but a single filament each, while posterior to this are three pairs with two filaments each. Behind this are several with three filaments, then a number with four filaments, and a few somites before the pygidium the filaments are five or six in number. This species seems definitely to belong to the genus *Notopygos*, and to the species *Notopygos crinita* Grube. A detailed account of the anatomy of the amphinomids is given by Gustafson (1930).

#### FAMILY SYLLIDAE

These worms are generally of small size and more or less transparent. This was true of all of the specimens that we took at Bimini. The cirri and tentacles are long and very definitely articulated. This gives a very conspicuous, beaded appearance to the animal's appendages and makes rapid identification of a syllid possible.

Many members of this family were found by us in floating masses of green algae from the Gulf Stream side of North Bimini.

Of great interest is the fact that one of the two swarmings of fireworms which we observed was made up apparently entirely of

members of this family. One large female and several males were taken at this swarming on the evening of July 23, 1951. They have been identified as *Autolytus* sp.

Our epitokal specimens of syllids showed a clear-cut sexual dimorphism, with the female several times as large as the male. The genus "*Autolytus*" is indeed the genus in which Alexander Agassiz (1862) first described sexual dimorphism in the Annelida.

Several atokal specimens of *Odontosyllis enopla* are present in our collection.

#### FAMILY NEREIDAE

This family is represented in our material by three species, *Perinereis anderssoni* Kinberg, *Perinereis floridana* Ehlers, and *Namanereis ouanaryensis* (Gravier). The first species is abundant, and several hundred specimens were taken for experimental work and for a survey of the regenerative processes in nature. They range from less than 1 to over 10 cm. in length in the extended condition. This species differs from the common *Nereis* (or *Neanthes*) *virens* of the North Atlantic coast of North America in size, coloration, and other features. *Nereis virens* ranges up to 40-55 cm. in length (Brown, 1950), while *P. anderssoni* seldom reaches 10 cm. The former ranges from steel blue to greenish in color of the body, with tinges of orange and red, especially on the parapodia. The latter are pinkish or reddish, but this color seems to be due chiefly to the blood shining through the transparent hypodermis and cuticle. The great majority of our specimens were collected on the beach at low tide. They were found under empty conch shells, stones, and frequently under hard, cemented blocks of sand. The latter were numerous on the beach of Nixon's Harbor near the entrance to Cavelle's Pond (fig. 1). Under such sand blocks the worms usually were completely exposed and did not generally have burrows into which to retreat when the block was turned over. Under the conch shells or stones the animals seemed much more frequently to have burrows into which they would begin to disappear when the object was turned over. In both locations the most conspicuous other animal forms were small crabs of several species.

The free-swimming form, or heteronereis, of this species of nereis was collected in large numbers in the waters of Bimini Bay by means of a night-light placed about a foot beneath the surface of the water. The heteronereis, or predominantly reproductive

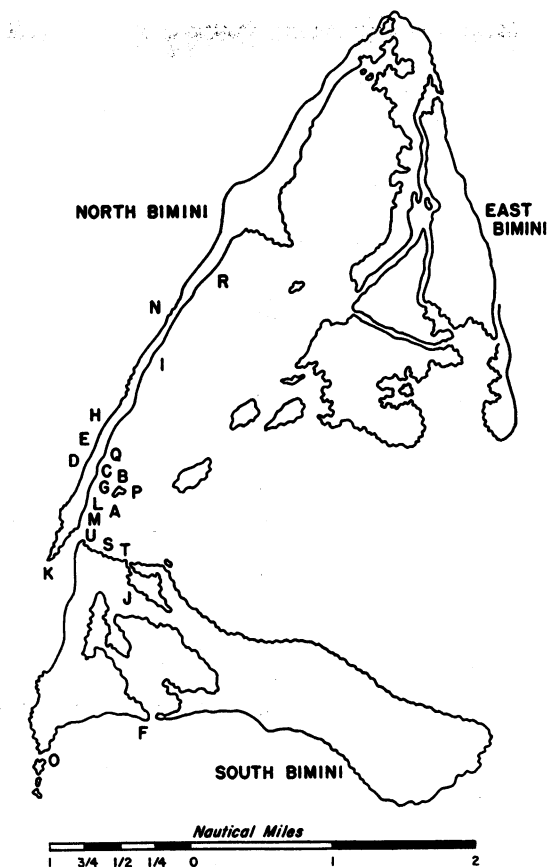


FIG. 1. Map of Bimini region, with collecting stations: A. *Hermodice carunculata* (Amphinomidae); *Eupolymnia crassicornis* (Terebellidae); Sabellariidae, July 4. B. *Eupolyodontes cornishii* Buchanan; *Marphysa sanguinea* Montagu (Eunicidae); sipunculids, July 5. C. *Scyphoproctus* (Capitellidae), July 10. D. *Odontosyllis enopla* Verrill (Syllidae), July 16. E. Single platyhelminth; terebellid worm, July 18. F. *Perinereis anderssoni* Kinberg (Nereidae), July 21. G. Fireworms (Syllidae), July 23. H. *Odontosyllis enopla* Verrill (Syllidae); *Glycera americana* Leidy (Glyceridae); chromadoroid nematodes, July 24. I. Smooth nematodes, July 26. J. *Namanereis ouanaryensis* Gravier (Nereidae), July 27. K. *Notopygos crinita* Grube (Amphinomidae), July 28. L. Heteronereis of *Nereis rüsei* Grube (Nereidae), July 28. M. *Chloeia viridis* (Amphinomidae), July 29. N. Colorful sabellariids, July 31. O. *Perinereis anderssoni* Kinberg (Nereidae), August 4. P. *Lysidice ninetta* Audouin and Milne-Edwards (Eunicidae) from stinker sponge, August 6. Q. Oligochaetes, Baileytown, August 8. R. Oligochaetes, Lyons' Estate, bay side, August 8. S. *Perinereis anderssoni* Kinberg (Nereidae), South Bimini pier beach, August 9. T. *Perinereis anderssoni* Kinberg (Nereidae); sipunculids, South Bimini pier beach, August 10. U. *Perinereis anderssoni* Kinberg (Nereidae); *Perinereis floridana* Ehlers (Nereidae), North Bimini, August 11.

stage, is known also as the epitokous in contrast to the atokous, or vegetative, stage of the worms. The heteronereis is a rich red color and swims very rapidly, passing in rather frantic circles about the light or in the bucket in which they have been collected. The appearance is dissimilar in many ways from the creeping form. The 10 head tentacles, however, are still present and have retained approximately the same proportions to one another. The four eyes have become enormously enlarged and those on each side almost fuse with one another (fig. 2). The adaptation for swimming is seen in the formation of a truly paddle-like extension on each parapodium. Treadwell (1921) says that the terminal joints of all setae become very broad and paddle shaped and faintly toothed along one margin.

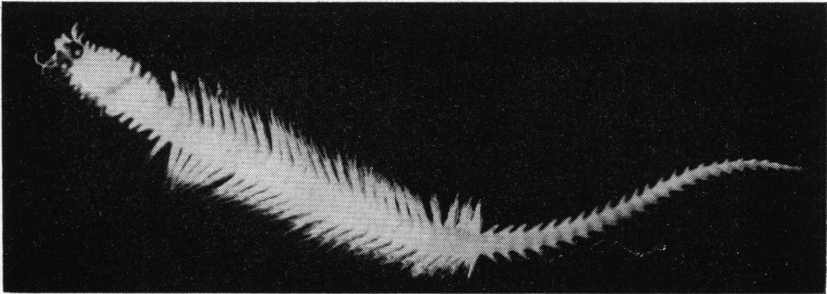


FIG. 2. Heteronereis, or epitokous, form of *Nereis* sp. Paddle-like extensions of the parapodia are seen on many segments of this freely swimming form, and the four eyes are enormously enlarged, the two on each side being almost fused.

Transverse ridges on area IV of the proboscis are characteristic of the genus *Perinereis*. *Perinereis anderssoni* Kinberg has the posterior notopodial lobes much prolonged. This species is common in West Indian localities, also in Bermuda and south to Brazil (Hartman, 1951a, p. 47).

The second species, *Perinereis floridana* Ehlers, of this family is represented by only two specimens, both taken on the harbor beach of North Bimini. Individuals of this species have the posterior parapodial lobes short, resembling those of the median segments, and thus are not to be confused with *P. anderssoni*. To date *Perinereis floridana* has been found only in the vicinity of the Florida Keys and northwest to Sarasota County, Florida.

The third species is *Namanereis ouanaryensis* (Gravier). The basal part of the prostomium, bearing the eyes, is very short in

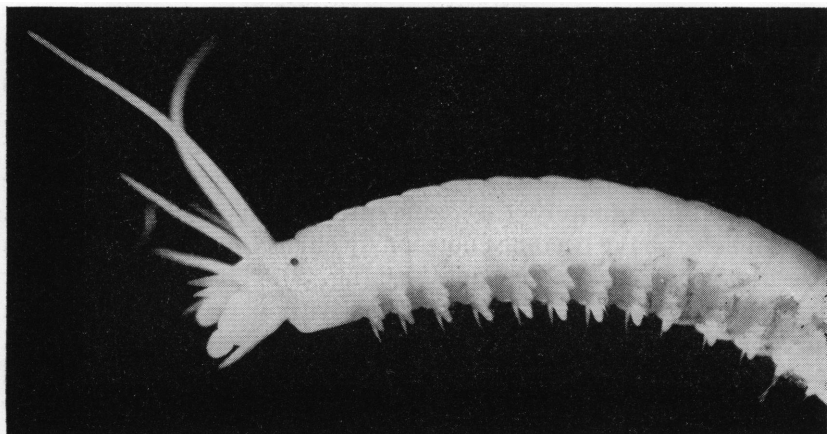


FIG. 3. Profile view of *Perinereis anderssoni* Kinberg in the vegetative, atokous, or crawling form. Note the large palps, a conspicuous feature of the species. This species is the most abundant annelid on the beaches of South Bimini.

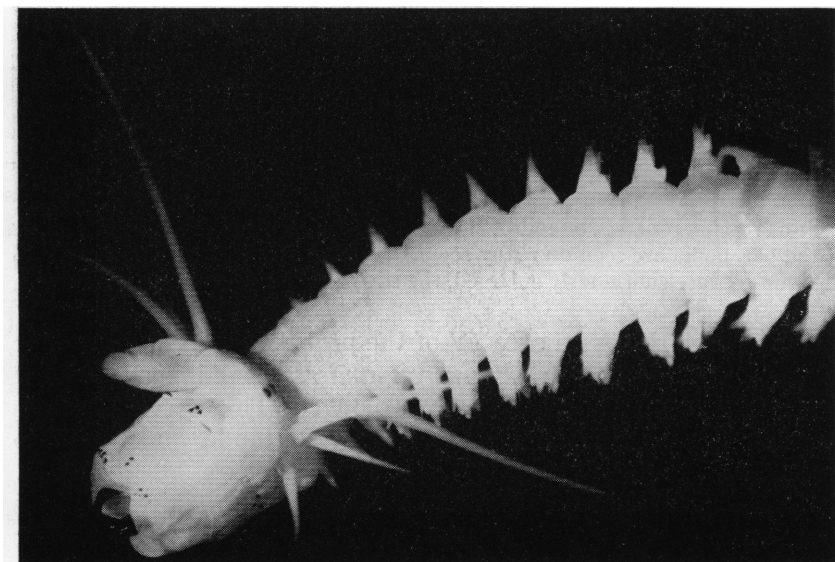


FIG. 4. Anterior end of *Perinereis anderssoni* Kinberg viewed from above with the proboscis extended. The tubercles appear as black bodies on its surface.

this species. Our specimens, of which five were obtained, are from the mud of a mangrove swamp on South Bimini. They were found burrowing near the mangrove roots. This species, ap-



parently, is known to date through only two records, both from French Guiana.

A third species of this family, *Nereis riisei* Grube, is represented by three epitokes which were taken at one of the "swarmings" of annelid worms on the evening of August 17.

One additional specimen of nereid, a juvenile, has been tentatively identified as *Platynereis dumerilii*, a species that apparently has a world-wide range in the Southern and Northern Hemispheres (Ramsay, 1914).

#### FAMILY GLYCERIDAE

The species identification is *Glycera americana*. Hartman (1950, p. 74) states that *G. americana* has been found on the Atlantic side from New England to Brazil, on the Pacific side from western Canada to Peru, and is also recorded from New Zealand and Australia.

#### FAMILY EUNICIDAE

The species of this family found most commonly was *Marphysa sanguinea* (Montagu). It was found in branching, parchment-like tubes, the branches of which end blindly. Most of our specimens were found in the interior of sponges, particularly in the stink-sponge, *Arcinia fasciculata*, which is common in the waters of Bimini (De Laubenfels, 1949). Some, however, were found under conch shells and stones. Treadwell (1939) states that in the Dry Tortugas the tubes of another species of this family, *Leodice denticulata*, follow the windings of sponge cavities, but that in Bermuda, where it is common also, the tubes are most frequently found on the under side of stones. It is therefore of some interest that in the Bimini area we find *Marphysa sanguinea* in both types of localities, although more frequently in sponges.

*Marphysa sanguinea* (Montagu) is world-wide in its occurrence in warm seas, being found in the intertidal and littoral zones (Hartman, 1944, p. 128).

Our larger specimens are about 180 mm. in length in the extended condition. Treadwell (1921) states that specimens in the Dry Tortugas range up to 500 to 600 mm. in length, and the one that he figures has 479 somites. Treadwell (*ibid.*, p. 25) makes the following statement: "all of those collected in Bermuda were smaller than those from the Dry Tortugas, indicating possibly a varietal difference, but I was unable to discover any other essential dif-

ferences between the two." The size at Bimini also may be of varietal significance.

*Marphysa sanguinea* grossly resembles *Eunice*, but peristomial cirri are lacking in the former, present in the latter. The prostomial antennae are five in number and are smooth and short (Hartman, 1951a, p. 57).

A second species of this family is *Eunice tibiana* (Pourtales), several specimens of which were taken with their tubes. This species belongs to the flavous-bidentate group of the Eunicidae (Hartman, 1944, p. 100). Heider (1925) gives a number of interesting anatomical and histological details on the members of the genus *Eunice*.

A third species of this family taken is *Lysidice ninetta* Audouin and Milne-Edwards. We found only a single specimen of this form, and it was taken from the interior of a smooth, brown or violet sponge, either *Callyspongia vaginalis* or *Oligoceras hemmorhages*. The specimen follows rather closely the description given by Treadwell (1939) for *Lysidice sulcata*. This author states that the natural reddish coloration of the body persists in alcohol. The color of our specimen persisted for some hours also in 10 per cent formalin in which it is preserved, but then faded to a whitish brown. Hartman (1944, p. 125) states that separation of species of this genus from one another is difficult. *Lysidice ninetta* has been widely reported from the West Indian region.

Dr. Cazlyn Bookhout has informed us in a personal communication that he believes that there are many more members of the family Eunicidae in the Bimini area than we have here described.

#### FAMILY ARENICOLIDAE

One specimen only belonging to this family was found. It has been identified as belonging to the species *Arenicola cristata* (Stimpson). It was found buried in the sand in one of the laboratory aquaria.

The jelly-masses containing the eggs of *Arenicola cristata* are among the more conspicuous features of the shallow water along the bay sides of North and South Bimini. They are elongated structures, each holding many thousands of eggs. Under the dissecting microscope the developing young may be seen moving through the viscous mass which generally contains many diatoms and other algae which serve as food. *Arenicola cristata* is the most common species of the genus south of Cape Cod.

This genus is the one to which the common lugworm *Arenicola marina* belongs. The latter species is abundant on the sandy shores around the British Isles and was the subject of a detailed monograph by Ashworth (1904). *Arenicola marina* also replaces *A. cristata* along the coast of the United States north of Cape Cod. *Arenicola marina* is dark brown or almost black in the adult state, while our specimen is of a glossy green color. *Arenicola marina* is the most abundant and most readily accessible polychaete of northern and western Europe (Ashworth, 1912). Ashworth (1912) states that the specimens of *A. cristata* from the Gulf of Naples are "of a fine dark green colour, with play of iridescence" and that American and West Indian specimens seem to exhibit similar coloration, but some specimens from Suez were yellowish or pinkish in color.

*Arenicola cristata* has 11 pairs of branchiae; *Arenicola marina*, 13 pairs.

#### FAMILY CAPITELLIDAE

The appendages in this family are small and inconspicuous, and for this reason its members bear a superficial resemblance to the Oligochaeta. The body is divided into a thorax of from nine to 14 somites and a longer abdomen. The parapodia are retractile processes on the thorax and simply flattened elevations or "tori" on the abdomen. Eyes are present as small pigment spots.

Two genera are represented among our specimens: *Dasybranchus* in which gills are present, and *Scyphoproctus*, in which they are absent. Both were found under conch shells and rocks near mangrove swamps.

In *Dasybranchus* the gills are retractile, and these conspicuous, branched organs can be withdrawn entirely from sight. The thorax has long, pointed, capillary setae, while the abdomen is uncinigerous, that is, bears a series of hook-like appendages (Fauvel, 1927).

The Capitellidae are the subject of a very extensive monograph by Eisig (1887), which gives numerous facts concerning the anatomy, physiology, and life histories of the capitellids. An exhaustive comparison is made with many other types of animals, not only of the Phylum Annelida but of a number of other phyla.

#### FAMILY TERESELLIDAE

These worms are striking in appearance because of the great number and length of their tentacles. Single tentacles of a worm

less than 1 inch in length may at times be extended for 2 or 3 feet, and as the tentacles are in constant writhing motion, the animal presents an almost awesome aspect.

The species is *Eupolymnia crassicornis* (Schmarda) (see Chamberlin, 1919).

The body is divided into thorax and abdomen, and large branching gills are present on the former. Our specimens were found living in conch shells and remained well hidden in aquaria, where they were kept for a month or more, a few tentacles protruding from a shell often being the only evidence of their existence. Occasionally broken pieces of tentacle are seen writhing on the glass wall of the aquarium, themselves resembling small white worms. We were interested in the considerable degree of autonomy shown by such pieces and kept some isolated in small dishes. They continued in active motion for as long as seven hours.

There are other species of this family in the area, but our material was too fragmentary for positive identification.

#### FAMILY SABELLIDAE

These are the plume worms, or "feather-duster" worms, tube-dwelling forms that never leave their homes. The body again is divided into thorax and abdomen. The "tentacles" here really are formed of many branchiae belonging to a large gill on either side. On each branchia are arranged two rows of filaments or barbules, and the whole constitutes a feeding apparatus to bring minute organisms into the mouth of the worm. The peristomium forms a definite collar which closes the tube when the animal is alarmed.

We took two types of sabellids, one of deep purple color, found as a populous colony on conch shells near Tokas Key, the other as a fairly common inhabitant of the rocks on the Gulf Stream side of North Bimini and displaying a "headdress" of brown and white tentacles with orange-red branchiae which resembles the bonnet of an Indian chief. The former type lived well in an aquarium; the latter did not seem to become acclimated.

The dark purple species has been tentatively identified as *Hypsicomus midoculi* Hoagland. This species appears to be common throughout the waters off the southeastern coast of the United States.

The second, more colorful, species of sabellid corresponds well with the description of *Sabellastarte magnifica* (Shaw) (see Hart-

man, 1951a, p. 116) except for being of smaller size. The tentacular filaments are magnificently colored in various shades of brown and with several series of color spots forming bands. The spread of the tentacular filaments of our specimens is not more than 5 or 6 inches at a maximum.

#### SIPUNCULOIDEA

This is a somewhat obscure group of worms without definite segmentation and on which taxonomic data are not readily available. Their most striking feature is the presence of an "introvert," a part of the pharynx which can be protruded for very great distances and on the distal end of which, at full extension, the wreath of tentacles is seen. Then the body of the worm is somewhat swan-like in shape.

Sipunculids were found by us in all types of sponges in this region and also under stones and shells at the pier region of South Bimini.

Through the kind assistance of Dr. Walter Fisher of the Hopkins Marine Station, our 10 specimens of sipunculids have been identified as belonging to four species: *Physcosoma varians* Keferstein, five specimens; *Physcosoma microdentigerum* Ten Broeke, three specimens; *Phascolosoma* sp., one specimen; and *Aspidosiphon cumingii* Baird, one specimen.

*Physcosoma varians* (Keferstein) is described by Gerould (1913) as being represented in the sipunculid collection of the United States National Museum by specimens found along the coast of Florida. He presents a photograph showing the external features of the species (pl. 62, fig. 18, p. 419) and gives a translation of Keferstein's original description. This species is described as an exclusively subtropical, littoral species inhabiting the region from Cape Hatteras southward through the West Indies. As the name implies, the species appears to be remarkably variable.

*Physcosoma microdentigerum* is described from Curaçao by Ten Broeke (1925, p. 88). Our specimens are the first to be found since the species was named.

Individuals of the genus *Aspidosiphon* have a distinct shield in front of the anus and one at the posterior extremity of the body. The long introvert is much more slender than the trunk. Most of the species of this genus inhabit the Pacific and Indian oceans. *Aspidosiphon cumingii* is described and figured in Selenka (1883, p. 113, pl. 13, figs. 183-186).

A good general account of the sipunculid worms is given by Pickford (1949). While these animals have pronounced annelid affinities, they totally lack setae and have an anal opening located near the anterior end of the trunk. A more detailed account of the sipunculids is given by Baltzer (1931).

#### OLIGOCHAETA

The variety of the polychaetes in the Bimini area is striking. We have found, however, only one species of the Oligochaeta. These oligochaetes resemble earthworms but are a richer red. They were found under stones, shells, and fallen coconuts along the Baileytown beach, on the beach at the Lyons' Estate, and in the mud of the mangrove swamp north of Baileytown.

In preparation of the specimens it was interesting to see the remarkable resistance to narcosis by magnesium sulfate which was exhibited by these worms, for they had to be kept in it for as long as 12 hours to stop their motion and obtain relaxation and extension. The majority of polychaetes were narcotized very readily, usually within 20 minutes, indicating a marked physiological difference.

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