

Ecology and Taxonomy of Recent Marine  
Ostracodes in the Bimini Area, Great  
Bahama Bank

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[Reprinted from INSTITUTE OF MARINE SCIENCE, Vol. V, December, 1958]



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## Abstract

Areal distributions of kinds and abundance of both living and dead ostracodes in the Bimini area have been mapped on a photogrammetric base. Evidence was found indicating that substrate, salinity and current velocity affected distribution of ostracodes. Dissolved oxygen, pH, water color, organic detritus, organic content of the sediment, water depth, and daily temperature variation had little effect. Ostracodes, belonging to the suborder Myodocopa, were abundant in the Bimini area, but their shells decomposed after death and were absent from the sediment. The sediments containing the largest number of dead ostracodes did not occur in areas containing the largest number of living ostracodes. In North Sound and Cavalle Pond living ostracode species differed in kind from dead ostracodes contained in the sediment.

## Introduction

Ostracodes have been extremely useful to geologists as stratigraphic markers. Their small size and abundance in many formations make it possible to study a whole fauna even though the available sample may be very small. The ostracode has the longest

range of any group used extensively for stratigraphic correlations. Many recent species seem to extend backward into the Tertiary unchanged.

Principally because of the importance of ostracodes to geology, fossil ostracodes are better known than those living in today's seas. The present study was undertaken in order to determine some of the environmental factors possibly influencing the distribution of living marine ostracodes. Information of this sort is useful in interpreting conditions which were in existence during the formation of fossil ostracode-bearing strata.

Another phase of the present study was the comparison of the areal distribution, abundance and kinds of living ostracodes with ostracode shells contained in the sediment. Ostracode shells in recent sediment are potential fossils. Knowledge of the relationship between the living animals and their remains is useful for understanding the limitations of fossil material used to infer ancient environments and faunas.

This study was made in the vicinity of the Bimini Islands, which are situated in the northwestern part of the Great Bahama Bank (Fig. 1). The sample area covers approximately 320 square kilometers in the shallow waters east of the Bank rim. An ecological study in the Bahamian region becomes especially significant because the warm, clear shelf sea of this area probably typifies limestone-forming seas which covered a large part of the continents in the past.

Among the environmental factors considered in this study are salinity, temperature, dissolved oxygen, pH, water depth and color, current velocities and direction, type of sediment and its organic content, presence or absence of organic detritus, and the biota.

The Ostracoda are usually divided into four suborders: 1) Myodocopa, 2) Podocopa, 3) Cladocopa, 4) Platycopa. Only members of the suborders Podocopa and Platycopa occur in abundance as fossils, although the Myodocopa extend backward into the Silurian and the Cladocopa at least into the Jurassic. This seems principally because many members of the suborders Podocopa and Platycopa bear shells strongly fortified with calcium carbonate, which makes them more easily preserved than members of the suborders Myodocopa and Cladocopa, which have shells with less calcium carbonate. The systematics of the Myodocopa encountered in the Bahama area are considered in this paper. Systematics of others suborders are to follow. The suborder Myodocopa is represented in Bimini waters by 10 genera, two of which are new, and 19 species, which include 14 new species and one new subspecies.

#### ACKNOWLEDGMENTS

Data are from a Ph.D. dissertation, *Ecology and Taxonomy of Recent Marine Ostracodes in the Bimini Area, Great Bahama Bank*, 1957, Columbia University. The study was made as part of a biogeological survey of the northwestern part of the Great Bahama Bank under the direction of Professors N. D. Newell and John Imbrie and made possible through grants from the Humble Oil and Refining Company, Gulf Research and Development Company, the Shell Development Company, and Esso Research and Engineering Company. Free exchange of samples and data with Mr. Edward C. Purdy and Dr. Robert J. Menzies, who also were doing field work in the Bimini area, is gratefully acknowledged. Dr. R. S. Humm kindly identified algal specimens. The manuscript has been criticized by Mr. I. Gregory Sohn and Dr. Stuart A. Levinson. The base for the field operations was the Lerner Marine Laboratory of the American Museum of Natural History. The excellent facilities of this laboratory are greatly appreciated.

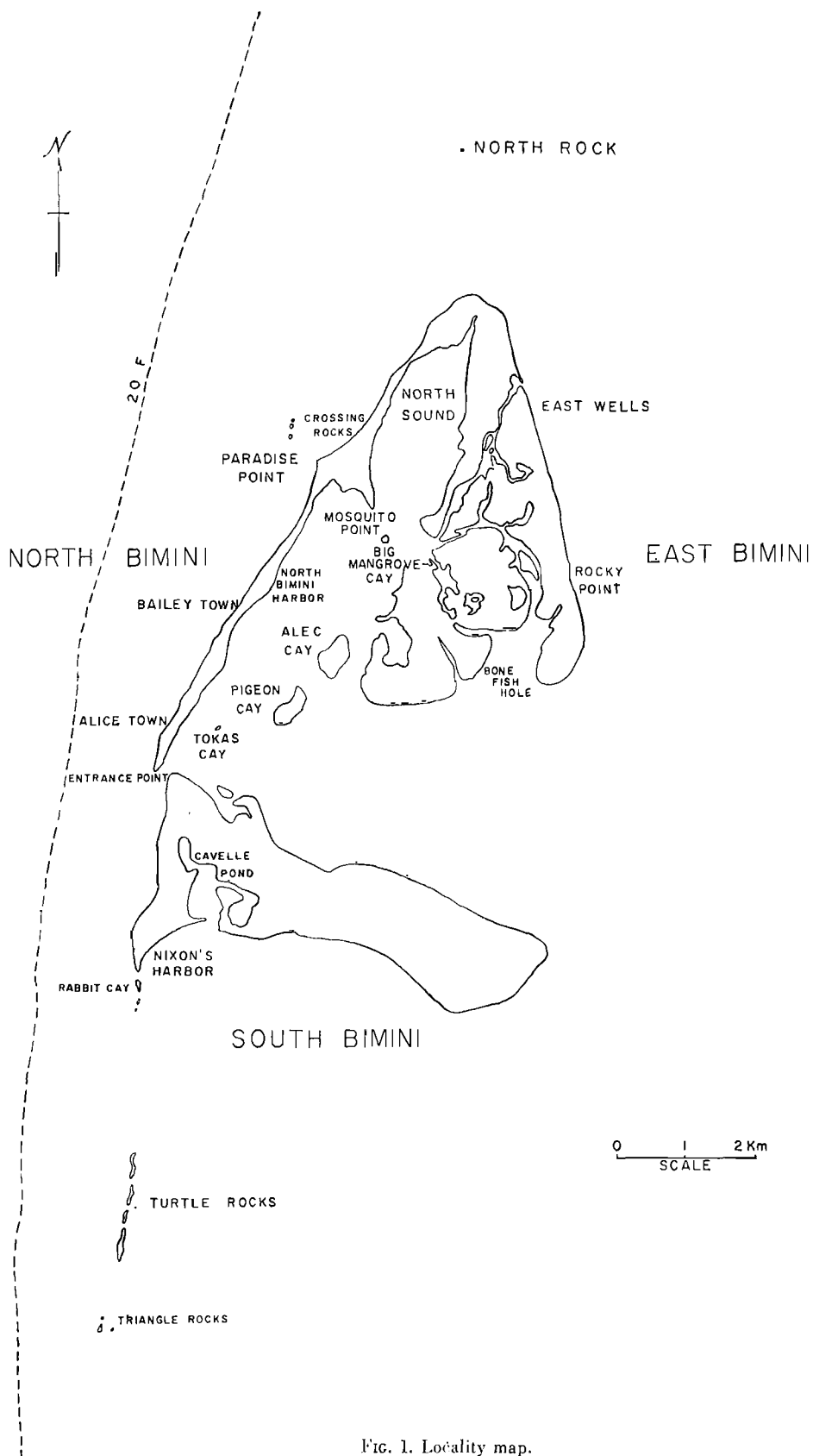


FIG. 1. Locality map.

Almost all of the underwater photographs and the photographs of ostracodes were taken by Mr. G. Robert Adlington of the American Museum. Final drawings were done, under the supervision of the writer, by Mr. and Mrs. T. O'Callaghan.

The map insert which gives the distribution of bottom types in the Bimini-Cat Cay area is the result of a joint effort by Professor Newell, Professor Imbrie, Mr. Purdy, Mr. William G. Heaslip, and the writer, and is published with the permission of the collaborators.

### Methods

Precise geographic location of sample stations was made possible by using photogrammetric base maps showing submarine configurations. Clarity of Bahamian waters made this procedure practical. In addition, since much of the work was done within sight of land, it was usually possible to fix the station location from horizontal sextant angles which were plotted in the field using a three-arm protractor (Shepard, 1948).

Most of the samples used for quantitative estimates of the number of living and dead ostracodes in the sediment at the station locations were obtained using a modification of the Petersen grab designed by Dr. K. O. Emery (Fig. 2). Samples obtained by hand using self-contained underwater breathing apparatus and by shallow water diving were used principally for sediment analysis.

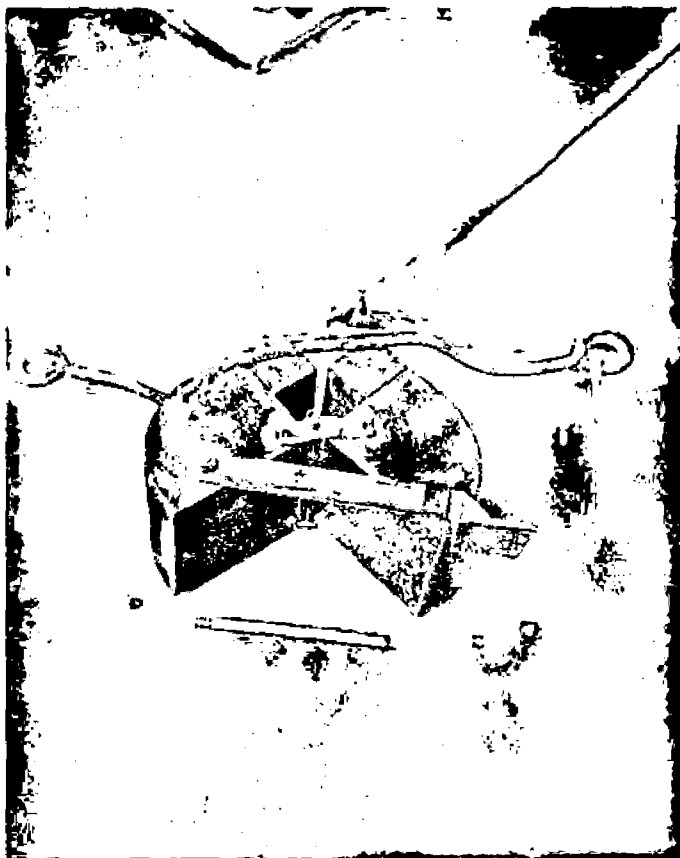


FIG. 2. Emery grab sampler.

Walton (1955) in mapping the distribution of benthonic Foraminifera in Todos Santos Bay, Baja California, cored the bottom and used the top centimeter of the core for a standard sample. This method is not feasible on rock bottoms covered by less than one centimeter of sand. In the Bimini area rock covers an extensive area of the bottom and for this reason bottom cores were not used in the present study. The Emery grab sampler was found to collect successfully from rock bottoms covered by both thick and thin sand layers; therefore, practically all samples used for obtaining estimates of ostracode abundance were obtained using the Emery sampler. A 10 cc. subsample was removed from the larger sample to serve as the standard sample used in obtaining estimates of living ostracode abundance.

There are difficulties in comparing samples from different bottom types. For example, 10 cc. of sand from a rock bottom covered by less than one centimeter of sand represents more surface area than 10 cc. of sand obtained from a grab sample which includes sand from several centimeters depth. However, the results of the investigation indicate that major variations in ostracode abundance have not been masked.

Although the living ostracode abundance is based on 10 cc. samples, 10 grams of this sample were used to arrive at estimates of dead ostracode abundance. This was done so that the results of this investigation could be used more readily in making future comparisons with ostracode abundance in ancient lithified sediment. As the sediment parameters were fairly uniform, the abundance distribution patterns would have been about the same if the dead ostracode abundance had been based on 10 cc. samples, but the absolute numbers in each sample would have been somewhat higher.

Living ostracodes were hand-picked from the 10 cc. sample under a binocular microscope while the ostracodes were still alive. In this way the ostracode movement aided in differentiating the ostracode from the sediment, and living ostracodes could be readily separated from dead ostracodes or molted shells which contained remnants of appendages. Empty carapaces were removed from the dried 10-gram sample by alcohol flotation (Kornicker, 1957b). The alcohol flotation method resulted in further sampling error, as only 40 to 50 percent of the articulated carapaces and practically none of the disarticulated carapaces were removed from the sample. However, as all samples were treated in the same manner, relative variation in geographic abundance should be about the same; but the absolute number per sample will be smaller. Scanning of the residue of a few samples indicated that the concentrate contained representatives of all common species present in the residue. To facilitate removal of ostracodes from the alcohol concentrate, it was split into two fractions by sieving through a 124 micron screen. The areal distribution of the ostracode content of each fraction was analyzed separately.

A triangular trawl covered with fine netting was dragged over the sediment and through grass and algae in order to secure larger samples of the ostracode community than could be obtained with the Emery grab. Surface plankton samples were obtained by towing a half-meter net for about 20 minutes.

At each sample locality specific information was recorded concerning the depth and temperature of the water, thickness of the sand, substrate, macrofauna and flora living in the immediate area, and presence or absence of organic detritus. Water samples were analyzed for salinity by the Mohr method using silver nitrate. Selected sediment samples were analyzed for organic carbon using Schollenberger's (1927) method as modified by Allison (1935). Dissolved oxygen was determined using the standard Winkler method. Water color was determined with a Taylor Color Comparator. Hydrogen-ion



concentration of selected samples was obtained using a colorimetric type pH meter manufactured by W. A. Taylor and Company. The pH values were corrected for salt error from the table given by Harvey (1955, p. 157). Cresol Red, which covers the range of pH values 7.2–8.8, was used as an indicator. Current velocity measurements were made with an Atlas Flowmeter attached to the end of a long pole in order to obtain bottom velocities. Current directions were determined by charting the direction of movement of floats (weighted balloons) and dye markers released from an anchored boat.

### General Patterns of Ostracode Distribution

The areal distributions of living ostracodes collected in 10 cc. standard samples (Figs. 3, 5) are interpreted in Figures 4 and 6. In making these interpretive distribution maps, ostracode abundance limits were chosen to bring out the effect of environmental factors

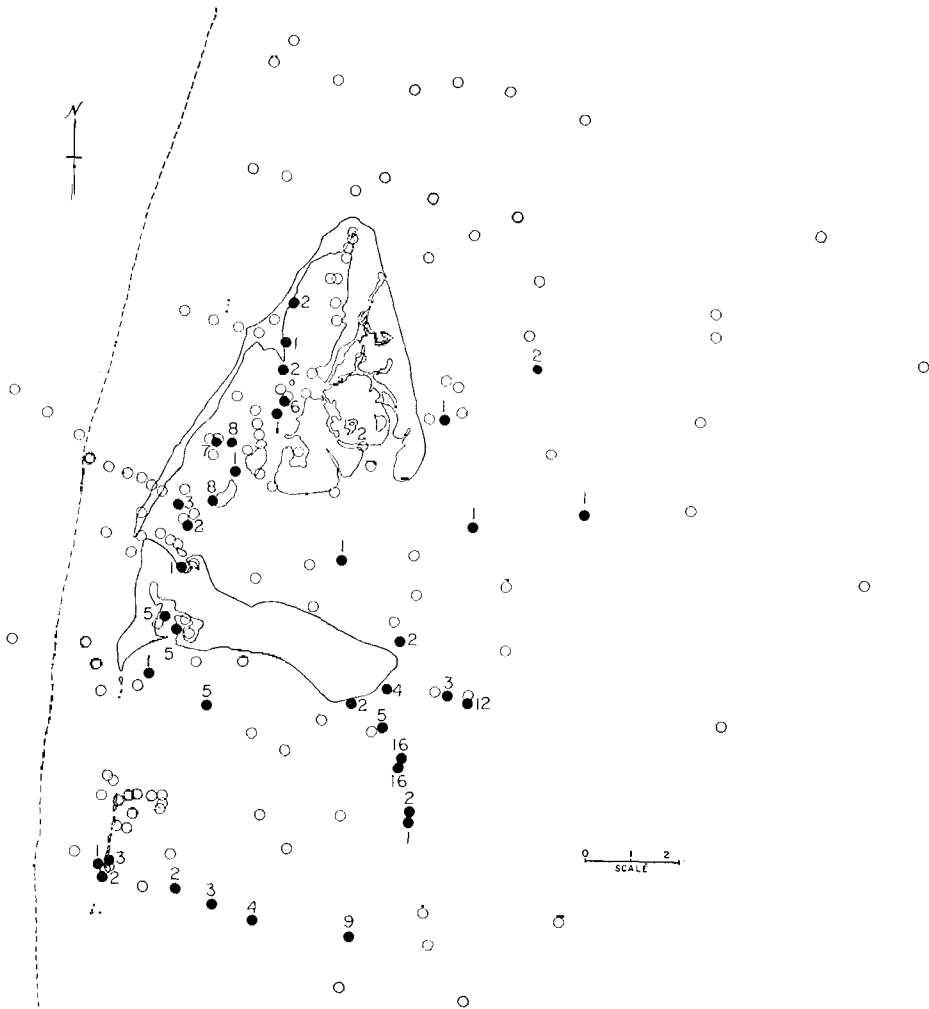


FIG. 3. Areal distribution of total living *Myodocopa*. Numerals indicate the number of specimens per sample (10 cc.). Clear circles indicate collections were made without finding individuals.

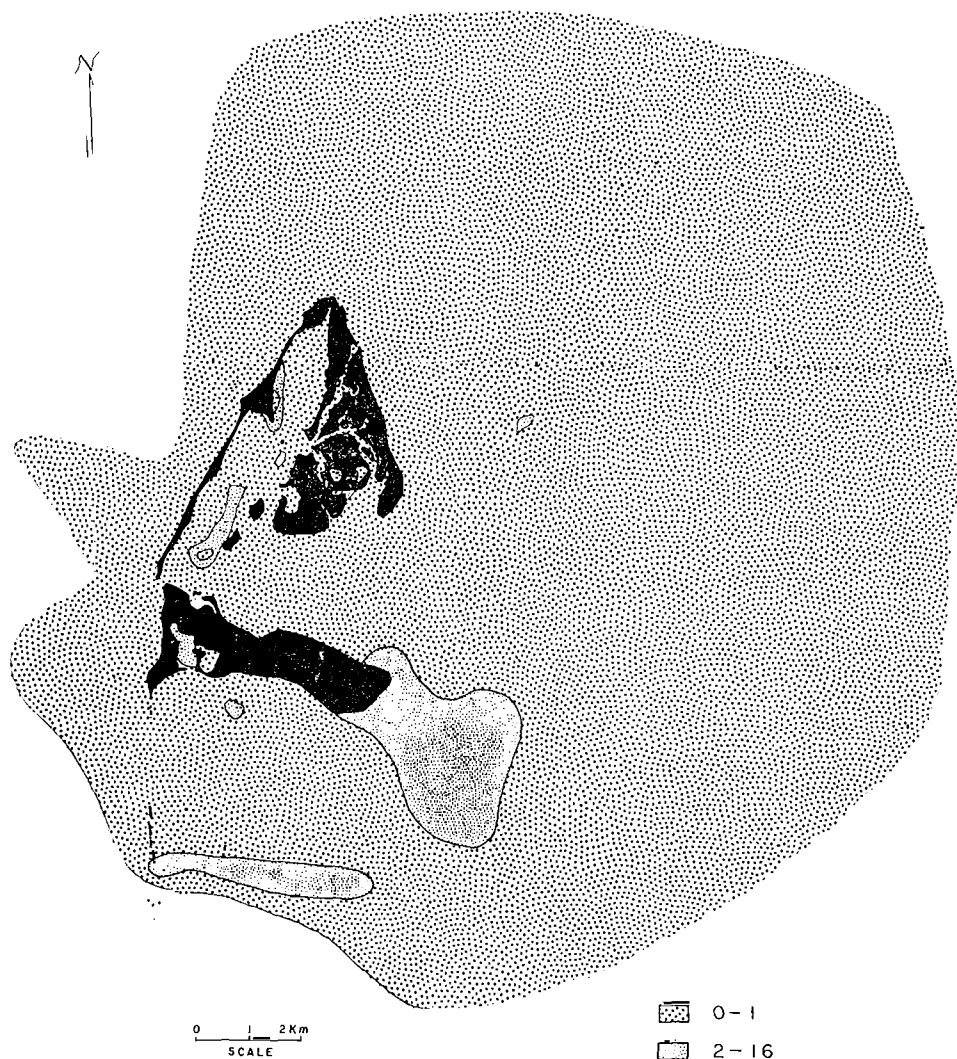


FIG. 4. Areal distribution of total living *Myodocopa*. The shading indicates the number of specimens per sample (10 cc.).

on ostracode abundance. For example, the effect of oolite bottom on *Myodocopa* distribution was best brought out by choosing limits of 0-1, 2-16 units, whereas limits of 0, 1-5, 6-40 were used for the combined *Podocopa*-*Platycopa*. Ostracode groups for interpretative maps representing the dead ostracode distribution were chosen on the same basis (Figs. 7-10). Causal environmental factors contributing to these areal distribution patterns are considered under later discussion of environment.

Only two out of 22 surface plankton tows taken in the vicinity of the Bimini Islands produced ostracodes. In one of these, obtained about 9 p.m., June 8, 1956, off the Lerner Marine Laboratory dock in North Bimini harbor, *Philomedes multichelata* Kornicker, a new species, was abundant and was evidently swarming. Several specimens were dissected and found to be males. No other ostracode species was in this haul. One

specimen of *Cypridina squamosa lernerii* Kornicker, a new subspecies, was collected from the same locality at 10 p.m., December 11, 1956. No halocyprids were captured in the Bimini vicinity either in the plankton tows or bottom samples.

Living ostracode collections were made in June and December, 1956. Identification of species in these samples was restricted primarily to the suborder Myodocopa. With the exception of *Asteropina extrachelata* Kornicker, a new species, of which only one individual was collected in June, 1956, all species were in the area during both collecting periods. Further work is needed to determine seasonal variations in ostracode abundance. The abundance and distribution of species belonging to the suborder Myodocopa are discussed along with species descriptions in the section on systematics.

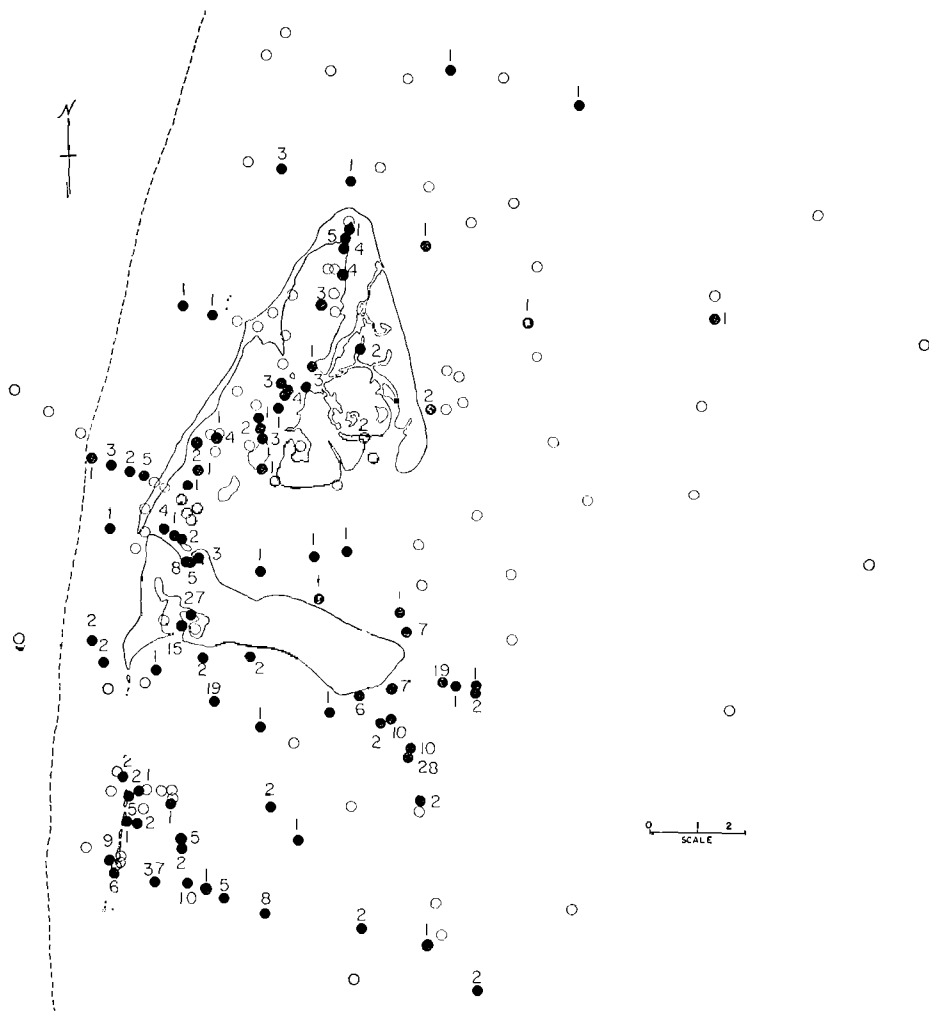


Fig. 5. Areal distribution of living Podocopa and Platycopa. Numbers indicate the total number of specimens per sample (10 cc.).

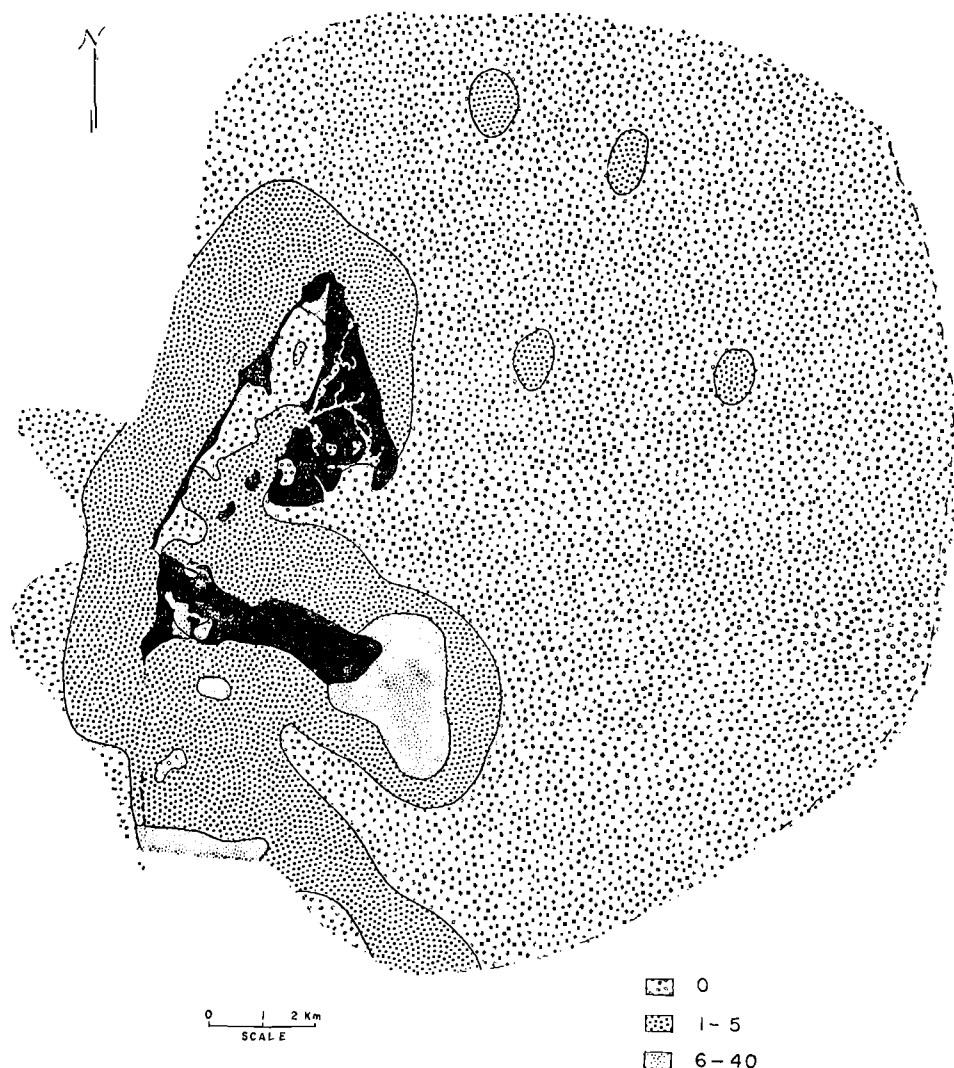


FIG. 6. Areal distribution of living *Podocopa* and *Platycopa*. Numbers indicate the total number of specimens per sample (10 cc.).

## Environmental Factors Affecting Ostracode Distribution

### INFLUENCE OF SUBSTRATE ON OSTRACODE DISTRIBUTION

The sediments in the Bimini area have been subdivided by Mr. Purdy and the writer into six facies:<sup>1</sup> chalky facies (I), pitted facies (II), unpitted facies (III), glazed facies (IV), faecal pellet facies (V), and oolite facies (VI). Figure 11 represents the areal distribution of these facies. These facies are distinguishable visually under a binocular microscope and have peculiar physical and chemical properties. Characteristic properties of the sediments of facies I, II, IV and VI are presented in Table 1.

<sup>1</sup> Facies is here used to define a geographical area covered by sediments distinguishable on the basis of physical, chemical, or biological properties from contemporary sediments covering adjacent or nearby areas.



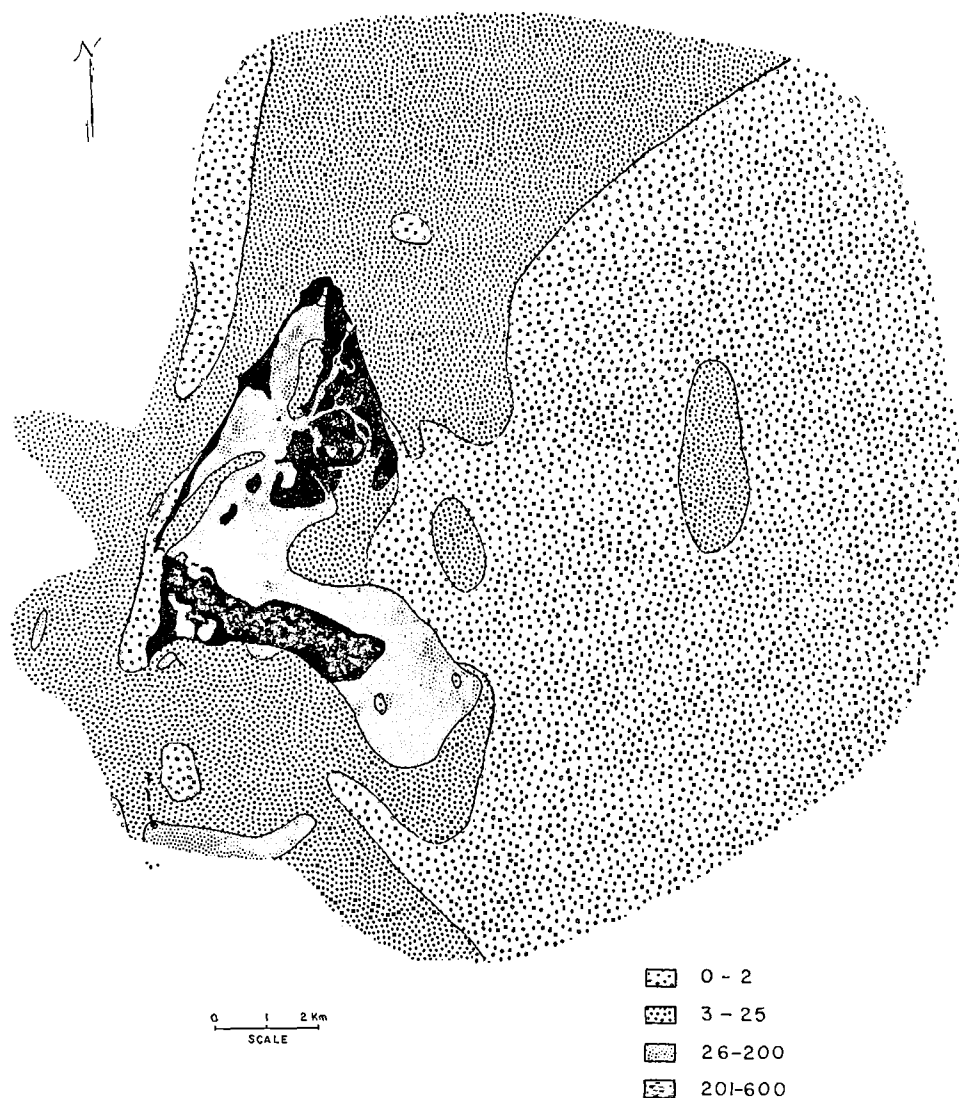


FIG. 8. Areal distribution of total dead *Podocopa* and *Platycopa*. Numbers indicate the total number of specimens per 10-gram sample (larger than 124  $\mu$  fraction).

very low (about 1.0 gms./cc.). Because of the presence of the fine material, the sorting index (SO) is relatively high (about 1.8).

The region covered by this facies includes extensive areas partially exposed at low tide, tidal channels traversed by fairly rapid currents, thickly vegetated sand as well as sand virtually barren of plants, and rock bottom areas covered by a few millimeters of sand (Figs. 12-15). Organic detritus forms a film over the sediment in practically all of this region, and the organic carbon content of the sediment is higher than in the sediments on the Banks or outer platform.

The abundance of living ostracodes within the area covered by this facies varies. *Myodocopa*, *Platycopa*, and *Podocopa* are common over most of the region. The abun-



and numerous cays project. The sediments of this facies butt against and blend with oolitic sediments which delimit this facies on the east.

Although sand, often supporting profuse vegetation, usually of *Thalassia*, is accumulating in the protected near-land areas, a large part of the region covered by pitted bioclastics is rock bottom containing small pockets of sediment or at most a film of sand a few millimeters thick. Where a rock bottom is present, a varied algal flora, often dominated by the genus *Sargassum*, combine with sea whips, corals, and sponges to form a community rich in numbers and diversity (Figs. 16-21).

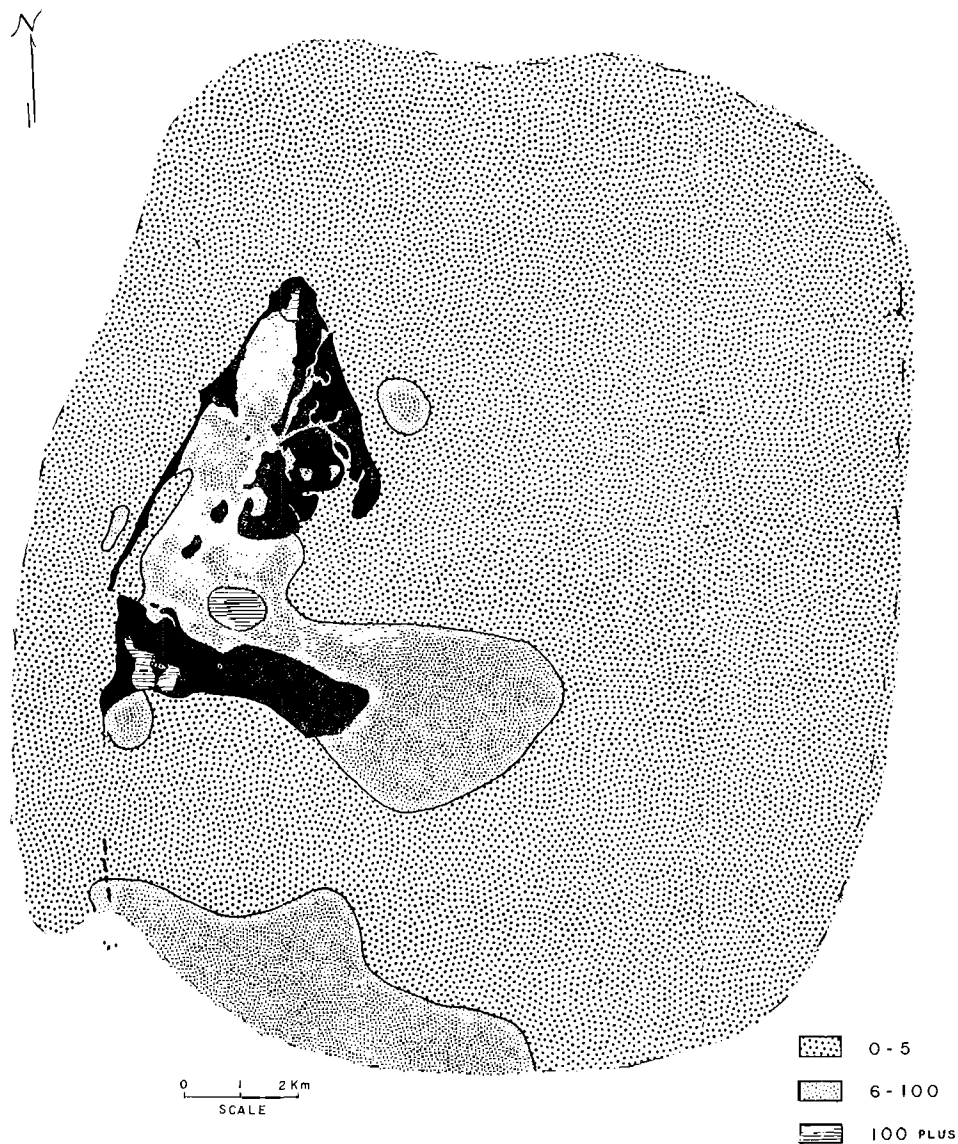


FIG. 10. Areal distribution of total dead Podocopa and Platycopa. Numbers indicate the number of specimens per 10-gram sample (smaller than 124  $\mu$  fraction).



Living ostracode abundance in the area covered by this facies is variable. Living ostracodes are common over most of the area but extremely abundant east of South Bimini and in a narrow strip just south of Turtle Rocks. The reason for this abundance is not known. The distribution of the dead ostracodes here is similar to that of the living ostracodes.

*Unpitted facies* (III): The sediments within Cavelle Pond are well preserved bioclastics and do not exhibit intensive pitting.

Cavelle Pond supports a profuse vegetation. The western segment of the Pond contains *Thalassia* as the dominant flora, whereas *Laurencia* is dominant in the eastern part. The passageway which connects the two segments is covered in many places by only 15 cm. of water at low tide.

Living ostracodes are common in this pond. In general, the same species living here are living in other marine environments in the Bimini vicinity. Dead ostracodes are extremely abundant and consist predominantly of brackish water forms not living in Cavelle Pond at present. These shells are probably relicts from the time Cavelle Pond

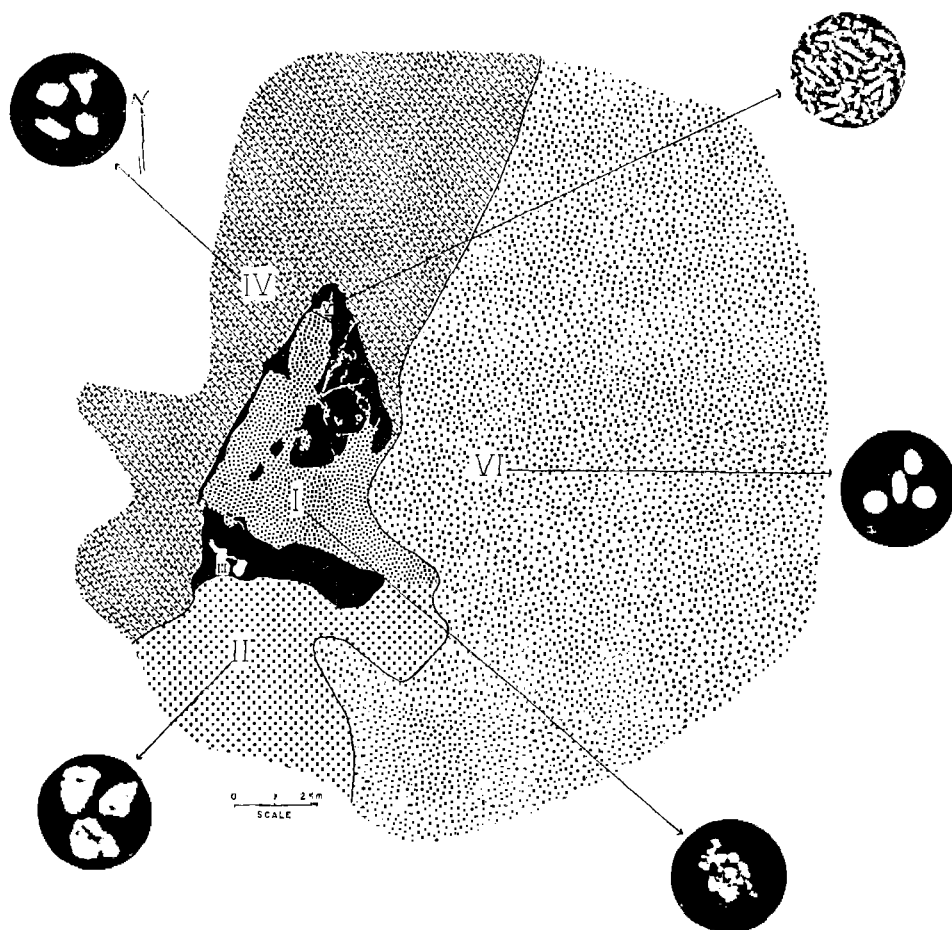


FIG. 11. Sediment facies map. I, chalky facies; II, pitted facies; III, unpitted facies; IV, glazed facies; V, faecal pellet facies; VI, oolite facies.

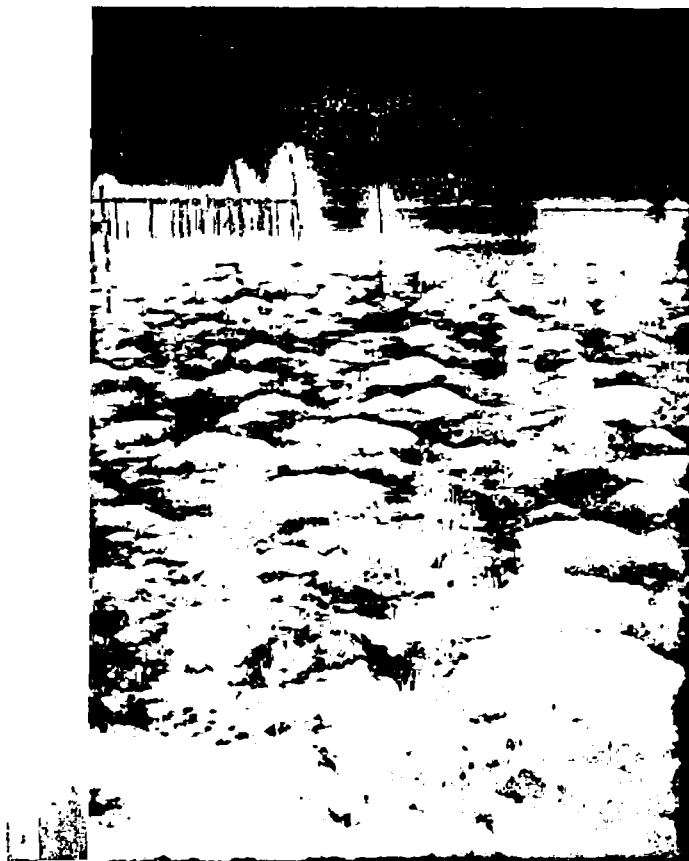


FIG. 12. Intertidal zone, North Bimini Harbor in front of Lerner Marine Laboratory. Mounds in foreground are formed by the worm *Arenicola*.

was separated from the sea and contained brackish water (see section on "Salinity").

*Glazed facies* (IV): Bioclastics which are rounded and appear glazed form the beach sands and sediment along the western shores of North and South Bimini. Aggregates of the glazed grains are common where the glazed bioclastics blend with oolite sands around the northern end of North Bimini.

The shifting sands which are parallel to the coast line support little vegetation, although isolated patches of *Thalassia* and *Chondria tenuissima* (Goodenough and Woodward) appear to be thriving on this substrate. Rock-bottom areas off the coast are covered by only a film of sand. These support abundant and diverse plant and animal life (Figs. 22, 23).

Living and dead ostracodes are rare in the area covered by this facies. The rock-bottom areas seem to contain more ostracodes than the surrounding sand areas. The rarity of ostracodes in this region is considered to be the result of agitation of the sand by waves. Ostracodes are, for the most part, burrowing animals, and many species may not be adapted for existence in shifting sand.

Faecal pellet facies (V): Faecal pellets of the gastropod *Batillaria minima* were abundant in the sediment in the extreme northern end of North Sound (Kornicker and

Purdy, 1957). Although the lime-secreting organisms (ostracodes, Foraminifera, pelecypods, gastropods) form but a small percentage of the total sediment in the upper few centimeters, their proportion materially increases in the sediment below the surface due to poor preservation of the faecal pellets.

Myodocopa are absent from the area covered by this facies. This is thought to be the



FIG. 13. Holothurian and algae on rock bottom, North Bimini Harbor. Water depth is about 1 meter.



FIG. 14. "Coral patch", North Bimini Harbor. Water depth is about 1 meter.

result of the high and variable salinities encountered in this region. It was not possible to evaluate the role of sediment type, which actually might be quite important. Living *Podocopa* and *Platycopa* are fairly common. Dead ostracodes are extremely abundant. The abundance of dead ostracodes is attributed to the relative scarcity of other organisms with calcareous parts living in this area. Some podocopid species which are present in abundance in the sediment are restricted to this region; other species abundant elsewhere are absent here. This distribution is also considered the result of high and variable salinities (see section on "Salinity").

*Oolite facies* (VI): The term oolite sand is loosely used in this paper to include calcium carbonate coated faecal pellets as well as spherical grains with well developed concentric structures.

Two oolite bores are a minor part of the oolite sands in the Bimini area. Level oolite sand areas are commonly coated with organic detritus which makes them darker than the oolite bores. They also support more vegetation than the bores. Identification of these sands as oolite requires close examination of the sediment. They are not distinguishable from bioclastic sands on aerial photographs as are the bores.

Sediments belonging to the oolite facies are characterized by being extremely well sorted; the diameter of most grains lies within the 124–248 micron range. The dry (and

wet) bulk density of oolite sand is higher than that of other sands in the vicinity of Bimini (Figs. 24, 25). The organic carbon content of oolite sand is lower than in other sediments in this region. However, a film of organic detritus is not uncommon on the sediment.

Living and dead ostracodes are virtually absent from the area covered by oolitic sands. The influence of the oolite sands on the distribution of ostracodes is especially notable in the submarine area around the eastern end of South Bimini. In this region ostracodes are abundant in the pitted and chalky bioclastic sediments but are absent or extremely rare in the adjacent oolitic sands.

The reason for the rarity of ostracodes in the oolite sands is not definitely known. Vegetation is sparse in this region, and the organic carbon content of these sands is lower than in the other sediments in the Bimini vicinity, so it is possible that food supply may be the limiting factor. Organic detritus is present on much of the oolite sediment, and the vegetation, although sparse, possibly occurs in sufficient quantities to support more ostracodes than are present in these sands.

In the Bimini vicinity, except for the two bores shown on the map insert, which probably are shifting, the sand has been somewhat stabilized by sparse vegetation; ripple marks and other evidence of shifting were not observed. Therefore, in this area

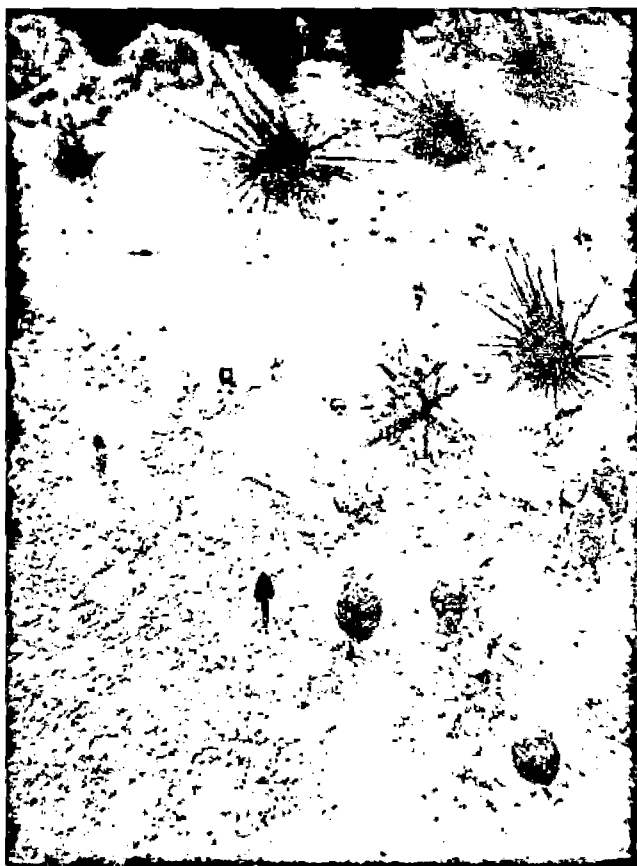


FIG. 15. Echinoids and algae on rock bottom, North Bimini Harbor. Water depth is about 1 meter.

sand movement is not likely to be a major environmental factor influencing the distribution of ostracodes.

Six myodocopid ostracodes were isolated in glass vials containing oolite. After 23 days all ostracodes were alive and several living young had been produced. Although the data are too few to be conclusive, it does suggest that oolite is not inhibiting.



FIG. 16. Dense *Thalassia*, south of South Bimini. Water depth is about 5 meters.

The writer from observing the behavior of ostracodes in the laboratory has come to the conclusion that physical properties of sediment are extremely important to benthonic ostracodes who crawl on, or burrow into, the sediment. The interstices between grains of Bimini sediments were too small to accommodate an ostracode, so that in order to burrow the animal had to force its way into the sediment. Although the ostracode does this partly by moving grains to the rear with its appendages, most of the forward movement is accomplished when the animal using its carapace as a wedge forcing it through the sediment by pulling and pushing on grains of sediment. The ability of an ostracode to burrow therefore depends both on its strength and the resistivity of the sediment to displacement.

Oolite is the densest sediment in the Bimini area. It is possible that ostracodes avoid the oolite area because of burrowing difficulties. See preliminary experiments suggesting that ostracodes may prefer to burrow in less dense sediment, Kornieker (1957a).

With the exception of the oolite, which seems to be unfavorable for ostracodes, the type of sand in the Bimini vicinity did not appear to exert any marked influence over areal ostracode distribution.

*Grass, Rock, and Open Sand.*—The bottom in the Bimini vicinity is almost equally divided into rock areas, open sand areas, and grass areas (Fig. 26 folded chart). *Thalassia*

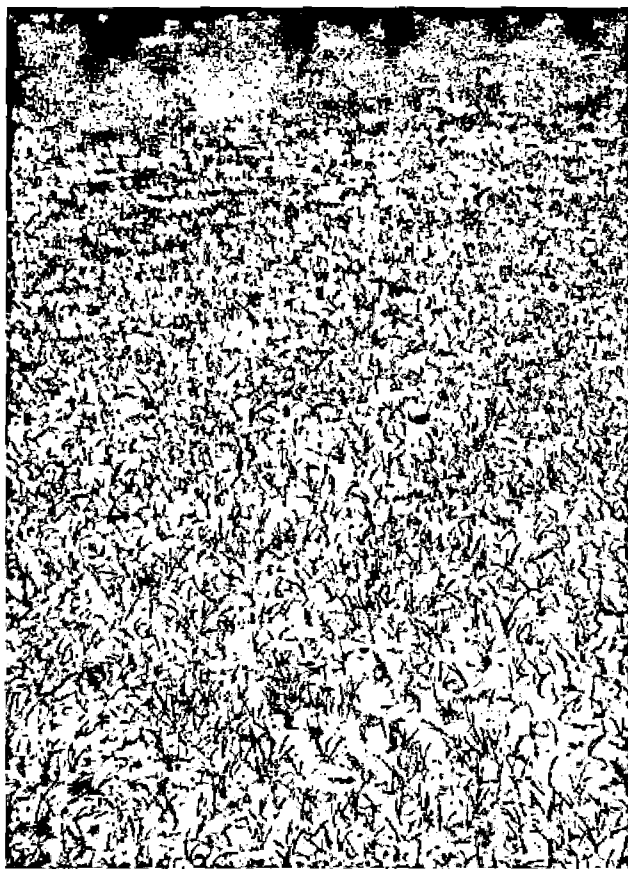


FIG. 17. Moderately dense *Thalassia*, south of South Bimini. Water depth is about 2 meters.



FIG. 19. Community living on sand-covered rock. Water depth is about 6 meters.

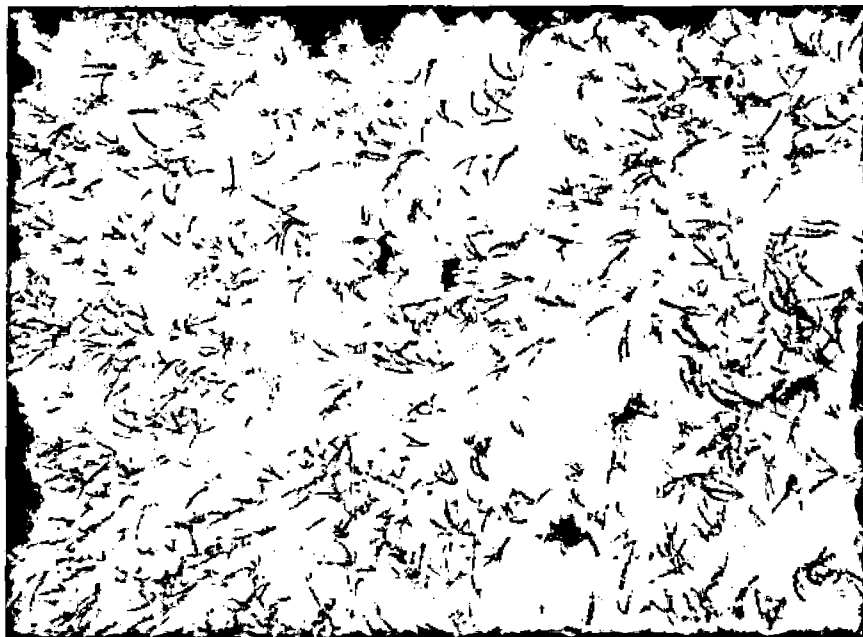


FIG. 18. Sparse *Thalassia*, south of South Bimini. Water depth is about 2 meters.





FIG. 21. Sea fans and *Madrepora* on rock bottom near Turtle Rocks. Water depth is about 7 meters.

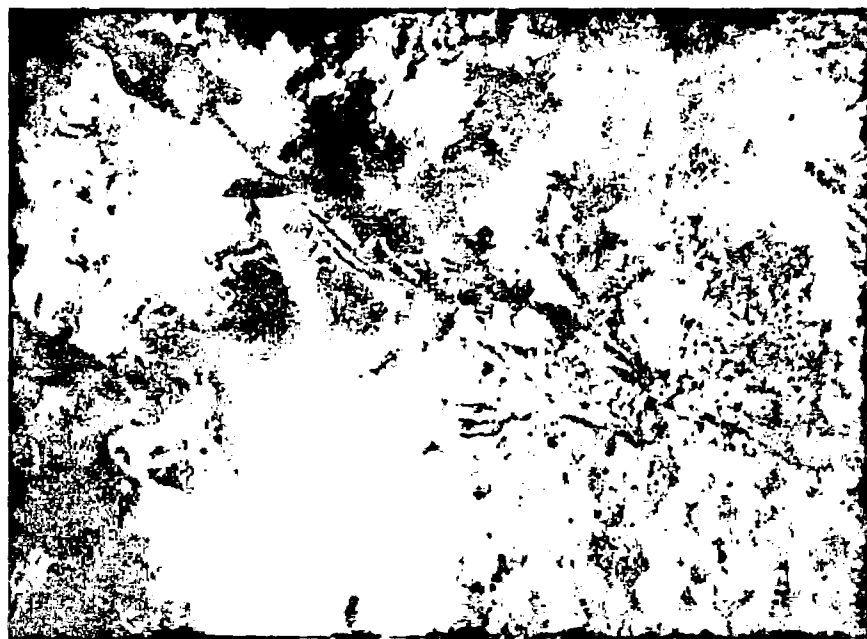


FIG. 20. Coral heads and rock ledges on rock bottom near Turtle Rocks. Water depth is about 7 meters.

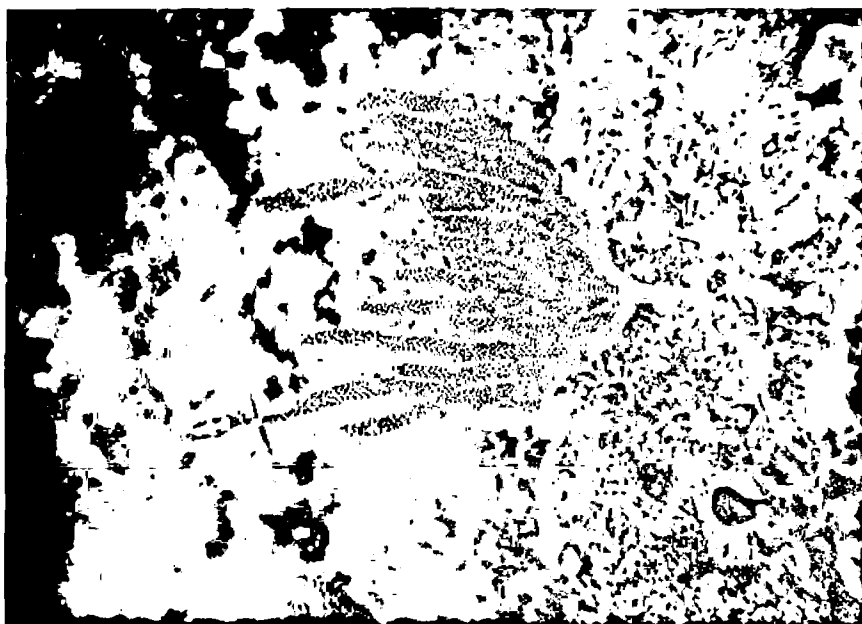


FIG. 23. Note the snail *Cyphoma*, which is a common inhabitant of sea whips near Crossing Rock. Water depth is 6 meters.



FIG. 22. Sea whip in foreground is characteristic of the rock bottom near Crossing Rocks. Depth of water is 6 meters.

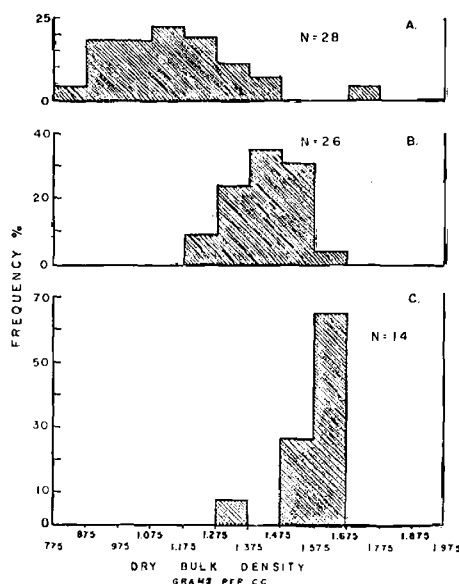


FIG. 24. Comparison of dry bulk density of sediment from "A" chalky facies, "B" glazed facies, and "C" oolite facies.

is by far the dominant vegetation and mostly grows either in small patches or covers larger areas where it is usually sparse.

Before the investigation the writer thought that large variations in ostracode distribution and abundance would be found among the different bottom types. Therefore, sampling was conducted so that each bottom type was sampled in all areas. Statistical consideration of the data did not produce significant differences with the exception of the platform area west of North Bimini, where both the living and dead ostracode abundance varied directly with the estimated areal coverage of the sampling locality by flora and fauna ( $P$  less than 5). The flora and fauna were principally confined to the rock bottom and practically absent from the wave-agitated sand areas (Fig. 27).

The writer has no explanation for not finding larger variations in ostracode content on different bottom types in the other areas. Perhaps it indicates an abundance of food in all areas. Detailed sampling may bring out subtle differences masked by the present sampling procedure.

#### INFLUENCE OF SALINITY AND TEMPERATURE ON OSTRACODE DISTRIBUTION

*Salinity.*—Typical salinity values (in parts per thousand) reported by Turekian (1957) for the Bimini area are listed in Table 2. These salinities were obtained during the spring mostly under dry conditions. After a heavy rain the regions with limited intercourse with the open sea experience marked lowering of salinity. For example, the salinity just below Mosquito Point in North Bimini harbor decreased from about 39 parts per thousand to 30.8 following a rain (Turekian, 1957).

The salinity fluctuation of the Florida Straits and Great Bahama Bank water in the vicinity of Bimini was very small. In North Bimini harbor the fluctuation in salinity was somewhat greater, but in all three regions the salinity remained within the 30 to 40



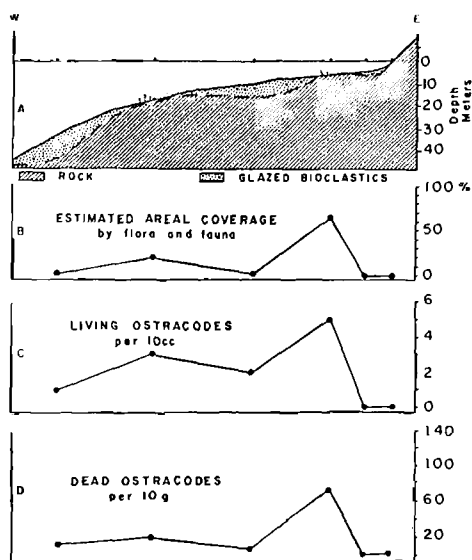


FIG. 27. Platform Area West of North Bimini.

- A. Cross-section showing distribution of the sediment.  
 B. Estimated areal subsurface coverage by flora and fauna.  
 C. Number of living ostracodes per 10 cc. sample.  
 D. Number of dead ostracodes per 10-gram sample.

TABLE 2

Salinity of Water in Bimini Area

	Salinity
Florida Straits (near Bimini)	35.85-35.92
Great Bahama Bank (near Bimini)	37.50
North Bimini Harbor	36.10-39.40
North Sound	40.00-46.50
Cavelle Pond, South Bimini (1 sample)	31.52

corals as well as most sponges were restricted to the lower end where normal marine salinities occurred (Fig. 28-29).

The ostracode population also experienced a change in this region (Fig. 30). The genus *Bairdia* which was common in all other environments in the Bimini area did not occur in the upper part of North Sound. *Loxococoncha dorsotuberculata* (Brady) also was restricted to the lower end. *Loxococoncha levis* (Brady) was collected only in the upper part of North Sound. Another species (*Hemicythere* sp.) was also restricted to the northern end. The last two species were not collected alive. *Hemicythere* sp., however, often contained appendages which indicates that the specimens died recently. The *Myodocopa* also seemed restricted to the less saline southern part.

The sediment in the northern part of the Sound contained an abundance of empty ostracode carapaces. These could not be accounted for by an abundance of living ostracodes. An explanation for this favored by the writer is that the absence of other sediment-forming organisms such as corals and the alga *Halimeda* permitted the empty ostracode carapaces to form a large part of the sediment.

Cavelle Pond is a small pond on South Bimini (Fig. 1). It is almost bisected by a

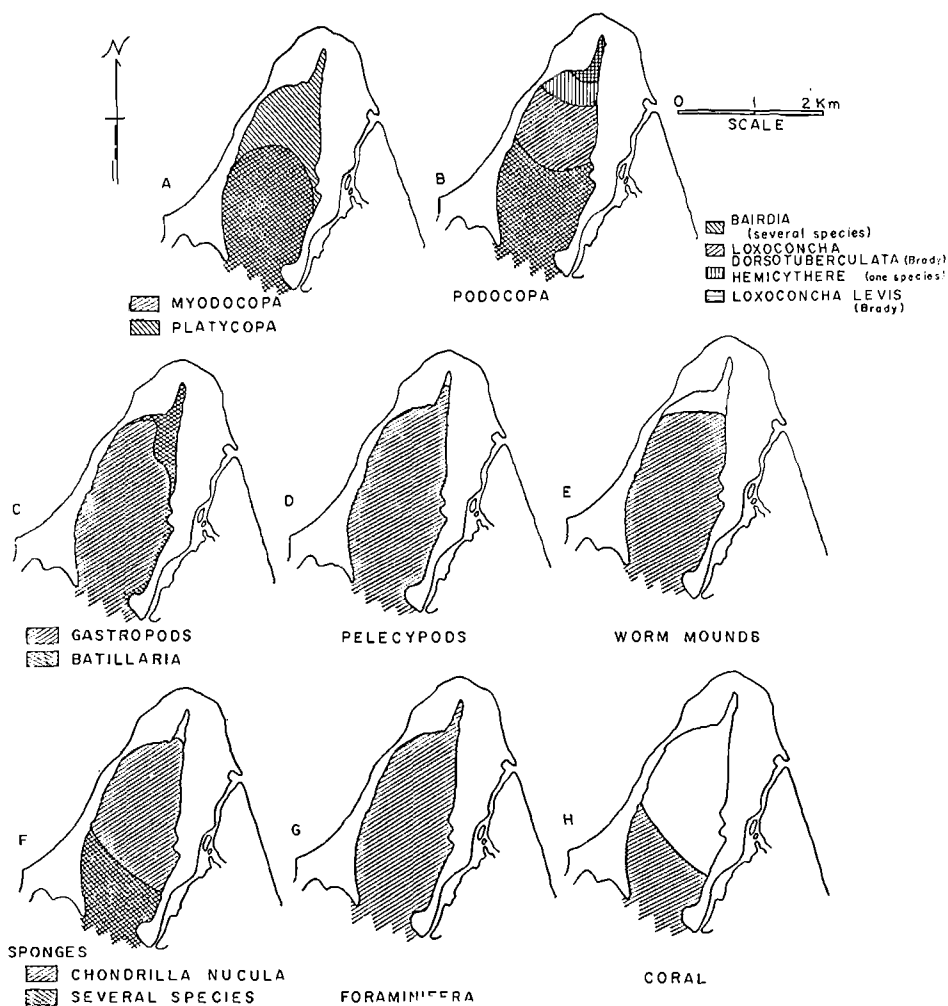


FIG. 28. Faunal ranges in North Sound.

north-south trending mangrove spur. The two halves of the pond are connected at the northern end by a shallow stream which has a rock bottom on which corals grow. Each section of the pond has a sediment substrate which supports a luxuriant crop of vegetation.

The only salinity determination available for this pond is 31.5 parts per thousand, obtained from the center of the western section of the pond (Turekian, 1957). Interchange of water during tidal change is quite rapid, and it is probable that the waters in at least the western section are normally marine, although it is not unlikely that after a heavy rain the salinity falls below 30 parts per thousand.

The dominant ostracode genus present in the sediment is *Cyprideis*, a known brackish water form (Brady, Crosskey, and Robertson, 1874; Sohn, 1951; Swain, 1955). Also abundant in the sediment are valves of the pelecypod *Anomalocardia cuneimeris* which is a recognized estuarine (poikilohaline) species (Hedgpeth, 1953, p. 178). Neither of these forms which were abundant in the sediment were found alive.

In Cavelle Pond many species of dead ostracodes in the sediment are not living in the

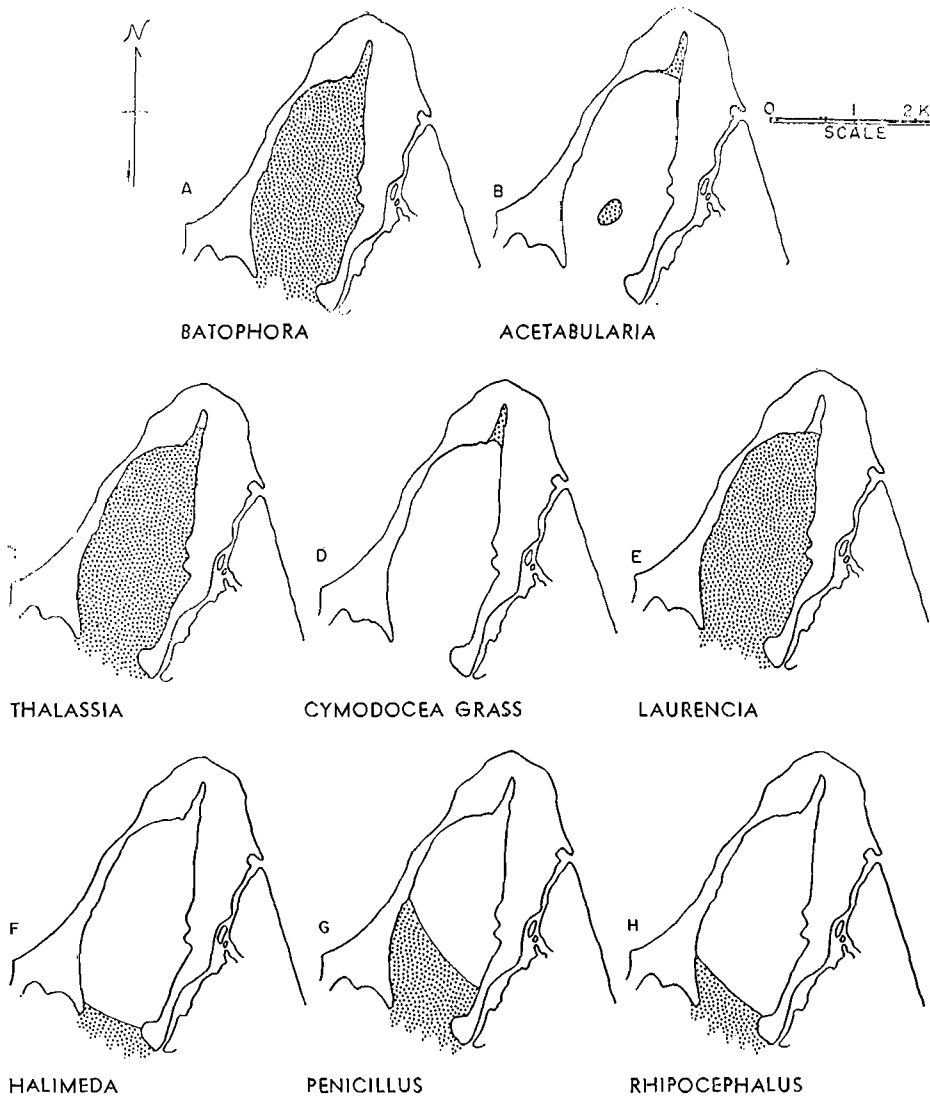


FIG. 29. Floral ranges in North Sound.

pond at the present time. Marine forms are living in the pond, whereas estuarine forms compose a large part of the sediment. An examination of the older maps of the region revealed that Cavalle Pond was once closed off from the sea. The earliest map reviewed showing a connection between Cavalle Pond and the sea was the Naval Air Pilot, 1940, H. O., No. 194, United States Navy Department, Hydrographic Office, p. 193. Inhabitants of Bimini recall that the pass connecting Cavalle Pond with the sea was excavated in an attempt to reduce the number of mosquitoes breeding in the brackish water of the pond.

Although living ostracodes belonging to the suborder Myodocopa were abundant around Bimini, their remains were absent from the sediment probably because of poor preservation of the carapace, which usually softens after death of the animal. With the exception of the North Sound and Cavalle Pond areas, species belonging to the sub-

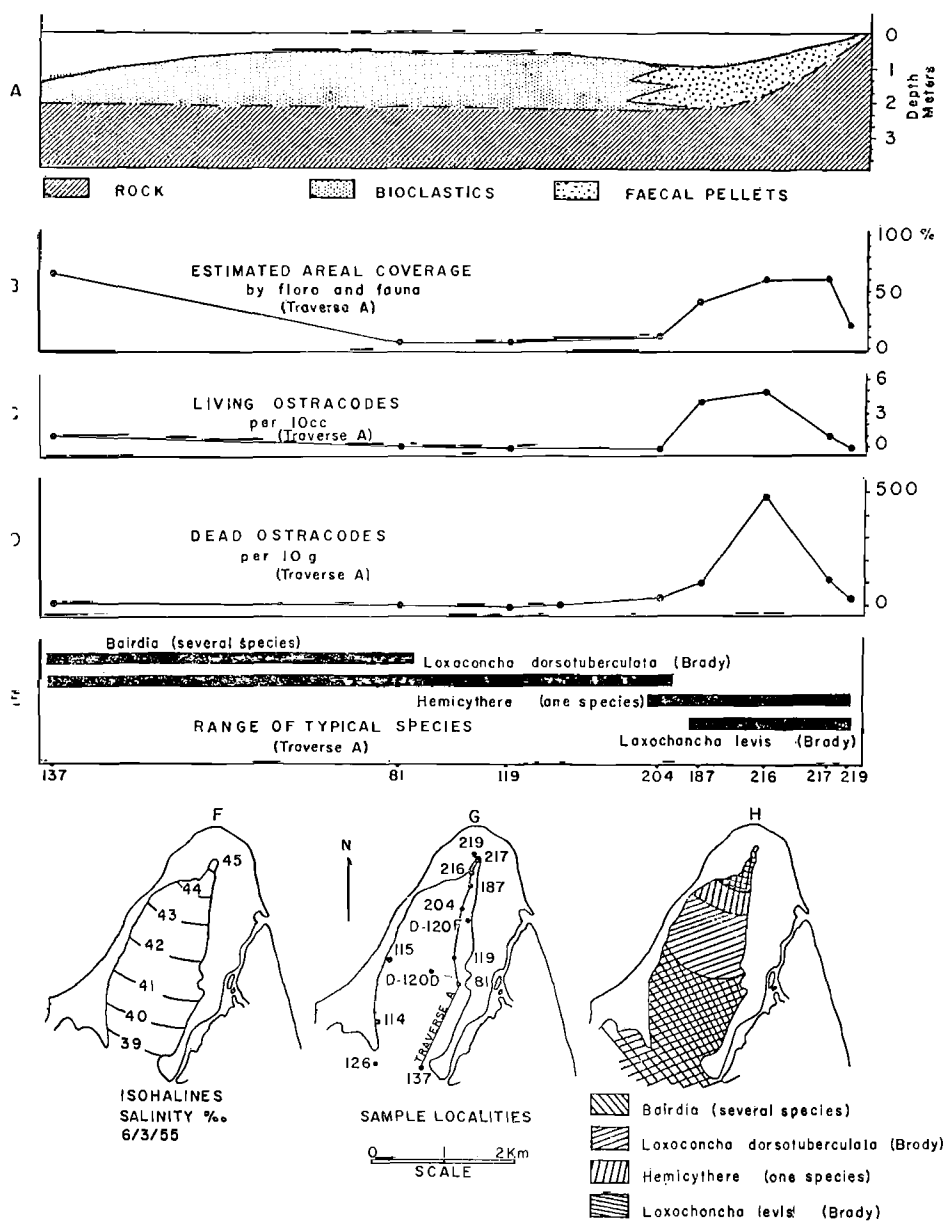


FIG. 30. North Sound.

- A. Cross section showing distribution of sediment.  
 B. Estimated coverage of subsurface by flora and fauna.  
 C. Number of living ostracodes obtained in 10 cc. sample.  
 D. Number of dead ostracodes obtained in 10 gram samples.  
 E. Range of typical species along Traverse A (see part G for location of Traverse A).  
 F. Salinity isohalines in North Sound. Data partly from Turekian (1957).  
 G. Sample locality map.  
 H. Map showing distribution of typical species in North Sound.

orders Podocopa and Platycopa represented by many empty carapaces in the sediment were also collected alive during the periods in which this study was made.

*Temperature.*—Daily temperature variations in the Bimini vicinity were only a few



degrees (Turekian, 1957), and under normal conditions this difference is not likely to have any effect on ostracode distribution. Occasionally, however, unusually cold winter temperatures have been encountered. For example, Dr. Louis A. Krumholtz (personal communication, 1956) recorded a temperature of 14° C. in North Bimini harbor on January 12, 1956. At this time fish were killed by the cold water of the harbor. The effect of this low temperature on the ostracodes of the region is not known, but it is possible that the absence of living *Hemicythere* sp. from North Sound was a result of the low temperature of the previous winter. The carapaces of this species, which in many instances still contained appendages, were abundant in the sediment.

#### INFLUENCE OF WATER COLOR AND PHOTOTAXIS ON OSTRACODE DISTRIBUTION

The waters of North Bimini harbor often were greenish-yellow when viewed from a distance. This was especially noticeable during ebb tide where the harbor water entered the blue waters of the Gulf Stream. Yellow color may be due to a trace of organic compounds which absorbs blue and near ultraviolet light (Harvey, 1955) and may be derived from mangroves or marine vegetation. The color, as determined by a Taylor Color Comparator (Table 3), which probably did not differentiate subtle color variation, did not seem to have any influence on ostracode distribution.

TABLE 3  
Water Color and pH

Location	Water Color*	pH*
Northern end North Sound	15	8.0
Center North Sound	0-5	8.2
Big Mangrove Cay	0-5	8.2
Southern end North Sound	0-5	8.2
Center North Bimini Harbor	0-5	8.1
Tokas Cay	0-5	8.2
Southern end North Bimini Harbor	0-5	8.1
West side Cavalle Pond	0-5	8.2
East side Cavalle Pond	0-5	8.2
South of Cavalle Pond	0-5	8.2

\* All samples were obtained between the hours of 6:00 A.M. and 9:00 P.M. during June, 1956.

In shallow water near land areas a considerable number of particles which reflect light upward are usually in suspension. The amount of reflected light is also affected by the substrate; open sand reflects more light than either grass or uneven rock. The amount of light reaching the bottom probably has an influence on ostracode distribution. Ostracodes seem to be either negatively or positively attracted to light (see Kesling, 1951). The response to light of specimens of *Myodocopa* collected by dragging a net through a *Thalassia* patch in North Bimini harbor was observed in a petri dish for one hour and 35 minutes. The net response of this population to light was positive (Fig. 31).

#### INFLUENCE OF DISSOLVED OXYGEN AND PH ON OSTRACODE DISTRIBUTION

Dissolved oxygen in the waters of Cavalle Pond and North Bimini harbor was determined using the Winkler procedure (Table 4). The waters were found to be sufficiently aerated, and it is improbable that ostracode distribution was affected directly by oxygen.

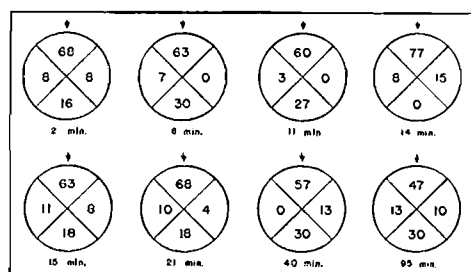


FIG. 31. Response of *Myodocopa* to light. Petri dish was rotated before each observation. Light source was microscope lamp. Sample of ostracodes was obtained from *Thalassia* patch in North Bimini harbor. Community contained *Sarsiella truncana* (13), *S. carinata* (11), *S. gigacantha* (5), *S. punctata* (3), *S. capillaris* (3), *Philomedes multichelata* (1), *P. paucichelata* (8), *Rutiderma dinorchelata* (1), *Asteropteron monambon* (2).

TABLE 4  
Dissolved Oxygen Content of Waters

North Bimini Harbor\*

Oxygen ml/l.	Water Temperature C.	Time	Air Temperature C.	Date
			22.9	11/10/56
3.69	23.5	10:30	24.4	
3.93	24.1	11:30	24.9	....
			23.1	....
4.64	25.7	1:30	24.7	....
5.25		4:45	24.5	...

Cavelle Pond, South Bimini\*\*

Oxygen ml/l.	Water Temperature C.	Time	Air Temperature C.	Date
5.03	25.2	2:00 P.M.	..	11/6/56
5.16		2:15	..	..
4.99	24.9	2:20	25.1	..
5.30		2:30	..	..
5.38	24.7	2:45	..	..

\* Location: east of Lerner Marine Laboratory, about 22 meters from shore, water about 1 meter deep. High tide was at 2:30 P.M.

\*\* Location: about 30 meters within the entrance of Cavelle Pond, water about 1 meter deep. High tide was at 12:00 M.

The pH variation in the Bimini vicinity was small and did not appear to be a factor directly influencing ostracode distribution (Table 3). This conclusion coincides with observations which were made in other areas by Tressler and Smith (1948) and Benson (1955).

#### INFLUENCE OF ORGANIC CARBON AND ORGANIC DETRITUS ON OSTRACODE DISTRIBUTION

*Organic detritus.*—A gelatin-like film containing fragments of shell debris and plants, unicellular algae, and diatoms (Fig. 32) formed a tan-colored coating on the submarine sediments in the vicinity of Bimini (Fig. 33). A simple experiment in which water from North Bimini harbor was pumped into a settling tank demonstrated that this material was also suspended in the water (Fig. 34).

Organic detritus is considered a basic food for benthic fauna (Dexter, 1944). Yonge (1953) questions the actual food value of detritus and states, "... possibly its major

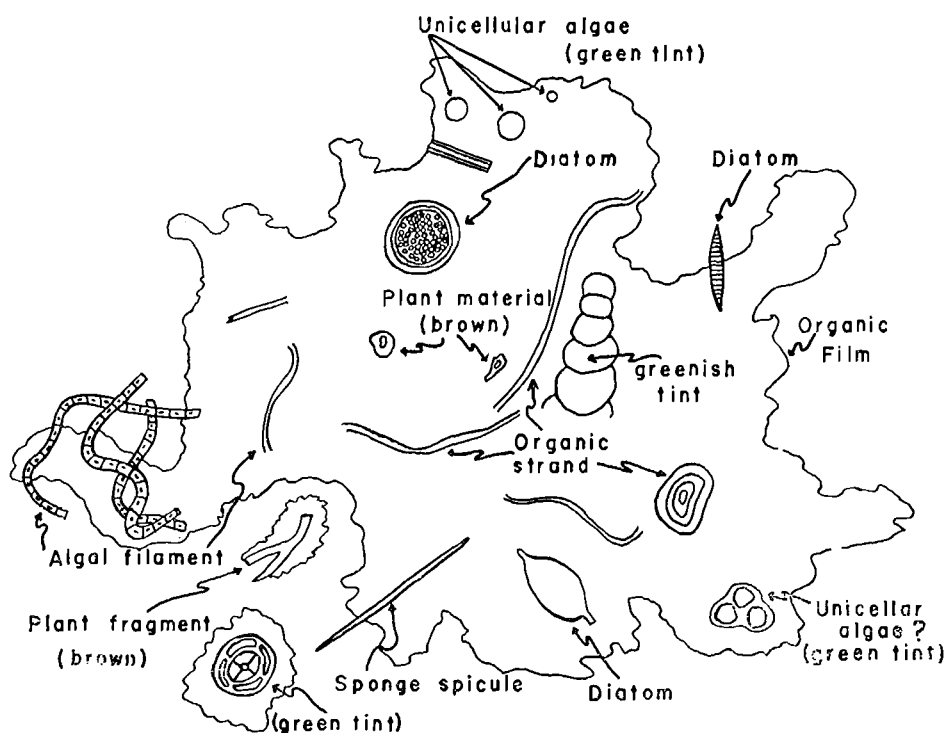


FIG. 32. Organic detritus (sketched under high magnification).

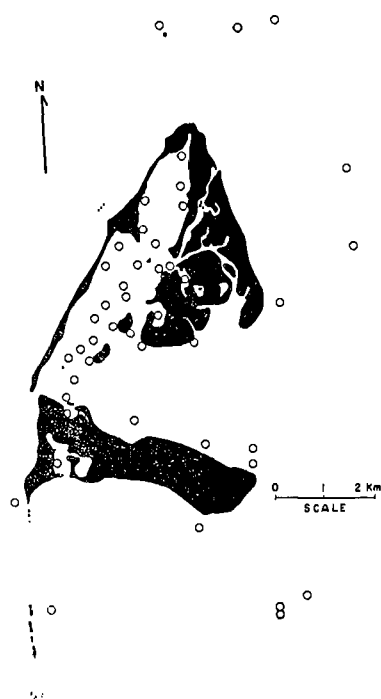


FIG. 33. Distribution of sample localities coated with organic detritus.

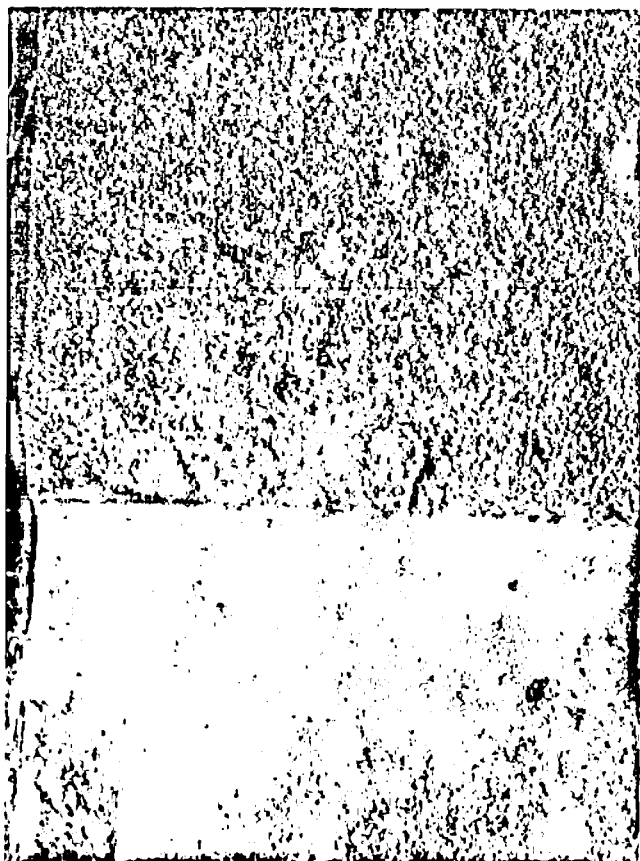


FIG. 34. Photograph of sand on bottom of small tank through which 3,000 gallons of water were passed at the rate of  $2/3$  gallon per minute. In the top part of the photograph the organic detritus which settled from the water has been removed to expose clean sand. The contrasting dark color in the lower part of the photograph is the result of organic detritus accumulation.

importance may be as a culture medium for Protozoa and bacteria." Cannon (1934) concludes, after studying the feeding mechanism of *Cypridina antarctica* and members of the subfamily Philomedinae, that these ostracodes probably feed on minute detritus. Klugh (1927) found that several fresh water species ingested both algae and detritus but did better on algae.

Hoff (1942) states, "The foods of few species (of ostracodes) have been studied in detail, although a study of food habits might have some bearing on problems of distribution." Very little has been added to knowledge concerning the food habits of ostracodes since Hoff made the statement quoted above. It seems probable, however, that at least some of the ostracodes in the Bimini vicinity feed on organic detritus.

The presence or absence of organic detritus seemed dependent to a large extent on current action. In shallow areas where the sand was in almost continuous action, organic detritus was rare and probably had been removed by currents. Ostracodes were usually rare in these sands, but this was probably because agitated sand is an unfavorable habitat rather than because of the lack of detritus. Extensive areas of oolitic sand which were almost barren of ostracodes were coated with organic detritus.

*Organic Carbon.*—Sediment from creeks flowing through mangrove swamps on East Bimini were found to be relatively high in organic carbon (1.39 to 2.90 percent) (Fig. 35). Many of these sediments were dark in color, emitted an  $H_2S$  odor, and contained fragments of mangrove leaves. Ostracodes were rare in these sediments.

Sediment within North Bimini harbor and most of North Sound contained the next highest organic carbon content (0.44 to 1.00 percent; average 0.74 percent). The lowest organic carbon content was encountered in the sediments on the outer side of the islands (0.39 to 0.61 percent; average 0.49 percent).

Within small areas, such as North Bimini harbor, the organic carbon content of the sediment was uniform, even though the amount of visible vegetation varied at the sample stations. Perhaps this is the reason for finding in this study about the same number of ostracodes living in open, nonshifting sand areas as in neighboring vegetated areas.

#### INFLUENCE OF CURRENT VELOCITIES ON OSTRACODE DISTRIBUTION

The highest current velocity in the area caused by tides was encountered at the entrance of North Bimini harbor, where the velocity reached 1.2 meters/second during ebb tide. This dropped to 0.16 meters/second outside the entrance. Within the harbor the highest current velocities occurred within the main channel. A measurement of 0.3 meters/second was made in this channel about 1.5 kilometers from Entrance Point. In the northern part of the harbor the current velocities were very low (0.01 meters/second).

South of South Bimini, except close to shore where the crescent shape of the southern shore line created a low current velocity area, the current velocities approached those encountered in the main channel of the harbor. The highest velocity measured in this area was 0.5 meters/second, which occurred immediately above the crest of an oolite ridge. The restriction in the path of water flow created by this ridge caused an increase in current velocity. Velocities in about the same range as those south of South Bimini were obtained north of North Rock. Velocity measurements taken immediately to the east of Bimini, on the Great Bahama Bank, indicated low velocities in this area (maximum velocity recorded here was 0.18 meters/second).

A current velocity measurement of 0.2 meters/second was obtained west of North Bimini, between Paradise Point and Stepping Rocks. In this area waves were of greater importance as current producers than were the tides. Submarine ripple marks as well as the presence of winter berms on the beaches testified to the sediment-moving ability of the waves along the western shore of North Bimini.

Ostracodes were rare in the shifting sand area west of North Bimini and were absent in the channel at Entrance Point, where high water velocities probably disturbed the sediment. In the area between Turtle Rocks and South Bimini the current seems to keep the rock swept clean of sediment, and ostracodes were rare. From these observations the writer concludes that current velocities sufficiently high to stir the sediment may be a major factor in inhibiting the colonization of an area by ostracodes.

Most of the submarine environment included in this study was in shallow water less than seven meters deep.

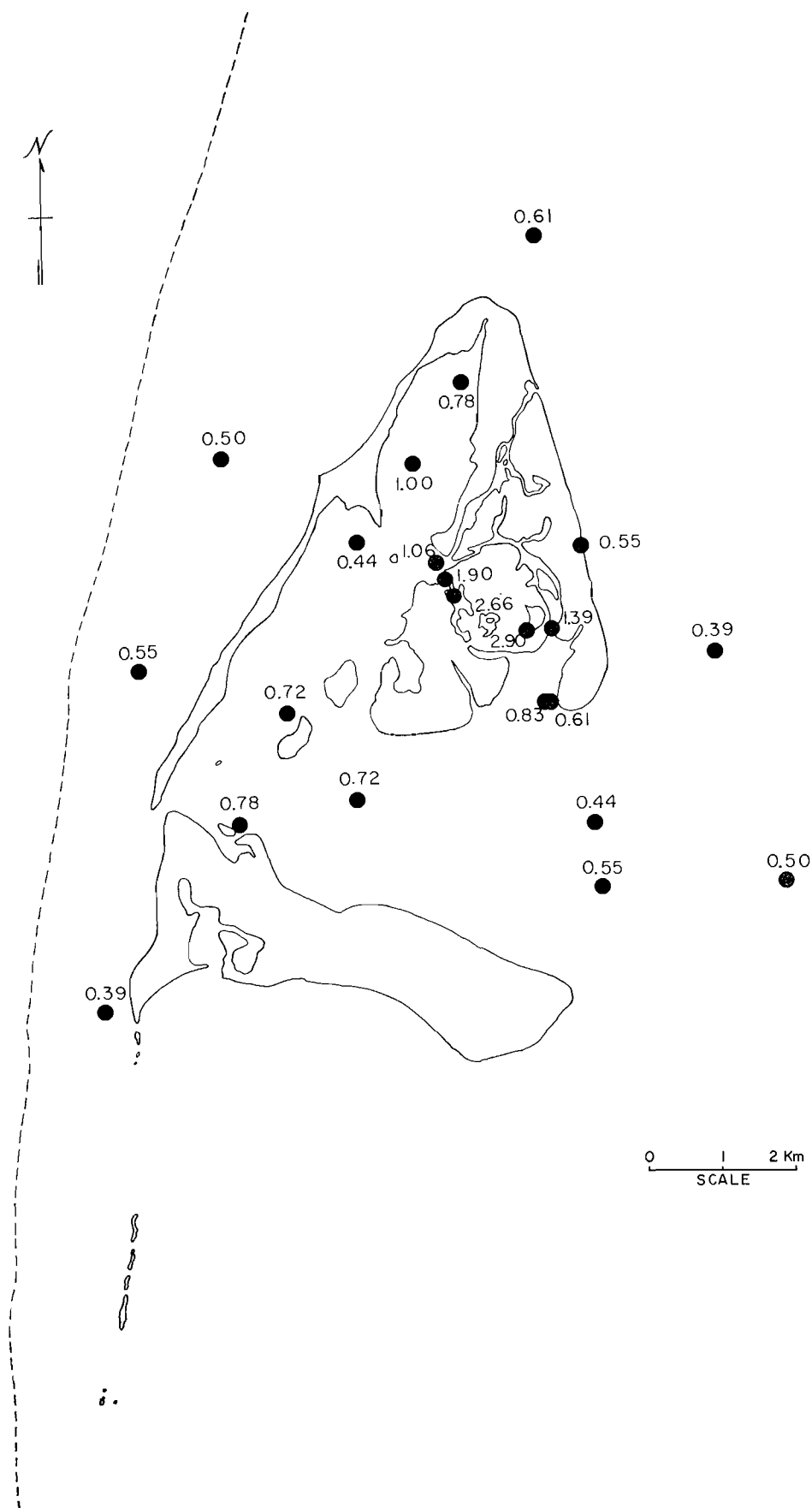


FIG. 35. Organic carbon content of the sediment (percent dry weight).

## Systematics and Occurrences of Ostracode Species

Descriptions of Bimini ostracodes follow. These include diagnostic morphologic features only and are not complete descriptions. Morphological features are shown in detail in illustrations. When sexual differences are striking, or are important for identification, both sexes have been figured and described. Variations in taxonomically important appendages are mentioned in the diagnoses and usually are figured. Appendages (most frequently the furca) of juveniles have been figured as an aid to identification.

Numbers given to specimens are based on sample or station numbers used in the present investigation. Dissected specimens have been mounted in glycerin and protected with paraffin-sealed cover-glasses. Holotypes are dried shells, or, if these were not available, shells preserved in alcohol. Holotypes have been deposited with the Columbia University Geology Department.

Shells for measurement were selected at random from various growth stages. The drawings and photographs of ostracode morphology, Figs. 46-89, are collected at the back in an appendix for the convenience of taxonomists.

Suborder Myodocopa

Family Cypridinidae

Subfamily Cypridininae

Genus *Cypridina* Milne-Edwards

*Cypridina squamosa* subspecies *leneri* Kornicker, new subspecies

(Figs. 47 1A-B; 48, A-D; 49, A-E)

Diagnosis: The shell is elliptical in lateral view, with protruding postero-ventral corner. The antennal sinus is fairly deep and the rostrum prominent. A cluster of muscle scars occurs near the center of the shell. Maximum shell height is posterior to the middle.

The adult furca bears eight claws; the fourth claw is smaller than the second and fifth; the second claw is attached to the lamina without a demarcation line at its base. The second antenna has basal spines which are longer on the distal joints. The secondary branch of the second antenna bears two long and two short bristles on the proximal joint and one long bristle on the end of the distal joint. The seventh limb has 23 to 29 lateral setae.

Comparisons: The shell of *C. squamosa leneri* is very similar to that of *C. squamosa squamosa* Mueller. *C. squamosa leneri* is smaller than *C. squamosa*. A gravid female of *C. squamosa leneri* (specimen number 247-3) measured 2.04 mm. whereas the female of *C. squamosa* reported from the Bay of Naples by Mueller was 3.3 mm. in length. *C. squamosa squamosa* bears six to seven claws on the furca, whereas the adults of *C. squamosa leneri* have eight.

Remarks: It is possible that two female ostracodes from the Dry Tortugas identified by Tressler (1949, p. 335) as *C. squamosa* belong in the subspecies *C. squamosa leneri*. Tressler's specimens have only seven furcal claws but, as these specimens were only 1.71 mm. in length, they may have been immature. The present study shows that immature specimens have fewer furcal claws (Fig. 48, A-C).

## Shell measurements (in mm.):

Specimen number	Length	Width	Height
212-1 (holotype)	1.31	0.55	0.79
247-3*	2.04	-----	1.40
656F	1.42	-----	0.94
P-1	0.71	-----	0.45
246-7	1.18	-----	0.80
93	1.58	0.62	1.03
127-1	1.29	-----	0.87
127-2	0.81	-----	0.54
127-3	1.26	-----	0.84
127-4	1.26	-----	0.81
127-5	0.71	-----	0.45
127-6	0.74	-----	0.48
93-2	0.84	-----	0.54
170	1.19	-----	0.68
5306M	0.71	-----	0.48

---

\* Gravid female.

**Material:** Twenty-four specimens were obtained from bottom samples and one (a male) from a surface tow. Five specimens, including a male and a mature female, were dissected. The holotype is specimen number 212-1 (an immature specimen) which is illustrated in Fig. 47, la-b. Carapace form was the same in mature and immature specimens.

**Occurrence:** *Cypridina squamosa lernerii* was most abundant east of South Bimini (Fig. 36). Specimens were collected in waters having temperatures of about 29.2°C. and salinities about 37.5 parts per thousand. Substrate was calcareous sand, and usually algal and *Thalassia* were growing in the area. One male was obtained in a surface plankton tow in North Bimini harbor.

## Subfamily Philomedinae

Genus *Philomedes* Lilljeborg*Philomedes multichelata* Kornicker, new species

(Figs. 46, 3A-B; 50, A-E; 51, A-D)

**Diagnosis:** The shell is elliptical in lateral view, with a shallow but distinct anterior sinus. The surface of the valves contains closely spaced pits and muscle scars.

The furca is long, narrow, and triangular in outline, with five strong and nine weak claws. The first antenna bears, on the penultimate joint, a sensory bristle which has numerous setae on the outer edge of its flattened base. The second antenna bears non-spinose, natatory setae; basal spines are absent. The mandible has, on the ultimate joint, two strong claws, one small claw, and two bristles. The exopodite of the mandible bears two bristles. The seventh limb has about five setae and terminates in a claw-like process. The female is not known.

**Comparisons:** *Philomedes multichelata* is closely related to *Philomedes oblonga*



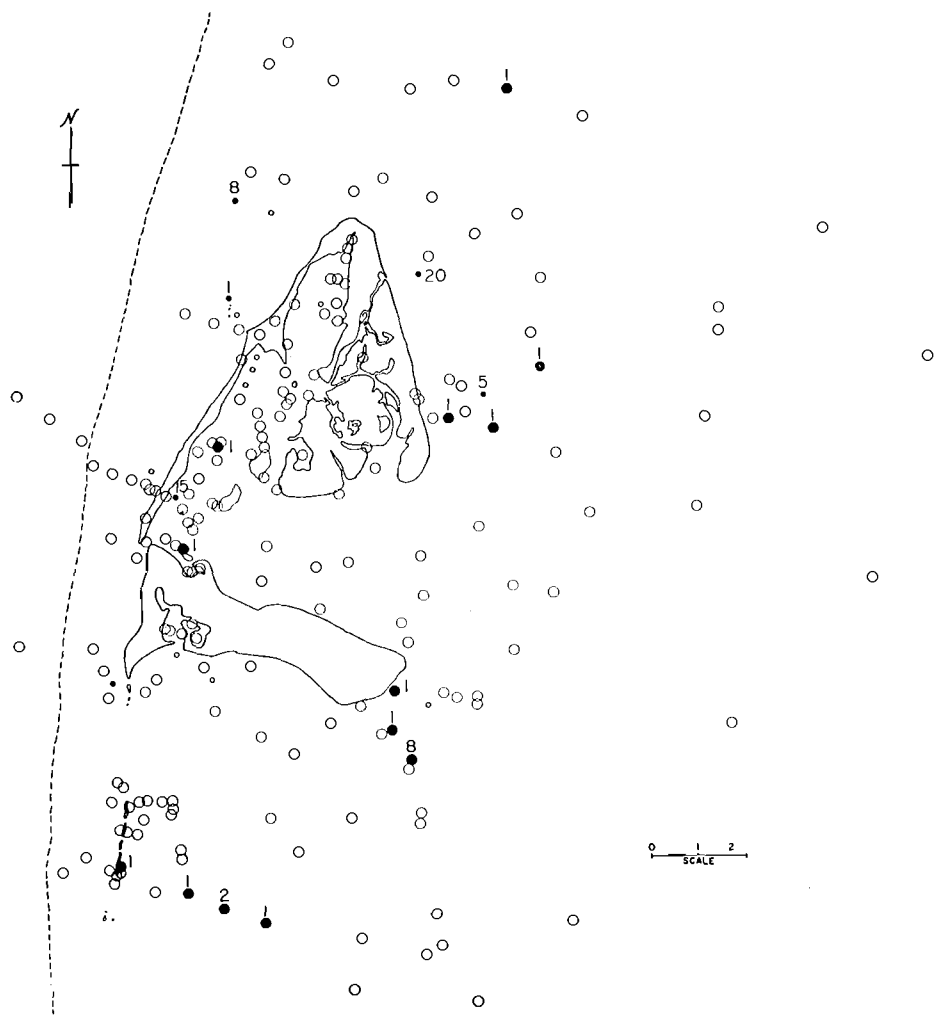


FIG. 36. Distribution of *Cypridina squamosa lernerii* Kornicker, new subspecies. Species was absent from samples shown as empty circles. Small circles represent trawl samples; large circles represent spot samples.

(Juday) Mueller, from which it differs in having 14 furcal claws, whereas, *P. oblonga* has only 10.

Shell measurements (in mm.):

Specimen number	Length	Width	Height
686Z-6 (holotype)	1.04	0.57	0.60
248	0.75	0.3	0.51
245	0.91	0.5	0.58
686Z-1	0.99	0.41	0.55
686Z-3	0.96	-----	0.52
686Z-4	0.98	-----	0.53
238	1.04	-----	0.66 (approx.)

**Material:** Four specimens were obtained from bottom samples and several hundred from a single night surface tow. Four specimens (all males) were dissected. The holotype is specimen number 686Z-6, Fig. 46, 3a-b.

**Occurrence:** Two individuals were collected from the bottom southeast of South Bimini and one from the lagoon (Fig. 37). Several hundred specimens were collected around a night light suspended from the end of the Lerner Marine Laboratory dock in North Bimini harbor. The water at the time of collection had temperatures of 28.3° to 29.2°C. and salinities of 36.1 to 37.5 parts per thousand. The bottom was calcareous sand.

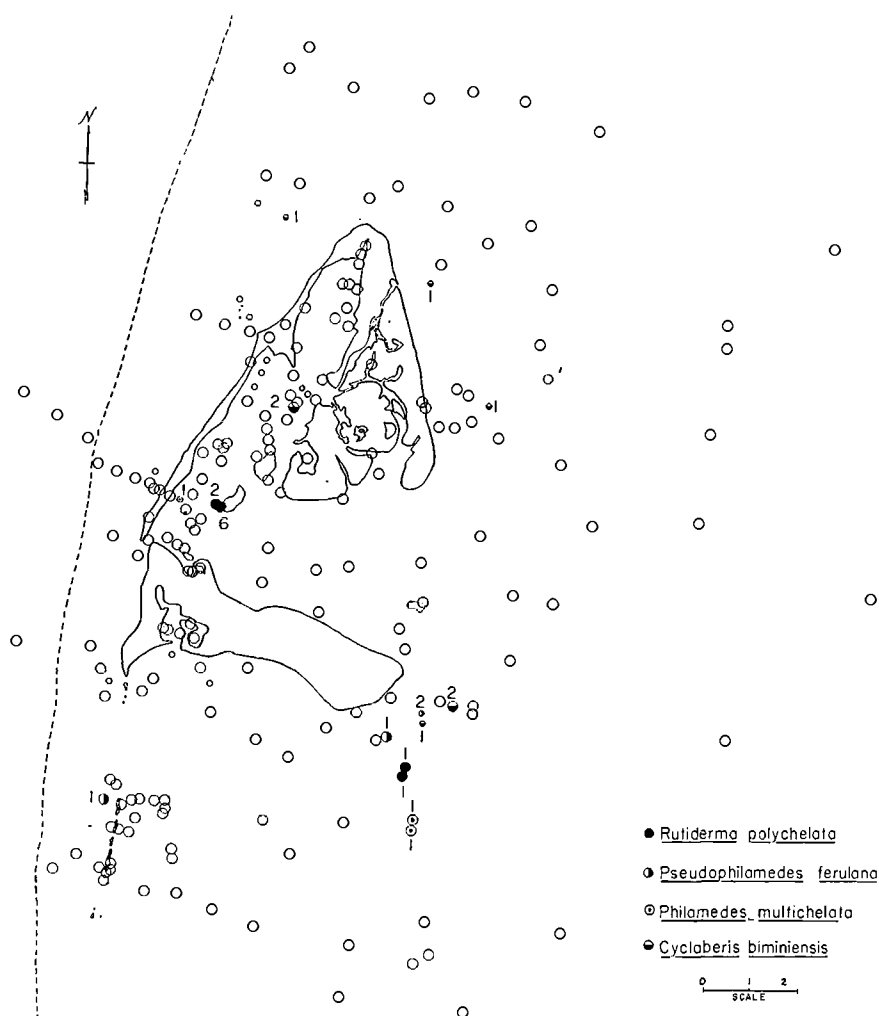


FIG. 37. Distribution of *Rutiderma polychelata* Kornicker, new species; *Pseudophilomedes ferulana* Kornicker, new species; *Philomedes multichelata* Kornicker, new species; *Cycloberis biminiensis* Kornicker, new species. Species was absent from samples shown as empty circles. Small circles represent trawl samples; large circles represent spot samples.

*Philomedes lomae* Juday

(Figs. 46, 7A-B; 52, A-E; 53, A-D; 86, A, E, I)

*Philomedes lomae* Juday, 1907. Univ. Calif. Publ. Zool., Vol. 3, No. 9, P. 141, Pl. 19, Figs. 1-6

Diagnosis: A process projects posteriorly from each side of the carapace, commencing at about the center. The antennal sinus is shallow but distinct. The surface of the valves is pitted.

The dorsal margin of the living ostracode is orange-red which fades rapidly after death, being no longer visible after a few months.

The furca contains six claws. The distal end of the fourth joint of the first antenna bears a sensory bristle which contains one thick and many fine setae. The secondary branch of the second antenna consists of three joints; the third joint is reflexed upon the second. A small sensory appendage which is ciliated on its outer extremity is on the distal end of the first joint of the mandibular palp. The terminal joint of the mandible contains one claw and three slender bristles. The female is not known.

## Shell measurements (in mm.):

Specimen number	Length	Width	Height
115-CI	1.24	0.44	0.75
215	1.18	0.34	0.73
92	0.89	0.33	----

Material: Nine specimens were collected from bottom samples; two of these (both males) were dissected.

Occurrence: *Philomedes lomae* seemed to be uniformly distributed in the Bimini area (Fig. 33). Specimens were collected in waters having salinities of 36 to 42 parts per thousand, and temperatures of about 29°C. The species was obtained at water depths ranging from one to 20 meters. The bottom in the collecting area was calcareous sand.

*Philomedes paucichelata* Kornicker, new species

(Figs. 46, 4A-B; 54, A-E; 55, A-C; 87, B, E, H.)

Diagnosis: The shell is elongate, with a prominent rostrum and a posteroventral projection, and is not strongly calcified. The surface is coarsely punctate and contains irregular horizontal ripples as well as light depressions above the central part of the shell.

The fifth leg terminates in a large quadrate tooth. The furca bears six claws; the first, second, and fourth claws are strong; the third, fifth, and sixth claws are weak. Natatory bristles on the second antenna are spined. The seventh leg bears four terminal and two lateral setae. The living ostracode has a characteristic orange-colored body and eyes. The male is unknown.

Comparisons: This species may be distinguished from *Philomedes flexilia* Brady and *Philomedes sculpta* Brady by the fewer number of claws on the furca. The shape of the shell is remarkably similar to that of *Streptoleberis crenulata* Brady but, as the appendage structure of the latter species is unknown, the relationship of these two forms remains in doubt.

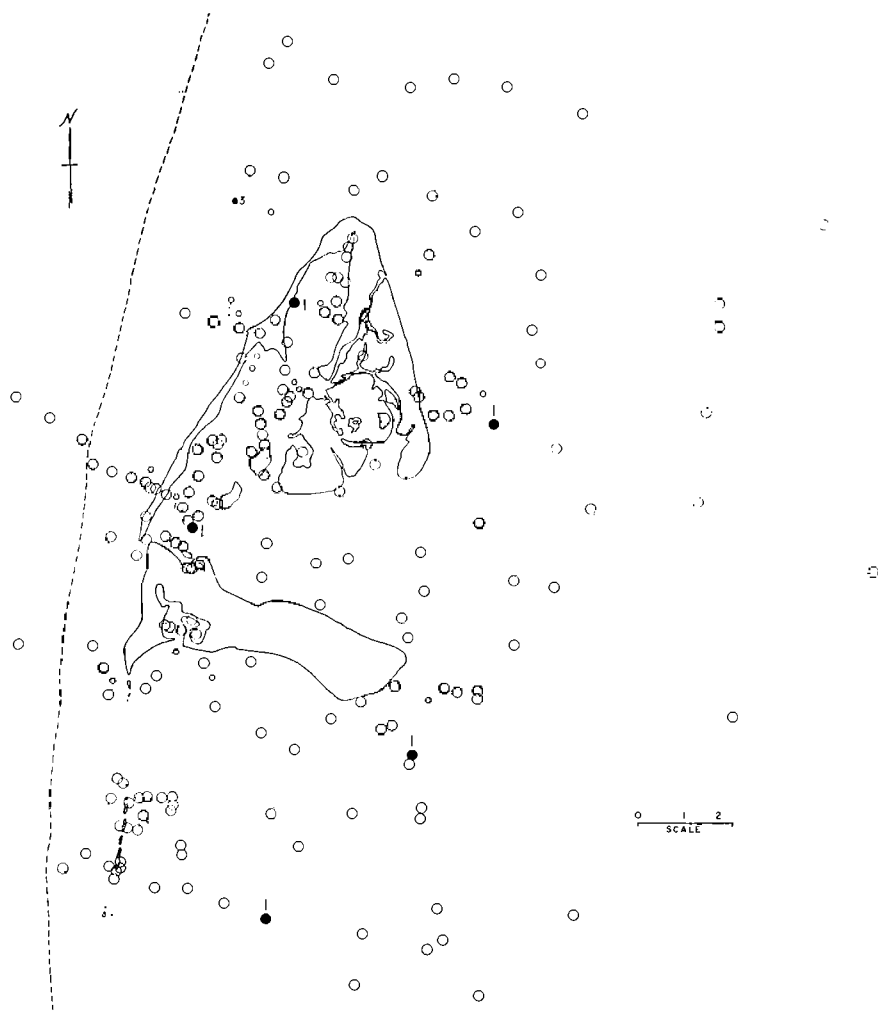


FIG. 38 Distribution of *Philomedes lomae* Juday. Species was absent from samples shown as empty circles. Small circles represent trawl samples; large circles represent spot samples.

Shell measurements (in mm.):

Specimen number	Length	Width	Height
287-1 (holotype)	0.83	0.35	0.46
62*	0.8	—	0.48
288	0.87	0.35	0.50
156-5	0.80	.....	0.4

\* Gravid female.

Material: Eighty-one specimens were collected from bottom samples; two of these (both female) were dissected, and, in addition, individual appendages were examined from several other specimens. The holotype is specimen number 287-1, illustrated on Fig. 46, 4a-b.

Occurrence: *Philomedes paucichelata* was a common species in the Bimini area (Fig.

39). It was found in water from one to about 20 meters in depth. Specimens were collected in waters having temperatures of about 29°C. and salinities of approximately 38 parts per thousand. The bottom in the collecting areas was calcareous sand.

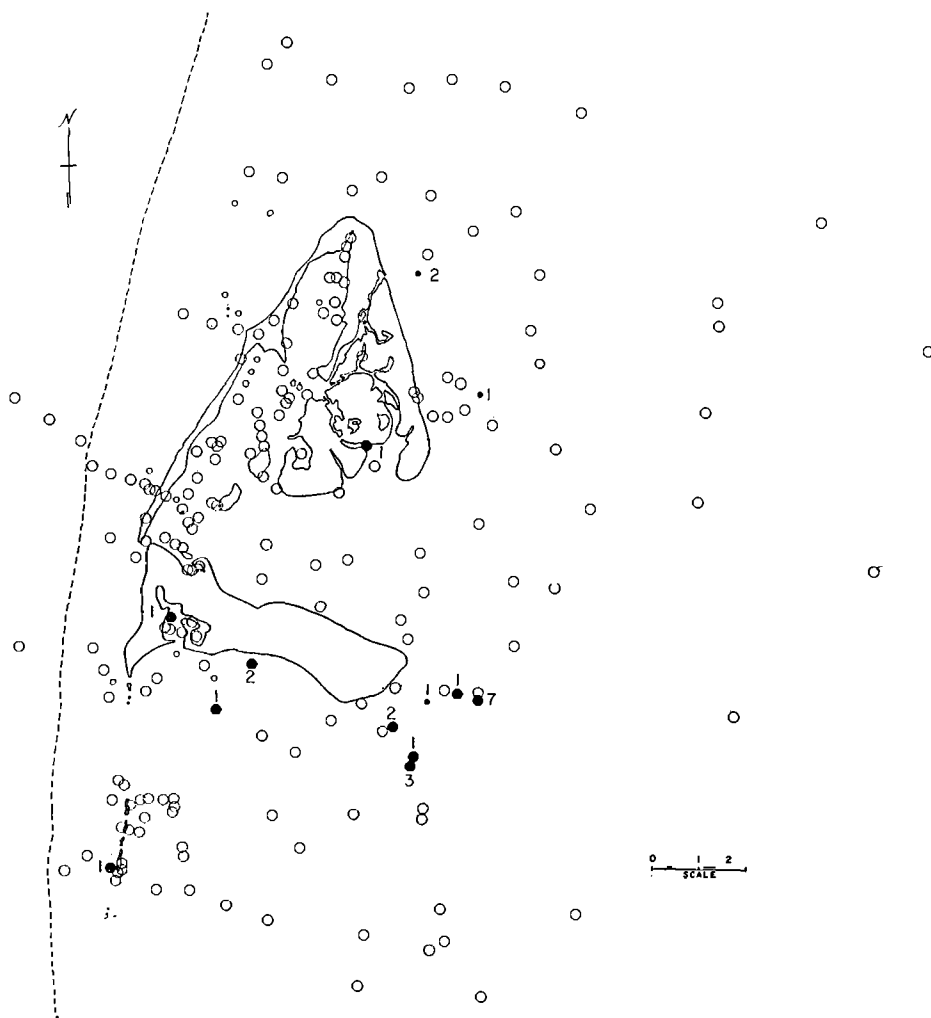


FIG. 39. Distribution of *Philomedes paucichelata* Kornicker, new species. Species was absent from samples shown as empty circles. Small circles represent trawl samples; large circles represent spot samples.

#### Genus *Pseudophilomedes* Mueller

This genus is characterized by having an elongate tooth on the fifth limb.

#### *Pseudophilomedes ferulana* Kornicker, new species

(Figs. 46, 1A-B, 2A-B; 56, A-D)

Diagnosis: The carapace of this species is elliptical in lateral view, with a small rostrum in the upper part of the anterior margin and a short postero-ventral projection.

The caudal furca contains a total of eight claws. The claw arrangement is typical of

the genus: two large claws on the distal end, followed by several smaller claws; the fourth claw is larger than the third, fifth, sixth, seventh, and eighth claws.

The maxilla bears on its end a blunt, elongate process. The remaining appendages are typical of the genus. The seventh limb contains six terminal and four lateral setae. The male is unknown.

Comparisons: Three species of this genus have been described previously: *Pseudophilomedes joveolata* G. W. Mueller; *Pseudophilomedes inflata* (Brady and Norman); and *Pseudophilomedes angulata* Mueller. *P. ferulana* may be distinguished from these forms by having eight furcal claws, whereas *P. joveolata* and *P. angulata* have only six and *P. inflata* has 10.

*P. ferulana* is also distinguished from the other species in having a long blunt process on the last joint of the maxilla. This feature may be of subgeneric value.

Shell measurements (in mm.):

Specimen number	Length	Width	Height
165-1 (holotype)	1.15	—	0.79
93-1	0.63	—	0.40
118B-3	?0.98	—	—

Material: Five specimens were collected from bottom samples; two of these (both females) were dissected. The holotype is specimen number 165-1, illustrated on Fig. 46, 2a-b.

Occurrence: Three specimens were obtained east of South Bimini, and one west of Turtle Rocks (Fig. 37). Water temperature in collecting area was about 29°C., and the salinity 37 parts per thousand. Water depth was about six meters.

Family Rutidermatidae

Genus *Rutiderma* Brady and Norman

This genus is characterized by having a strong chela on the mandible.

Subgenus *Rutiderma* Kornicker, new subgenus

Diagnosis: Caudal laminae have few (six) claws, which include three or four strong claws followed by two or three weak "claws" with hairs at their base.

Comparisons: Three species, *Rutiderma compressa* Brady and Norman, *Rutiderma rostrata* Juday, and *Rutiderma dinochelata* Kornicker, new species, form the subgenus *Rutiderma* which is based on the furca having few claws which decrease in length posteriorly. The subgenus *Alternochelata* is based on the included species (one at present) having a furca bearing numerous claws, with the strong claws alternating with weak claws and spines.

*Rutiderma (Rutiderma) dinochelata* Kornicker, new species

Figs. 46, 8A-B; 57, A-F; 58, A-D; 36, B, F, J)

Diagnosis: The shell is oval in lateral view with a truncate posterior. A shallow antennal sinus does not have an overhanging rostrum. The shell surface is coarsely punctate and ornamented with numerous riblets; two prominent longitudinal ribs run almost the complete length of the shell.

The caudal furca bears three strong claws which show distinct demarcation lines at

their bases, followed by two weak claws. The remaining appendages are typical of the genus. The seventh limb bears six terminal and four lateral setae. The male is unknown.

Comparisons: *Rutiderma dinochelata* differs from *Rutiderma compressa* Brady and Norman in the distribution of the strong and weak claws on the furca. *R. dinochelata* differs from *R. rostrata* Juday in not having an overhanging rostrum.

Shell measurements (in mm.):

Specimen number	Length	Width	Height
57-1 (holotype)	1.22	0.45	0.87
91-1	1.18	0.45	0.8
247-10	1.14	---	0.79

Material: Seventy-nine specimens were collected from bottom samples. Two specimens were dissected (both females), and individual appendages were examined from several additional specimens. The holotype is specimen number 57-1, illustrated on Fig. 46, 8a-b.

Occurrence: *Rutiderma dinochelata* was common in the Bimini area (Fig. 40). Specimens were obtained from waters which ranged in depth from one to 20 meters, and in salinity from 31 to 42 parts per thousand. Water temperature was about 29°C.

#### *Alternochelata* Kornicker, new subgenus

Type species: *Rutiderma (Alternochelata) polychelata* Kornicker, new species

Diagnosis: Caudal laminae with many claws; weak claws and spines alternate with strong claws.

Comparisons: The subgenus *Alternochelata* differs from the subgenus *Rutiderma* in having more claws on the furcal laminae and in having these claws arranged so that weak claws and spines alternate with strong claws.

#### *Rutiderma (Alternochelata) polychelata* Kornicker, new species

(Figs. 46, 6A-B; 59, A-E; 86, C, G)

Diagnosis: The shell is oval in lateral view, with a narrow antennal sinus and overhanging beak. The postero-ventral corner is compressed, forming a small but distinct projection. The surface of the shell is smooth and without ribs or other ornamentation.

The furca bears 10 claws and spines; two long distal claws are followed by a small annulated spine; then a short claw is followed by a weak claw, which is succeeded by a larger claw and four weak claws. The second antenna bears a secondary appendage which seems to have two joints. The proximal joint of the secondary appendage bears several short spines (five or six), whereas the distal joint bears a long spine which has secondary setae near its middle. The seventh limb contains six terminal and four lateral setae. The first and second antenna, maxilla, and the fifth and sixth limbs are typical of the genus.

Comparisons: *Rutiderma (Alternochelata) polychelata* differs from all previously described species of this genus in possessing a greater total number of claws (10) on the furca and also in that these claws are arranged so that strong and weak claws alternate.

Occurrence: Two specimens were collected east of South Bimini and eight were obtained in North Bimini harbor (Fig. 37). Water depth in collecting areas ranged from

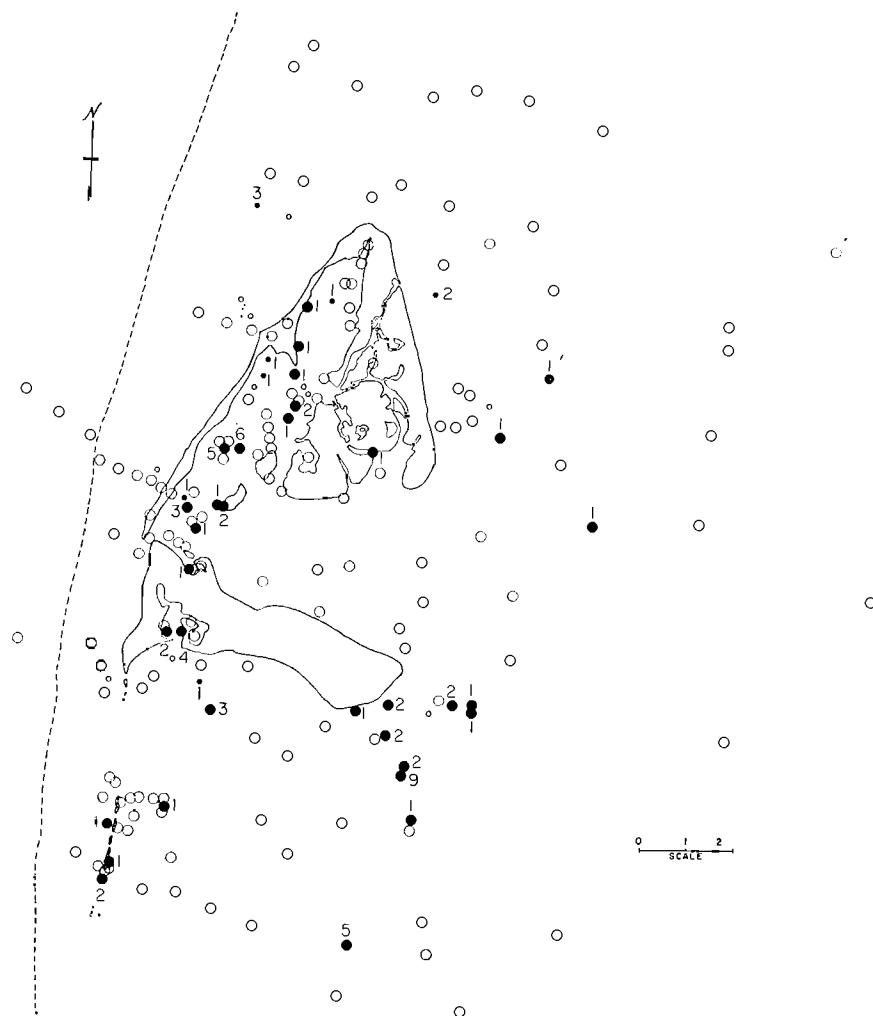


FIG. 40. Distribution of *Ruiderma dinochelata* Kornicker, new species. Species was absent from samples shown as empty circles. Small circles represent trawl samples; large circles represent spot samples.

one to five meters. Temperatures were about  $29^{\circ}\text{C.}$ , and salinities were about 37 parts per thousand. The bottom consisted of calcareous sand.

Shell measurements (in mm.):

Specimen number	Length	Width	Height
144-1	1.03	0.49	0.73
110F-2 (holotype)	1.36	0.55	0.98

Material: Ten specimens were collected from bottom samples; one specimen (sex not known) was dissected. The furca of a second specimen was examined and found identical to that of first specimen. The holotype is specimen number 110F-2, illustrated on Figure 86, C, G.



## Family Asteropidae

Genus *Asteropina* Strand*Asteropina mulleri* (Skogsberg)

(Figs. 60, A-F; 61, A-F; 87, A, D, G)

*Cylindroleberis teres* G. W. Mueller, 1894, Fauna Neapel, Monogr. Vol. 21, P. 220, Pl. IV, Figs. 13, 30, 43; Pl. V, Figs. 15, 24, 25; Pl. VIII, Fig. 5.

*Asterope mulleri* Skogsberg, 1920, Uppsala Universitat, Zool. Bidr. Uppsala, Suppl. Ed. 1, PP. 483-491, Fig. LXXXIX; Klie, 1940, Kieler Meeresforschungen, Band 3, PP. 409-411, Figs. 7-10.

Diagnosis: The shell is more or less pear shaped, with its greatest height and width behind the middle, but elliptical shells are occasionally encountered with the greatest height and width in the middle. Live shells have characteristic brown markings on the inner surface of the shell which are visible from the outside. These markings fade after death.

## Shell measurements (in mm.):

Specimen number	Length	Width	Height
CP5-1*	1.26	0.49	0.90
CP5-3	1.3	..	0.87
CP5-2*	1.26	0.57	0.89
CPAC-1	1.34	.....	0.93

\* Gravid female.

Remarks: This species is described in considerable detail by Skogsberg (1920). Skogsberg (1920) and Mueller (1894) describe this species as having six claws on the furca. The adults examined by the author (five females) had either five or six furcal claws. One individual contained six on the left lamina and five on the right. The Bimini specimens are slightly smaller than Skogsberg's or Mueller's forms and much smaller than specimens collected by Klie (1940).

Material: Fifty-three specimens were collected in the Bimini area from bottom samples. Seven specimens were dissected; of these three were gravid females, and the sex of the remainder was not determined.

Occurrence: *Asteropina mulleri* was widely distributed in the Bimini area (Fig. 41). It occurred in waters having salinities ranging from about 31 to 39 parts per thousand and temperatures around 29°C. Individuals belonging to this species were adept at agglutinating debris in order to form burrows in which they resided. Occasionally two individuals occupied the same burrow. Mueller (1894, p. 14) noted burrow formation by other members of this genus.

Distribution: Also reported from the English Channel, the Mediterranean Sea, and the coast of German Southwest Africa.

*Asteropina setisparsa* Kornicker, new species

(Figs. 46, 9A-B; 62, A-D; 63, A-D; 64, A-E; 86, L-P)

Diagnosis: The carapace is elongate with almost parallel dorsal and ventral edges.

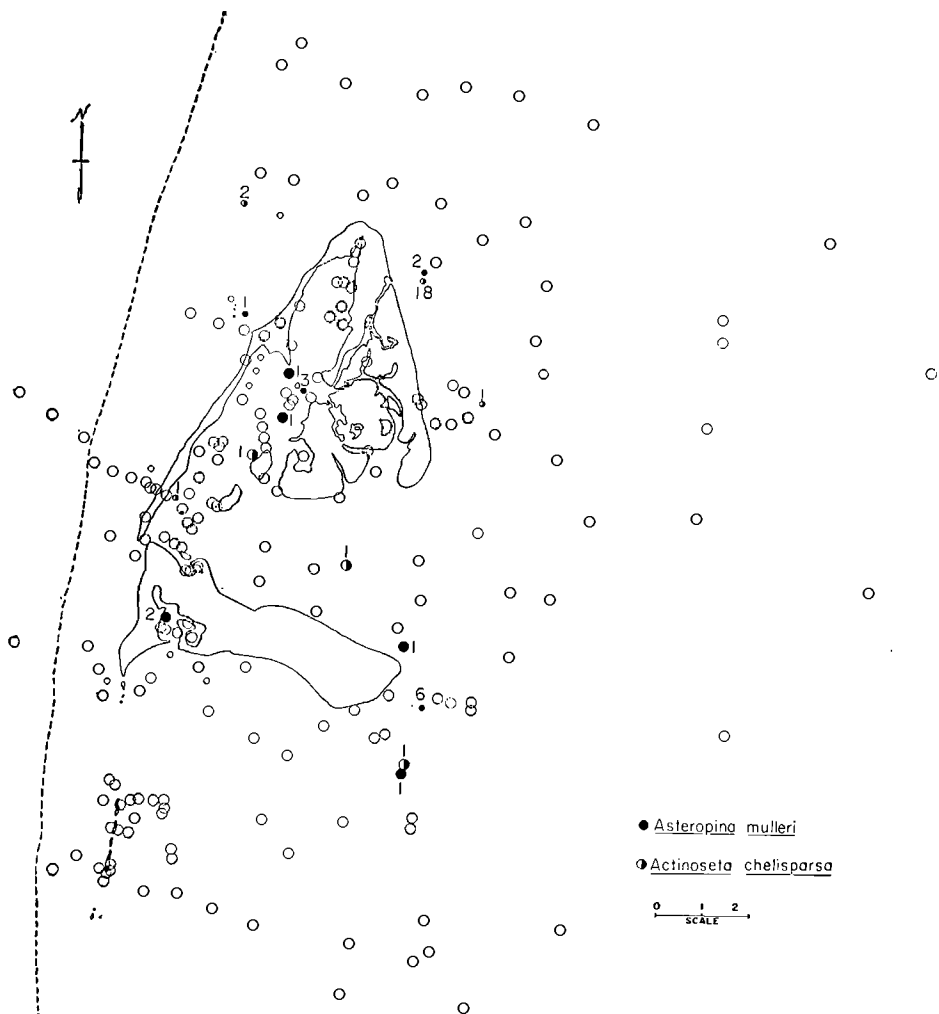


FIG. 41. Distribution of *Asteropina mulleri* (Skogsberg) and *Actinoseta chelisparsa* Kornicker, new species. Species was absent from samples shown as empty circles. Small circles represent trawl samples; large circles represent spot samples.

The postero-ventral corner projects slightly in some individuals; in others the posterior end is evenly rounded. In dorsal view the carapace is slightly wider behind than in front. A narrow slit, the antennal sinus, is present in the lower half of the anterior part of the shell.

The furca contains seven to eight claws. The anterior five claws are sturdier than the last two or three. The seventh limb contains six lateral and six terminal setae. The antero-ventral corner of the sixth limb bears one thick bristle and one or two slender bristles; the ventral edge contains, at most, one bristle and many fine hairs. Two large black eyes are visible through the shell. The male is unknown.

Comparisons: The shell of this species is similar to that of *Asterope mariae* Baird. *A. setisparsa* differs from *A. mariae* in having fewer claws on the furca and in the absence of numerous bristles along the ventral edge of the sixth limb. *A. setisparsa* is also smaller than *A. mariae*.

Shell measurements (in mm.):

Specimen number	Length	Width	Height
48-6	1.45	0.53	0.69
246-3* (holotype)	1.54	.....	0.75
127G	1.5	0.57	0.78
122D-3*	1.52	.....	0.77
141K	1.22	0.47	0.63

\* Gravid female.

Material: Thirty-seven specimens were collected from bottom samples. Three specimens (all female) were dissected. The holotype is specimen number 246-3 illustrated on Fig. 86, L-P.

Occurrence: *Asteropina setisparsa* was abundant east of South Bimini and rare in other areas (Fig. 42). East of South Bimini where this species reached its greatest abundance, the depth of water from which this species was collected ranged from one to five meters and had a temperature of about 29°C. Salinity at this locality was about 37.5 parts per thousand. The bottom was calcareous sand and rock. Patches of *Thalassia* and the algae *Laurencia* grew in this area, but *A. setisparsa* was not restricted to them.

*Asteropina extrachelata* Kornicker, new species

(Figs. 65, A-E; 66, A-E; 87, C, F, I)

Diagnosis: The shell is oval in lateral outline and has a smooth surface; however, small pits may be observed under high magnification. The antennal sinus is a narrow slit just below the center of the anterior edge.

The furca bears five claws followed by four annulated bristles. The penultimate joint of the mandible has a "claw" at about the middle of the anterior edge. Along the ventral edge the sixth limb bears approximately 24 bristles. Two bristles are on the anterior edge, and a total of five bristles are on the antero-ventral corner. Six lateral and six terminal setae are on the seventh limb. Two lateral eyes are present as well as the gill-like organs typical of the genus.

Comparisons: The shell is similar to that of *Asterope abyssicola* Sars. *Asteropina extrachelata* differs from *A. abyssicola* in having fewer setae on the seventh leg. The furca of *A. extrachelata* differs from that of *A. abyssicola*, as well as *Asterope mariae* Baird, in that the last four digits are distinctly annulated bristles, whereas the other two species bear weakly developed claws.

Only one individual of this species was collected. The "claw" on the anterior edge of the penultimate joint of the mandible differentiates this species from all other species of this genus known to the author. For this reason a new species was erected with this minimum of individuals.

Shell measurements (in mm.):

Specimen number	Length	Width	Height
118-1* (holotype)	1.88	.....	1.01

\* Gravid female.

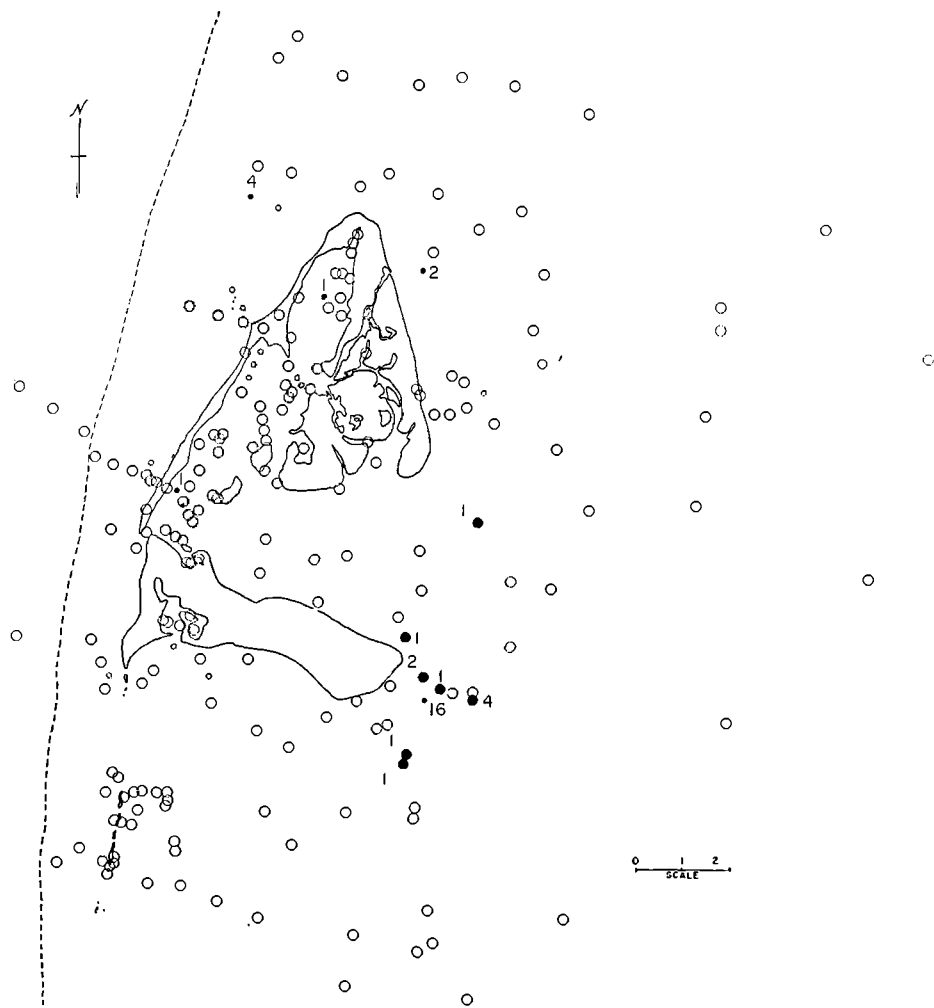


FIG. 42. Distribution of *Asteropina setisparsa* Kornicker, new species. Species absent from samples shown as empty circles. Small circles represent trawl samples; large circles represent spot samples.

Remarks: The individual examined was a female. It contained rosette-like markings on the shell similar to those described by Tressler (1949) on *Cyclasterope sphaerica*. These markings have been observed by the author on some individuals of other species and seem to be due to the decomposition of the soft parts as they are not present on the living animal. A diagram of one of the markings on *A. extrachelata* is presented on Fig. 41, 8c.

Material: One specimen (a female) was collected in a bottom sample. The holotype is specimen number 118-1, illustrated on Fig. 87, C, F, I. Appendages of this specimen are figured on Figs. 65, A-E; and 66, A-E.

Occurrence: The only specimen of *Asteropina extrachelata* collected came from the eastern section of Cavelle Pond, South Bimini. The sediment there gave off an odor of hydrogen sulfide and supported an abundant growth of the algae *Laurencia*.

Genus *Cycloberis* Skogsberg*Cycloberis biminiensis* Kornicker, new species

(Figs. 67, A-D; 68, A-F; 85, A-E)

**Diagnosis:** The shell is oval in lateral outline and only slightly longer than high. An antennal sinus is approximately in the middle of the anterior edge. A distinct muscle scar of rosette form is visible near the center of the shell. Lateral eyes are situated above the muscle scars.

The furca bears four claws followed by three or four bristles. Between the third and fourth claw is an additional small bristle. The seventh limb bears 23 to 32 setae. Six protuberances are on the anterior edge of the penultimate joint of the first antenna. Otherwise, this limb, as well as the frontal organ, is similar to that of *Cycloberis americana* (Mueller). The male is unknown.

**Comparison:** Many species of *Cycloberis* have a carapace of similar shape. The number and arrangement of claws and bristles on the furca are used for differentiating species. *Cycloberis brevis* (Mueller) is the only species known, other than *C. biminiensis*, whose furca bears four claws; all other known species bear only three claws. *C. biminiensis* differs from *C. brevis* in the presence of a small bristle between the third and fourth furcal claws. *C. brevis* has five to seven bristles following the fourth claw, whereas *C. biminiensis* has only three or four.

## Shell measurements (in mm.):

Specimen number	Length	Width	Height
177-1 (holotype)	1.8	0.74	1.4
177-2	1.5	.....	1.1
156-1	1.8	0.9	1.3

**Material:** Seven specimens were collected from bottom samples. Of these specimens three (?females) were dissected, and the caudal furca of two additional specimens examined. The holotype is specimen number 177-1, illustrated on Figs. 85, A-B; 67, A-C, and 68, A-B, D-E.

**Occurrence:** *Cycloberis biminiensis* was collected in waters ranging in depth from three to 10 meters with temperatures around 20° C. (Fig. 37). The salinity was about 37 parts per thousand.

*Actinoseta* Kornicker, new genusType species: *Actinoseta chelisparsa* Kornicker, new species

**Diagnosis:** The shell is strongly calcified, densely pitted, and appears imbricate in dorsal view. In the type species the shell is almost oval in lateral view and contains a shallow antennal sinus.

The natatory bristles of the second antenna bear spines on the distal half; basal spines are not present. The posterior appendage of the second antenna bears numerous spines on the first and second joints. The seventh limb has abundant pinnately arranged setae. The furca bears three (always?) sturdy, medium-length claws with fine hairs at the base. Following these claws are a few weak non-annulated setae.

**Comparisons:** *Actinoseta* is closely related to *Cyclasterope* Skogsberg and *Asterop-*

*teron* Skogsberg and possesses some of the diagnostic morphological features of both genera. *Actinoseta* differs from *Cyclasterope* in not having powerful basal spines on the second antenna and in having only a few furcal bristles. It differs from *Asteropteron* in having spines on the natatory setae on the second antenna and in possessing numerous setae on the seventh limb.

*Actinoseta chelisarsa* Kornicker, new genus, new species  
(Figs. 46, 10A-B; 43, A-L; 69, A-F; 70, A-I; 89, H-J, P, Q)

**Diagnosis:** The shell is almost oval in lateral view, with a shallow antennal sinus and small rostrum. The surface of the shell is densely pitted and appears imbricate in dorsal view. Three or four faint protuberances are present in the postero-dorsal corner paralleling the margin. These are not always apparent and are absent on some specimens.

The furca bears three strong claws. At the base of the second and third claws are numerous fine hairs. Occasionally these are also found between the first and second claws. In the posterior corner of the furca are three short, slender bristles. The seventh limb contains about 46 setae which are on about the distal 22 segments; two setae are attached to each segment. The second joint of the posterior appendage of the second antenna bears eight lateral setae. The male is not known. Considerable change in appendage morphology takes place during ontogeny (Fig. 43).

Shell measurements (in mm.):

Specimen number	Length	Width	Height
60-1	1.68	0.92	1.19
CP52-19	0.95	.....	0.73
CP52-16	0.83	.....	0.63
CP52-6*	2.47	.....	1.95
CP38-2* (holotype)	2.42	1.29	1.92
5216B	2.0	.....	1.55
CP52-24	0.61	.....	0.46
CP38-7	0.83	.....	0.71
246-2	0.99	0.55	0.78

\* Gravid female.

**Material:** Thirty-two specimens were collected from bottom samples. Six specimens (all females) were dissected for comparison. Many others were partially dissected during identification. The holotype is specimen number CP38-2, illustrated on Figs. 43, A-L; 69, A-F; 70, B-D, F-I; 89, I, Q.

**Occurrence:** *Actinoseta chelisarsa* was found in waters three to 15 meters in depth

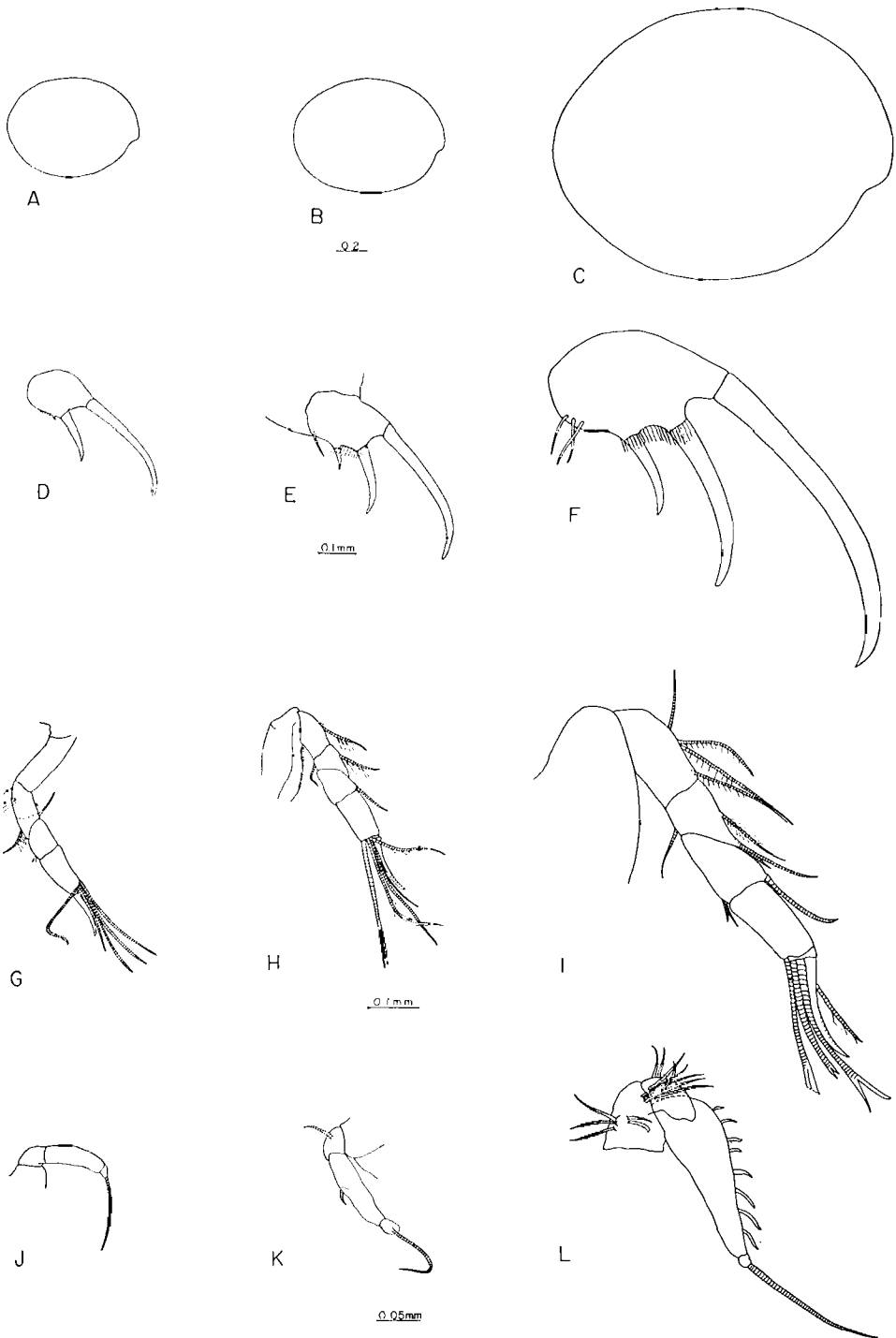
FIG. 43  
Ontogenetic stages in female of *Actinoseta chelisarsa*.

A, D, G, J. Young instar: A, carapace; D, Furca; G, First antenna; J, Posterior appendage of second antenna. Specimen number CP52-16.

B, E, H, K. Immature instar: B, carapace; E, Furca; H, First antenna; K, Posterior appendage of second antenna. Specimen number CP52-19.

C, F, I, L. Mature female: C, carapace; F, Furca; I, First antenna; L, Posterior appendage of second antenna. Specimen number CP38-2.

Figures with similar magnification: A, B, C; D, E, F; G, H, I; J, K, L.



(Fig. 41). Salinity was about 37 parts per thousand and temperature about 29°C. This species was common in Cavelle Pond where salinities as low as 31.5 parts per thousand were recorded.

Genus *Asteropteron* Skogsberg

*Asteropteron monambon* Kornicker, new species

(Figs. 46, 11A-B; 71, A-G; 72, A-D; 86, D, H, K)

Diagnosis: The shell is elliptical in lateral view, with a shallow antennal sinus slightly below the middle of the ventral margin. The width of the shell increases gradually from the anterior margin to a point about one-fourth of the shell length from the posterior margin and then decreases rapidly so that in dorsal view the carapace resembles the head of an arrow. A raised border parallels the shell's outer edge except at the postero-dorsal corner, where the border forms two or three nodes. These are more distinct on some individuals than on others. A more or less horizontal slightly raised ridge extends from the anterior border, at a point directly behind the antennal sinus, to the posterior portion of the carapace, dying out before reaching the posterior border. In the center of the shell this ridge expands and encloses about 15 reticulations. The surface of the shell is punctate.

The furca is elongate and bears three main claws followed by four smaller secondary claws. The second antenna does not contain basal spines. Natatory bristles of the second antenna also lack spines. The ultimate joint of the secondary branch of the second antenna is covered with fine hairs. The seventh limb bears 16 setae. The terminal part of the seventh limb resembles the "aristotle lantern" of an echinoid. Lateral eyes are not readily visible through the shell. The male is unknown.

Comparisons: *A. monambon* is closely related to *Asteropteron agassizi* (Fr. Mueller) and *Asteropteron fusca* (G. W. Mueller). It is readily distinguished from these two species by the character of the carapace sculpture; viz., the border of *A. monambon* is continuous, and a horizontal ridge approximately bisects the carapace, whereas, the border of *A. agassizi* is discontinuous, and the horizontal ridge runs below the center. The border of *A. fusca* is also discontinuous.

Shell measurements (in mm.):

Specimen number	Length	Width	Height
113G (holotype)	1.25	0.63	0.90
243-1	1.14	0.58	0.83
CP38-1	0.93	.....	0.67
CP52-4	1.52	.....	1.04
91	0.66	.....	0.5
119C	0.61	.....	0.48

Material: Thirty-four specimens were collected from bottom samples. Three specimens (? females) were dissected. The holotype, specimen number 113G, is illustrated on Fig. 46, 11a-b.

Occurrence: *Asteropteron monambon* was fairly uniformly distributed in the Bimini area (Fig. 44). Specimens were collected in waters ranging in salinity from 31.5 to 42 parts per thousand, and in depth from three to about 20 meters. Temperature was about 29°C.



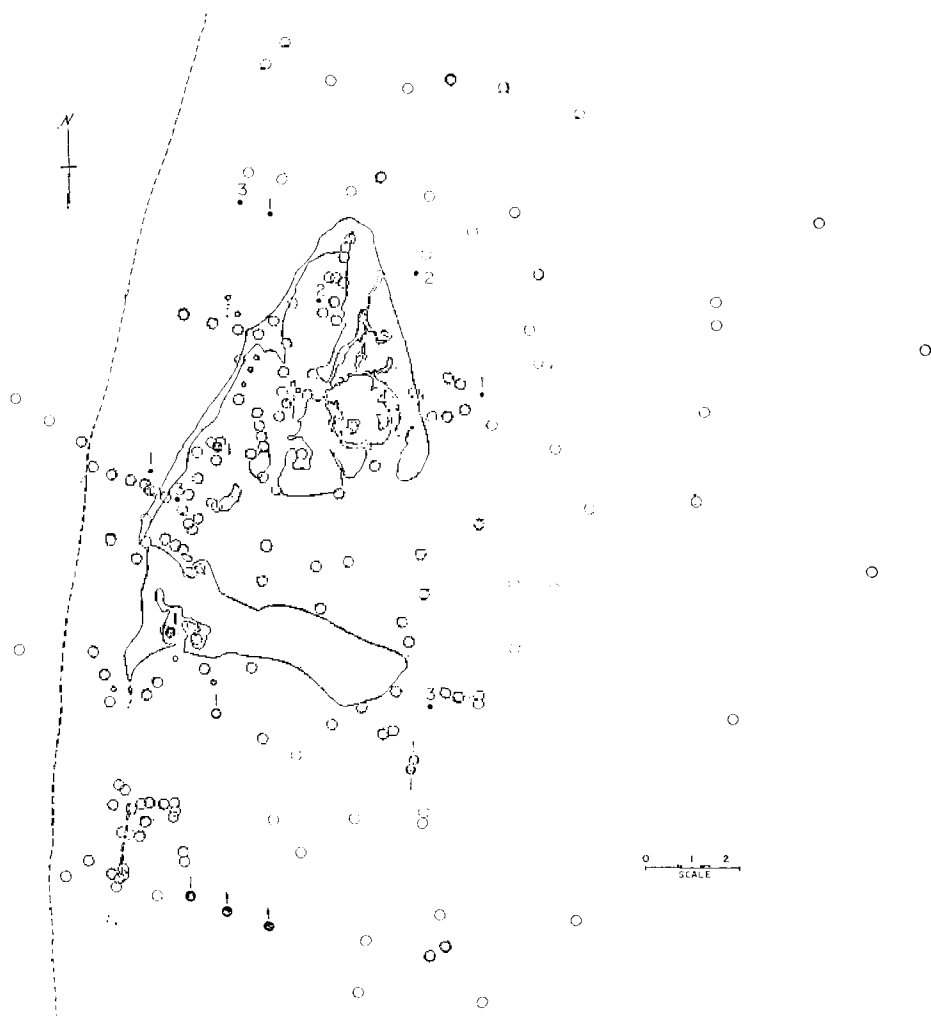


FIG. 44. Distribution of *Asteropteron monambon* Kornicker, new species. Species was absent from samples shown as empty circles. Small circles represent trawl samples; large circles represent spot samples.

#### Family Sarsiellidae

##### Genus *Sarsiella* Norman

##### *Sarsiella carinata* A. Scott

(Figs. 47, 5A-B; 73, A-G; 74, A-F; 75, A-D; 88, J, N, R; 89, E)

*Sarsiella carinata* A. Scott, 1905, Rep. Ceylon Pearl Fisheries, Suppl. Rep, 22, P. 368, Fig. 1, 1-2; Fig. 2, 40-41.

Diagnosis: The male shell has a prominent rostrum and a shallow sinus. Two longitudinal ribs fringed with short hairs terminate in protuberances posteriorly. A series of hair-covered nodes parallels the ventral margin.

The male furca bears five claws, which increase in length distally. The seventh limb of the male has two lateral and four terminal bristles, and the distal end is closed. The first antenna bears a brush-like sensory organ.

The female shell has ornamentation quite similar to that of the male which differs in having no antennal sinus. Shells of mature females contain marginal radial furrows. The female shell varies in shape and would be difficult to differentiate from other sarsiellids were it not for short stiff hairs which always cover the shells of this species and which are easily visible under high magnification. These hairs are abundant along the horizontal riblets which ornament the shell and around the numerous protuberances along the ventral and dorsal portions of the shell. The horizontal riblets occur, especially on immature individuals, as a series of disconnected protuberances.

The female furca bears five claws followed by two short "points." The seventh limb of the female contains six terminal and two lateral spines; the distal end of the seventh limb is open and bears "teeth." An immature female had only two lateral and two terminal setae on the seventh limb and possessed a closed distal end similar to that of the male.

Comparisons: The female of *S. carinata* resembles *Sarsiella globulus* Brady (Brady and Norman, 1896, Fig. 60, 5-7) from which it differs in having numerous surface protuberances which are covered by short stiff hairs and in possessing fewer spines on the seventh limb. *S. carinata* does not resemble the type species of *S. globulus* (Brady, 1881-1886, Fig. 15, 8-9).

Shell measurements (in mm.):

Specimen number	Length	Width	Height	Sex
686-X2	1.42	0.67	1.12	Female
CP38-5	1.28	.....	0.86	Female
CP38-13	1.48	....	1.14	Female
CP52-23	1.18	.....	0.68	Male

Remarks: Females of this species have not previously been reported.

Material: Seventy-eight specimens were collected from bottom samples. Eight males were among the collected specimens. Three individuals were dissected.

Occurrence: *Sarsiella carinata* was the most abundant species of the genus *Sarsiella* in the Bimini area. It was especially abundant in North Bimini harbor in front of the Lerner Marine Laboratory. Specimens were collected in water ranging in depth from one to 20 meters, and in salinity from 31.5 to about 38 parts per thousand. Temperature was about 29°C. Areal distribution of the family Sarsiellidae is shown in Fig. 45.

Distribution: This species has been reported from near Ceylon (A. Scott, 1905).

*Sarsiella capillaris* Kornicker, new species  
(Figs. 47, 7A-B; 76, A-F and H; 89, A, B, D, F, O)

Diagnosis: The shell is subcircular in side view, with a posterior projection. Numerous protuberances are present on the surface of the shell. A long hair, which is annulated and becomes wider at about two-thirds of the distance from its proximal end, projects from the apex of each protuberance. Surrounding the base of the long hair are many shorter hairs which may have bulbous tips. The posterior projection of the shell bears many long and short hairs similar to those on the protuberances.

The furca bears five claws followed by several "points." The seventh limb contains four terminal and two lateral setae. The balance of the appendages are typical of the genus. The male is not known.

Comparisons: *Sarsiella capillaris* is difficult to differentiate from some individuals of

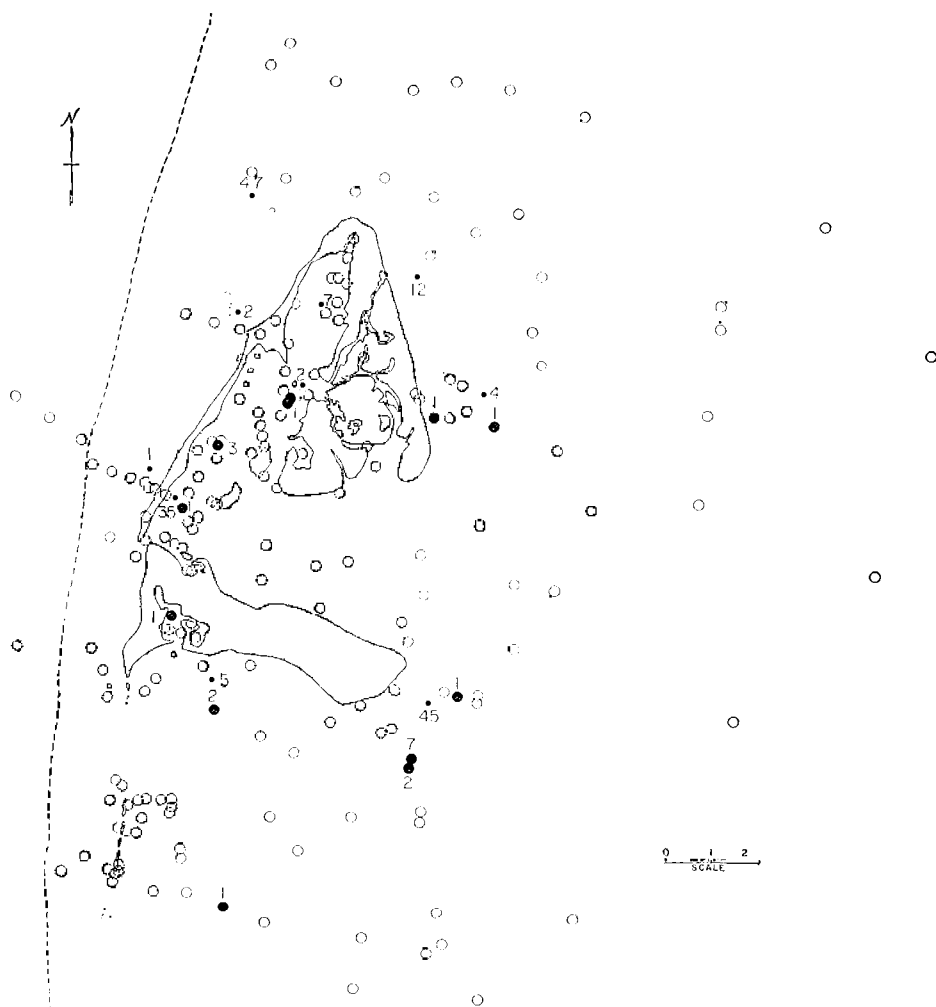


FIG. 45. Distribution of the family Sarsiellidae. Genus was absent from samples shown as empty circles. Small circles represent trawl samples; large circles represent spot samples.

*Sarsiella carinata* Scott, and especially from immature forms of that species. The presence of short stiff surface hairs on *S. carinata* permits differentiation from *S. capillaris* whose surface hairs are slightly longer and appear to be more pliable. Examination of surface hairs is best accomplished under high magnification. *S. capillaris* also differs from *S. carinata* in having fewer terminal spines on the seventh limb.

Shell measurements (in mm.):

Specimen number	Length	Width	Height	Sex
92-1 (holotype)	1.15	0.56	1.15	Female
CP38-10	1.1	...	0.81	Female
CP52-15	0.82	.....	0.66	Female
1117C-3	0.65	.....	0.49	Female

Material: Fifteen specimens were collected from bottom samples. One ostracode was

completely dissected and several others partially dissected. The holotype is specimen number 92-1, illustrated on Fig. 47, 7a-b.

Occurrence: *Sarsiella capillaris* was found in waters ranging in depth from two to 20 meters, and in salinity from 31.5 to about 37.5 parts per thousand.

*Sarsiella gigacantha* Kornicker, new species

(Figs. 47, 8A-B; 76; 77, A-E; 88, A F, H, I)

Diagnosis: The carapace is sub-oval in outline, with the posterior truncate. The male has a rostrum and surface riblets. A prominent spine occurs in the postero-dorsal part of the shell of both sexes.

The caudal lamina bears five strong elaws followed by several small "points." The seventh limb of the female contains four terminal and 11 lateral setae.

Comparisons: The postero-dorsal spine on the carapace and the numerous spines on the seventh limb distinguishes *S. gigacantha* from previously described ostracodes of the genus *Sarsiella*.

Shell measurements (in mm.):

Specimen number	Length	Width	Height	Sex
190-1A (holotype)	1.37	0.75	1.14	Female
122D-2	1.3	—	0.85	Male

Material: Forty-seven specimens were collected in bottom samples. Three specimens were males. Two ostracodes were dissected. The holotype is specimen number 190-1A, illustrated in Fig. 47, 8a-b.

Occurrence: *Sarsiella gigacantha* was found in waters ranging in depth from one to 20 meters, and in salinity from 31.5 to about 38 parts per thousand. Temperature was about 29°C.

*Sarsiella truncana* Kornicker, new species

(Figs. 78, A-E; 88, Q; 89, C)

Diagnosis: The shell is elliptical in lateral view, except for the truncate posterior. A shallow sulcus separates the slightly inflated postero-dorsal part of the carapace from the anterior part. The surface of the shell is covered with short hairs and minute punctae. The furca bears five to seven claws. The seventh limb contains six terminal and four lateral spines. The male is not known.

Comparisons: The shell of *S. truncana* does not resemble any previously described species.

Shell measurements (in mm.):

Specimen number	Length	Width	Height	Sex
CP52-21 (holotype)	1.3	0.69	1.13	Female*
CP38-5	0.8	—	0.67	Female
CP38-6	0.41	0.18	0.35	Female
246-3	1.36	—	1.3	Female*
121D-5	1.01	—	0.92	Female*

\* Gravid.

Material: Fifty-four specimens were collected from bottom samples. Two specimens were dissected. The holotype is specimen number CP52-21, illustrated on Fig. 83, Q; 89, C. Appendages from this specimen are figured on Fig. 78, A, B, D.

Occurrence: *Sarsiella truncana* was abundant east of South Bimini and in North Bimini harbor. Specimens were found in waters ranging in depth from one to 20 meters, and in salinity from 31.5 to about 38 parts per thousand. Temperature was about 29°C.

*Sarsiella punctata* Kornicker, new species

(Figs. 47, 3A-B; 79, A-I; 83, L, P, M)

Diagnosis: The shell is sub-oval, with posterior truncated. A shallow sulcus extends from the center of the dorsal edge almost to the posterior margin. The surface of the shell is distinctly punctate and without hairs. The furca bears five claws. The seventh limb of the female contains six terminal and four lateral setae. The male has a slight rostrum and two faint horizontal riblets in the posterior part of the shell.

Comparisons: *Sarsiella punctata* differs from *Sarsiella truncana* Kornicker in the absence of surface hairs and in having large punctae. *S. punctata* differs from *Sarsiella gracilis* Scott in not having setae or spines combined with claws on the furca. *Sarsiella crispata* Scott differs from *S. punctata* in having only four furcal claws. *S. punctata* differs from *Sarsiella murrayana* T. Scott in having terminal "teeth" and more setae on the seventh limb.

Shell measurements (in mm.):

Specimen number	Length	Width	Height	Sex
82-1 (holotype)	1.1	0.53	0.81	Female
246-6	0.97	—	0.69	Female
119A-1	0.98	0.57	0.77	Male
CP38-4	1.26	—	1.02	Female
CP38-9	1.04	—	1.0	Female

Material: Nineteen specimens were collected from bottom samples. Two males were among the specimens collected. One male and one female were dissected. The holotype is specimen number 82-1, illustrated on Fig. 47, 3a-b.

Occurrence: *Sarsiella punctata* was common in Cavelle Pond and in North Bimini harbor. Specimens were found in waters which ranged in depth from one to five meters, and in salinity from 31.5 to about 38 parts per thousand. The water temperature was about 29°C.

*Sarsiella costata* Kornicker, new species

(Figs. 47, 4A-B; 80, A-E; 81, A-E; 88, B, C, G)

Diagnosis: The shell is sub-oval in lateral view, with a truncated posterior. The surface of the shell is punctate. Surface ribs diverge from the postero-dorsal corner of the carapace and meet ventrally. A horizontal, anteriorly directed riblet branches from the lower rib in the postero-ventral quarter of the carapace. The male has a prominent rostrum and surface rib distribution similar to that of the female.

The furca bears five claws followed by two "points." The seventh leg of the mature female contains six terminal and four lateral setae.

Comparisons: The surface rib pattern differentiates *Sarsiella costata* from previously described species of the genus *Sarsiella*.

Shell measurements (in mm.):

Specimen number	Length	Width	Height	Sex
156-2 (holotype)	1.02	0.58	0.79	Female
CP52-7	0.97	—	0.61	Male
CP38-8	0.73	0.26	0.47	Female
CP38-16	1.14	—	0.84	Female

Material: Forty specimens were collected from bottom samples. Only one male was among those collected. Three specimens were dissected. The holotype is specimen number 156-2 and is illustrated in Fig. 88, C, G and Fig. 47, 4a-b.

Occurrence: *Sarsiella costata* was especially abundant east of South Bimini. Many specimens were also found in Cavelle Pond. The depth of water from which this species was collected ranged from one to five meters, with a salinity ranging from 31.6 to 12 parts per thousand. Temperature was about 29°C.

*Sarsiella sculpta* Brady

(Figs. 47, 6A-B; 82, D, E; 88, D, K, E, O, S)

*Sarsiella sculpta* Brady, 1890, Trans. Roy. Soc. Edinb., Vol. 35, P. 516, Pl. 1, Figs. 17-20; 1897, Brady, Trans. Zool. Soc. Lond., Vol. 13, P. 93.

Diagnosis: The shell is oval in side view, with a small retral process. The postero-dorsal quarter is globose. Two surface riblets diverge posteriorly; one riblet bisects the globose postero-dorsal quarter. The shell surface is coarsely punctate. Mature individuals have radial riblets along the shell margin.

The furca bears five claws followed by several minute "points." The seventh limb contains six terminal and seven lateral setae. The remaining appendages are typical of the genus.

Comparisons: Brady (1890) in the original description of *Sarsiella sculpta* illustrates two individuals differing considerably in appearance. It is questionable as to whether both individuals belong to the same species. The Bahamian individuals are similar to the first individual illustrated by Brady (Pl. 1, Figs. 17, 18). Brady later (1898) illustrated a caudal furca and the end of a seventh limb obtained from a third specimen of *S. sculpta*; the shell of this specimen was not illustrated. The appendages of the Bahamian forms are similar to those presented by Brady, with the exception of two small spines on the fourth claw of the caudal furca which are not present on the Bahamian specimen examined.

Shell measurements (in mm.):

Specimen number	Length	Width	Height	Sex
127-1	1.65		1.45	Female
177	1.54		1.31	Female*

\* Gravid.

Material: Thirteen specimens (females) were collected in bottom samples. One specimen was dissected.

Occurrence: *Sarsiella sculpta* was collected in waters which ranged in depth from two to 20 meters. Salinity was about 37.5 parts per thousand and temperature was about 29°C.

Distribution: This species has been collected from Numea (dredged in two to four fathoms), Levuka (from between tidemarks), Vuna Point (from between tidemarks), and Flinders Passage (taken in seven fathoms).

*Chelicopia* Kornicker, new genus

Type species: *Chelicopia arostrata* Kornicker, new species

Diagnosis: The shell of the male and female are sub-oval (the male is slightly more elongate than the female). The male and female are without rostrum or sinus. The carapace of the type species is covered by hair.

The furca contains many short and long claws. The first antenna is five-jointed. The secondary appendage of the female second antenna is three-jointed, with spines on each joint. The secondary appendage of the male second antenna is two-jointed, with spines on each joint. The ultimate joint is annulated. Other appendages are similar to those of the genus *Sarsiella*.

Comparisons: *Chelicopia* differs from the genus *Sarsiella* in having small claws between the large claws on the furca and in the absence of a rostrum on the male shell.

*Chelicopia arostrata* Kornicker, new genus, new species

(Figs. 47, 2A-B; 82, A-C; 83, A-D; 84, A-E; 89, G, K-N)

Diagnosis: The shell is sub-oval in lateral view and covered with short hairs. The male is without sinus or rostrum and is slightly longer than the female. Distinct lineated pores parallel the shell margin on the inside.

The first, second, and fourth furcal claws are larger and do not have a line of demarcation at the base. The third and remaining four smaller claws have lines of demarcation at their bases. The secondary appendage of the second antenna of the female is three-jointed (joining indistinct) and has two or three bristles on each joint. The secondary appendage of the male is two-jointed, with the second joint annulated; two bristles are on each joint. The seventh limb contains four terminal and two lateral setae. The remaining appendages are similar to those of the genus *Sarsiella*.

Shell measurements (in mm.):

Specimen number	Length	Width	Height	Sex
91-1 (holotype)	1.06	0.66	0.96	?Female
CP38-16	0.78	—	0.76	?Female
118A-1	0.98	0.51	0.82	Male

Material: Five specimens were collected from bottom samples. Three specimens (two females and one male) were dissected. The holotype is specimen number 91-1, illustrated on Fig. 47, 2a-b.

Occurrence: *Chelicopia arostrata* was found in Cavalle Pond and North Bimini harbor. The waters in which specimens were collected had a salinity range of about 31.5 to 39 parts per thousand. The depth was from one to three meters, and the temperature about 29°C.

## Summary and Conclusions

This paper describes a study of the relationship of living and dead ostracodes to the substrate, salinity and other factors in the diverse environments around Bimini.

1. Evidence was found indicating that substrate, salinity, and current velocity affected distribution of ostracodes. Dissolved oxygen, pH, water color, organic detritus, organic content of the sediment, water depth, and daily temperature variation had little effect in the Bimini area. Several species of *Myodocopa* were found to be positively responsive to light.

2. Living *Myodocopa* were abundant, but empty carapaces were not found in the sediment possibly because of the low calcium carbonate content of the carapaces of individuals in this suborder. Common species belonging to the suborders *Podocopa* and *Platycopa* found as empty carapaces in the sediment were also collected alive in the Bimini vicinity except in the North Sound and Cavelle Pond areas where certain podocopid species occurred commonly as empty carapaces but were not found alive.

3. Brackish water ostracode remains were abundant in the sediment of Cavelle Pond, but only normal marine forms were collected alive in the pond. This is interpreted as indicating that the pond had previously contained brackish water. This interpretation is supported by the fact that a pass connecting Cavelle Pond to the sea is of recent origin.

The occurrence of the relict faunal remains in the sediment of Cavelle Pond suggests that the numerous investigations being carried out today in which animal remains are being correlated with existing environments should be supplemented with a study of the living animal distribution.

4. The sediments containing the largest number of dead ostracodes did not occur in areas containing the largest number of living ostracodes. Empty ostracode carapaces were most abundant in areas where the salinity of the water was either high, low, or extremely variable. Lack of dilution by calcareous remains of other organisms is advanced as the reason for high concentration of empty carapaces in these areas.

5. The evidence in the Bimini area indicates that, in general, remains of the suborders *Podocopa* and *Platycopa* found in sediment reflect the kinds but not the absolute numbers of ostracodes of these suborders which were living in the area, and that the suborder *Myodocopa* was probably more widespread in the past than is indicated by its poor representation in the fossil record.

6. Ostracodes were differentiated taxonomically on the basis of appendage morphology as well as shell structure. Appendage morphology is especially important for differentiation of the suborder *Myodocopa* which was represented in Bimini waters by 10 genera, two of which are new (*Actinoseta* and *Chelicopia*), and 19 species, including 14 new species and one new subspecies.

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## Appendix

### Diagrams and Photographs of Ostracode Morphology

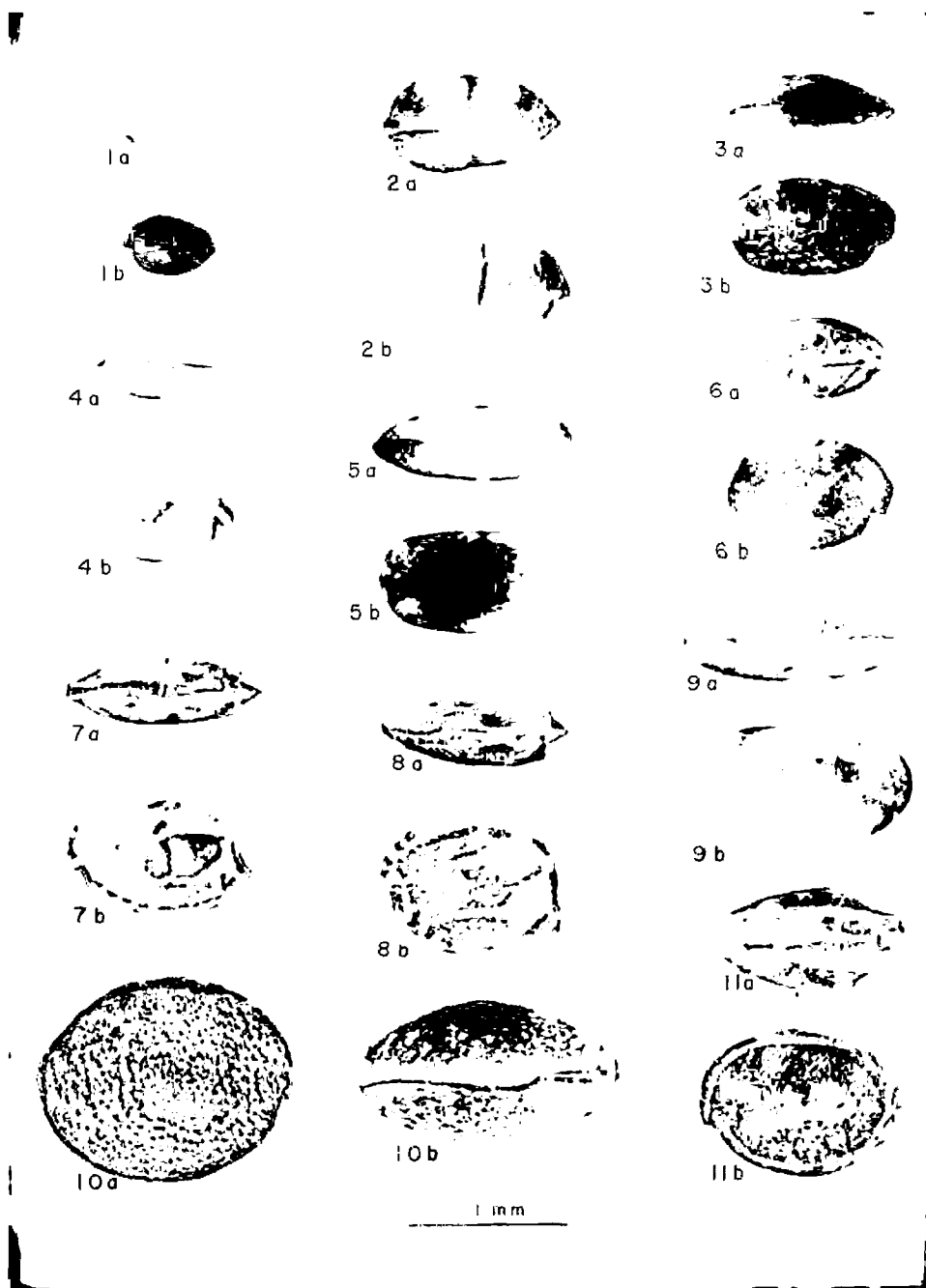


FIG. 46.

- 1a-b. *Pseudophilomedes ferulana* Kornicker, new species, immature instar. 1a. Dorsal view; 1b. Side view. No. 93-1.  
 2a-2. *Pseudophilomedes ferulana* Kornicker, new species. 2a. Dorsal view; 2b. Side view. No. 165-1.  
 3a-b. *Philomedes multichelata* Kornicker, new species. 3a. Dorsal view; 3b. Side view. No. 686Z-6.  
 4a-b. *Philomedes paucichelata* Kornicker, new species. 4a. Dorsal view; 4b. Side view. No. 287-1.  
 5a-b. *Asteropina setisparsa* Kornicker, new species. 5a. Dorsal view; 5b. Side view. No. 141K.  
 6a-b. *Rutiderma polychelata* Kornicker, new species. 6a. Dorsal view; 6b. Side view. No. 144-1.  
 7a-b. *Philomedes lomae* (Juday). 7a. Dorsal view; 7b. Side view. No. 115-C1.  
 8a-b. *Rutiderma dinochelata* Kornicker, new species. 8a. Dorsal view; 8b. Side view. No. 57-1.  
 9a-b. *Asteropina setisparsa* Kornicker, new species. 9a. Dorsal view; 9b. Side view. No. 43-6.  
 10a-b. *Actinoseta chelisparsa* Kornicker, new species. 10a. Side view; 10b. Dorsal view. No. 60-1.  
 11a-b. *Asteropteron monambon* Kornicker, new species. 11a. Dorsal view; 11b. Side view. No. 113G.

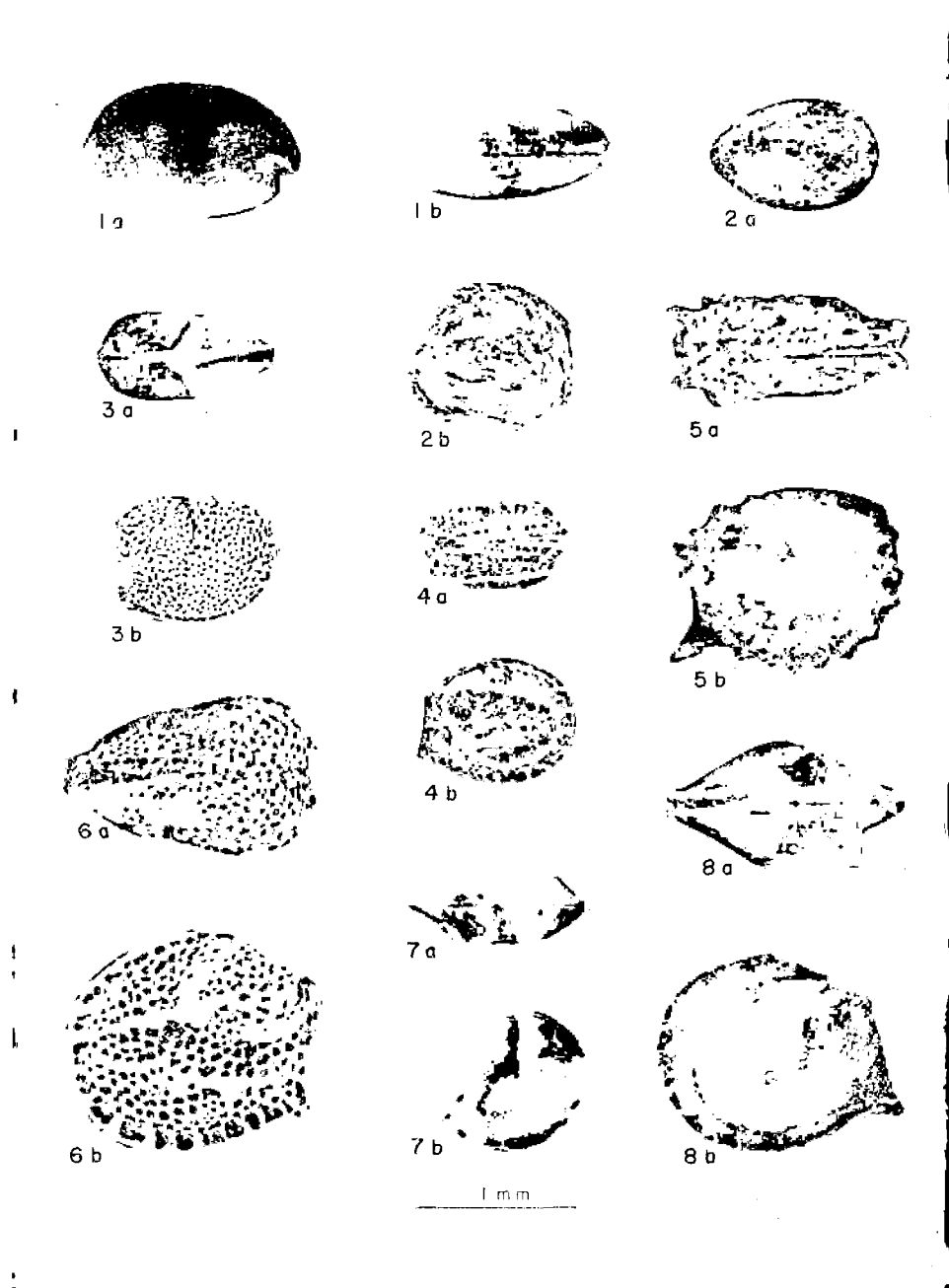


FIG. 47.

- 1a-b. *Cypridina squamosa leneri* Kornicker, new subspecies. 1a. Side view; 1b. Dorsal view. No. 212-1.  
 2a-b. *Chelicopia arostrata* Kornicker, new species. 2a. Dorsal view; 2b. Side view. No. 91-1.  
 3a-b. *Sarsiella punctata* Kornicker, new species, female. 3a. Dorsal view; 3b. Side view. No. 82-1.  
 4a-b. *Sarsiella costata* Kornicker, new species, female. 4a. Dorsal view; 4b. Side view. No. 156-2.  
 5a-b. *Sarsiella carinata* A. Scott, female. 5a. Dorsal view; 5b. Side view. No. 686X-2.  
 6a-b. *Sarsiella sculpta* Brady, female. 6a. Dorsal view; 6b. Side view. No. 127 1.  
 7a-b. *Sarsiella capillaris* Kornicker, new species, female. 7a. Dorsal view; 7b. Side view. No. 92-1.  
 8a-b. *Sarsiella gigacantha* Kornicker, new species, female. 8a. Dorsal view; 8b. Side view. No. 190-1A.

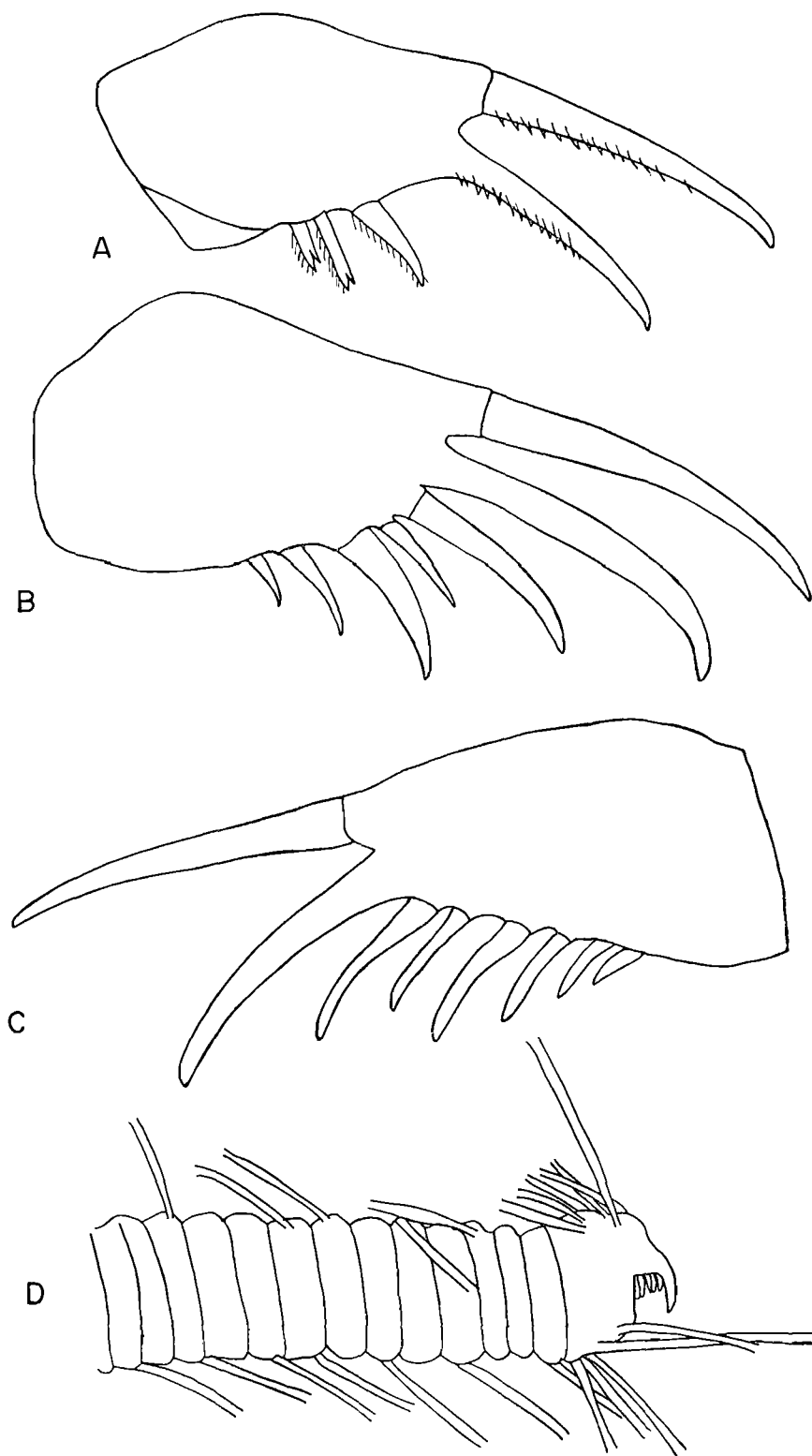


FIG. 48

*Cypridina squamosa lernerii* Kornicker, new subspecies.

- A. Furca. Specimen No. P-1 (juvenile).
- B. Furca. Specimen No. 246-7 (juvenile).
- C. Furca. Specimen No. 247-3 (gravid female).
- D. Seventh limb. Specimen No. 119-1 (mature male).



FIG. 49.

*Cypridina squamosa lernerii* Kornicker, new subspecies.

- A. Portion of maxilla or fifth limb of young instar. Specimen No. P-1 (juvenile).
- B. Mandible of young instar. Specimen No. P-1 (juvenile).
- C. First antenna young instar. Specimen No. P-1 (juvenile).
- D. Secondary branch second antenna. Specimen No. P-1 (juvenile).
- E. Second antenna. Specimen No. P-1 (juvenile).

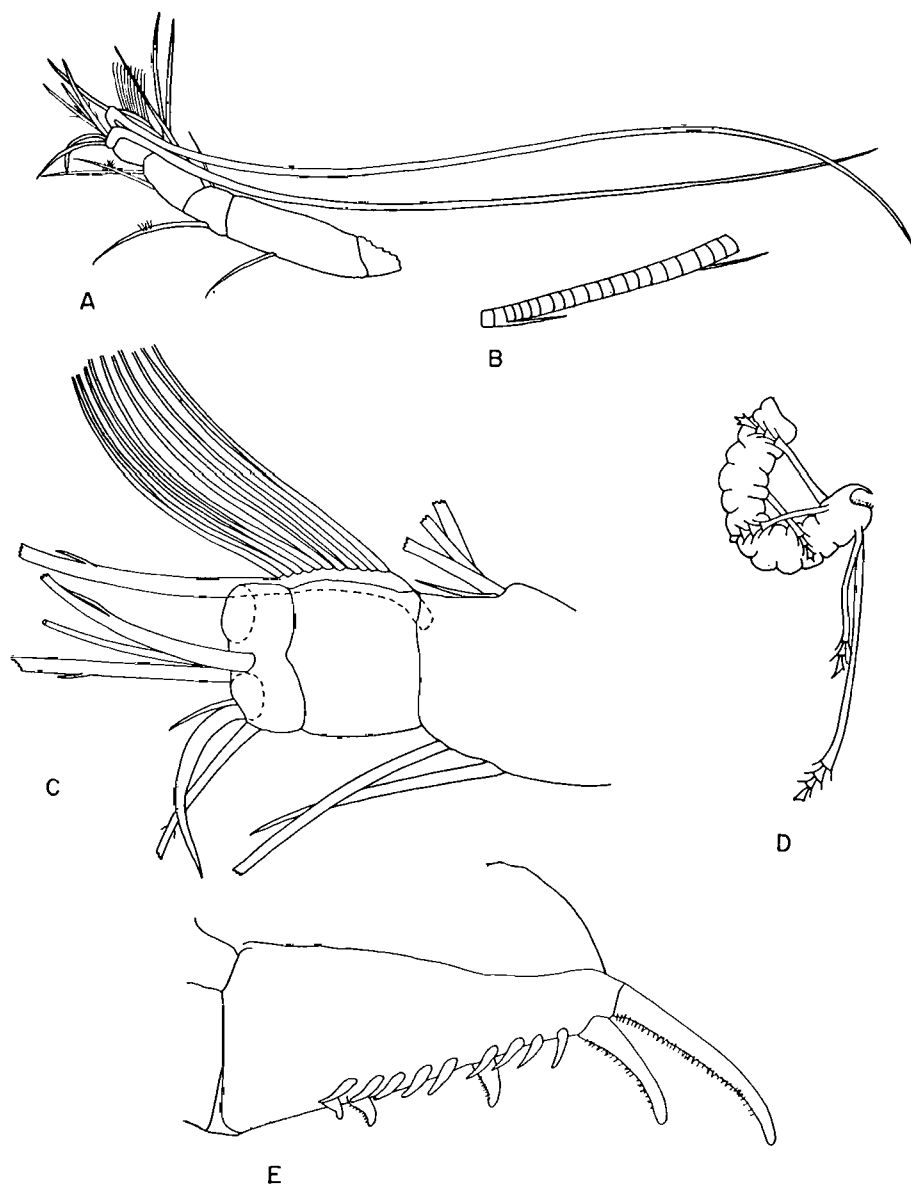


FIG. 50.

*Philomedes multichelata* Kornicker, new species (Male).

- A. First antenna. Specimen No. 686Z-2.
- B. Portion of sensory setae of first antenna enlarged. Specimen No. 686Z-2.
- C. Distal end first antenna; sensory setae not shown. Specimen No. 686Z-2.
- D. Seventh limb. Specimen No. 686Z-3.
- E. Furca. Specimen No. 686Z-4.

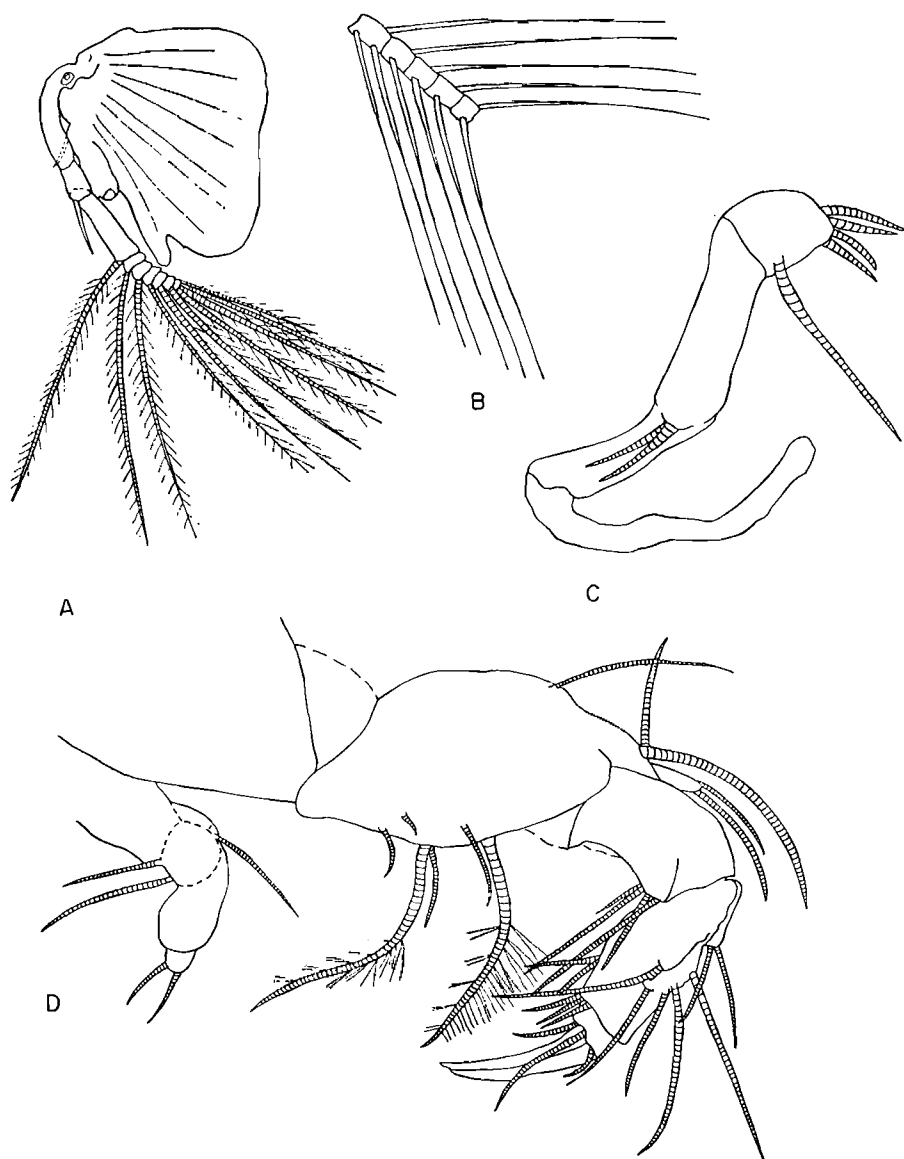


FIG. 51.

*Philomedes multicheluta* Kornicker, new species (Male).

- A. Second antenna. Specimen No. 686Z-2.
- B. Portion of sensory bristle enlarged. Specimen No. 686Z-2.
- C. Secondary branch of second antenna. Specimen No. 686Z-4.
- D. Mandible. Specimen No. 686Z-4.



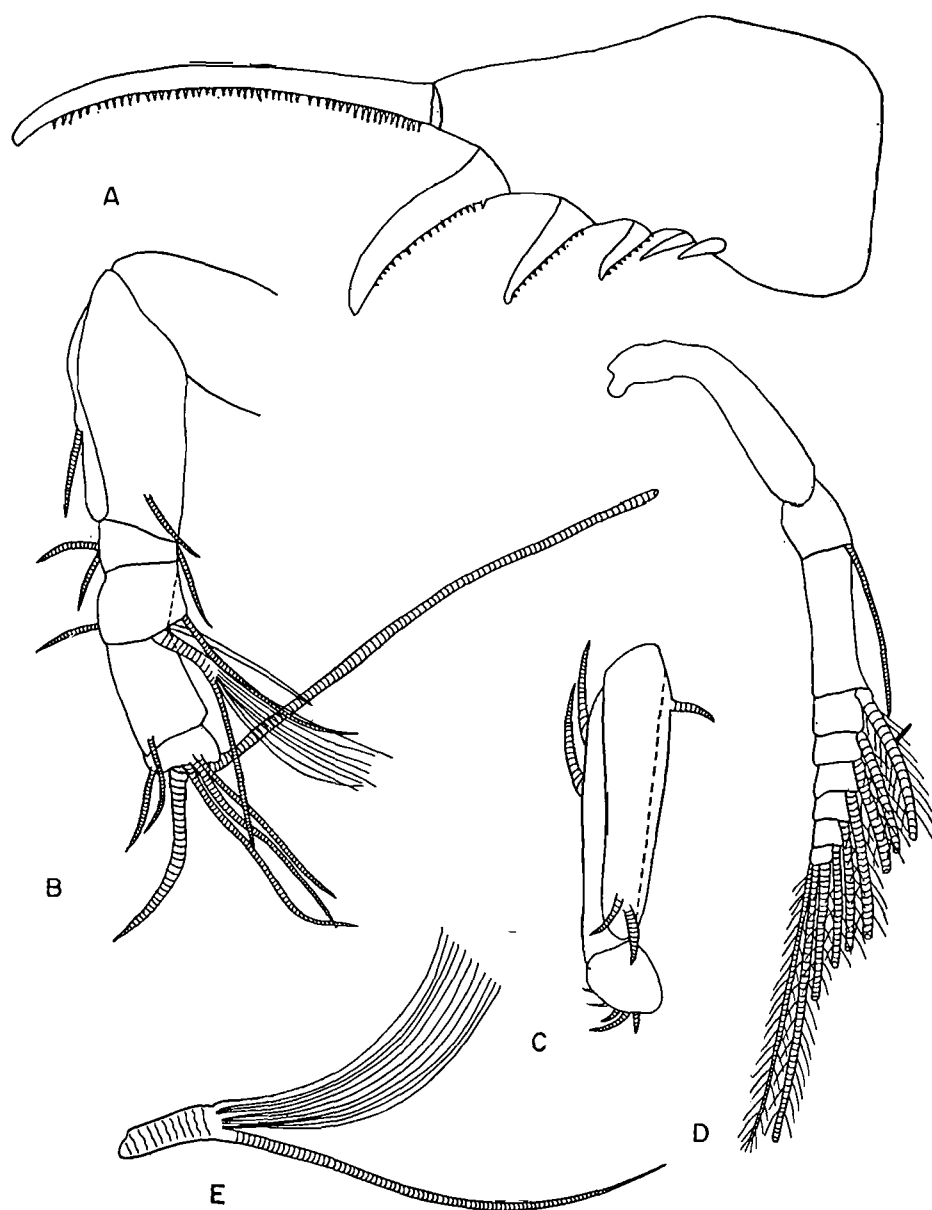


FIG. 52.

*Philomedes lomae* Juday (Male).

- A. Furca. Specimen No. CP52-12.
- B. First antenna. Specimen No. CP52-12.
- C. Secondary branch of second antenna. Specimen No. CP52-12.
- D. Second antenna. Specimen No. CP52-12.
- E. Sensory bristle of first antenna. Specimen No. CP52 12.

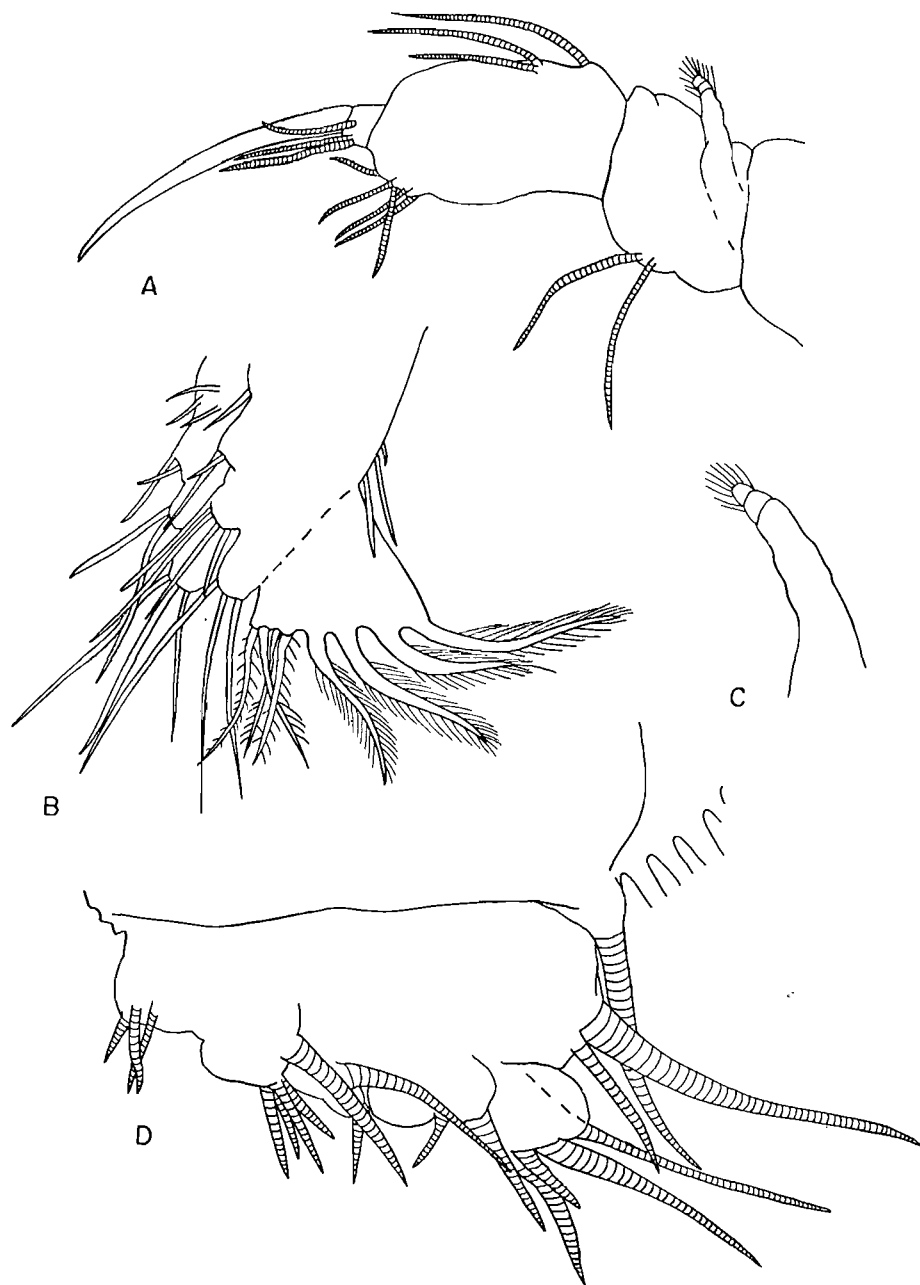


FIG. 53.

*Philomedes lomae* Juday (Male).

- A. Mandible. Specimen No. CP52-12.
- B. Portion of sixth limb. Specimen No. CP52-12.
- C. Sensory appendage on mandible. Specimen No. CP52-12.
- D. Portion of fifth limb. Specimen No. CP52-12.

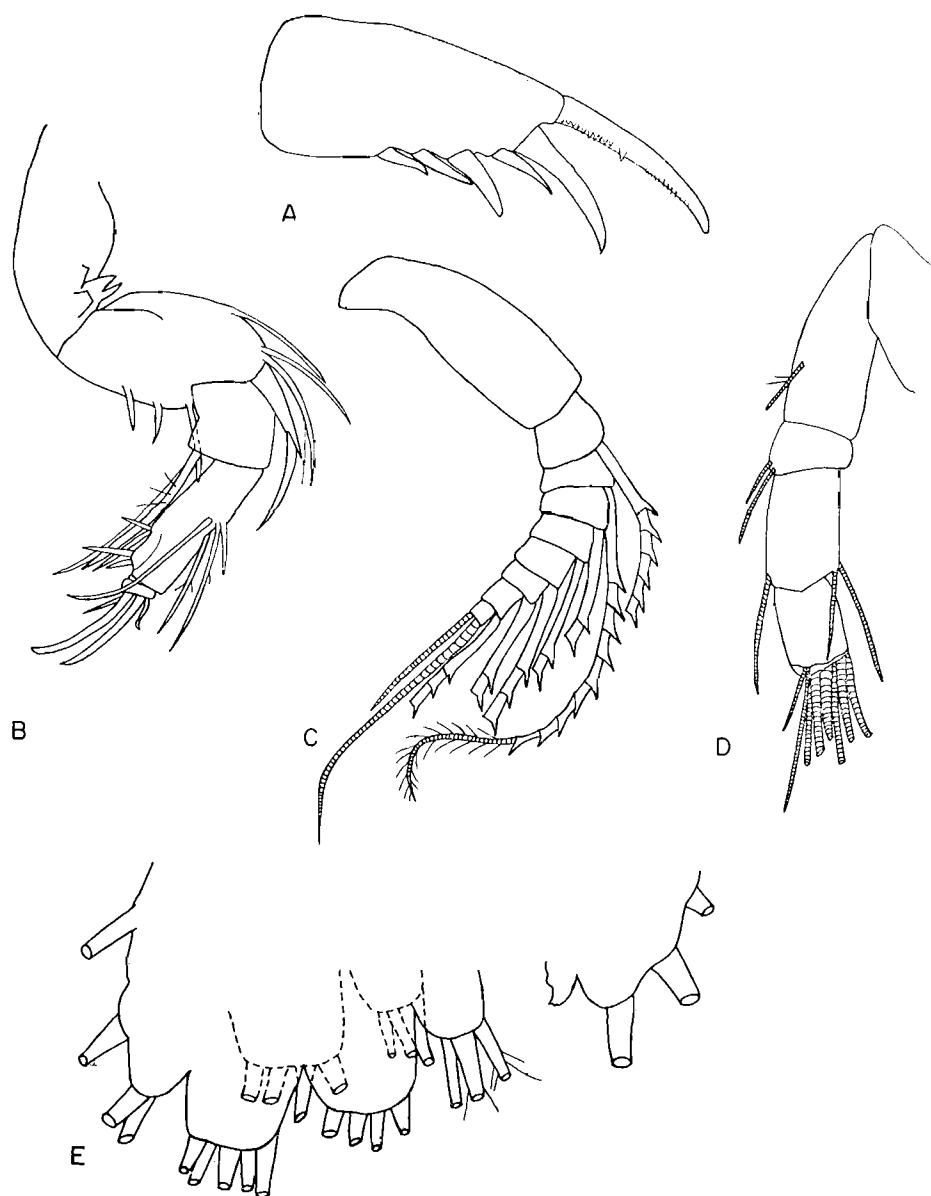


FIG. 54.

*Philomedes paucichelata* Kornicker, new species (Female).

- A. Furca. Specimen No. 156-5.
- B. Mandible. Specimen No. 156-5.
- C. Second antenna. Specimen No. 156-5.
- D. First antenna. Specimen No. 156-5.
- E. Part of sixth leg. Specimen No. 156-5.

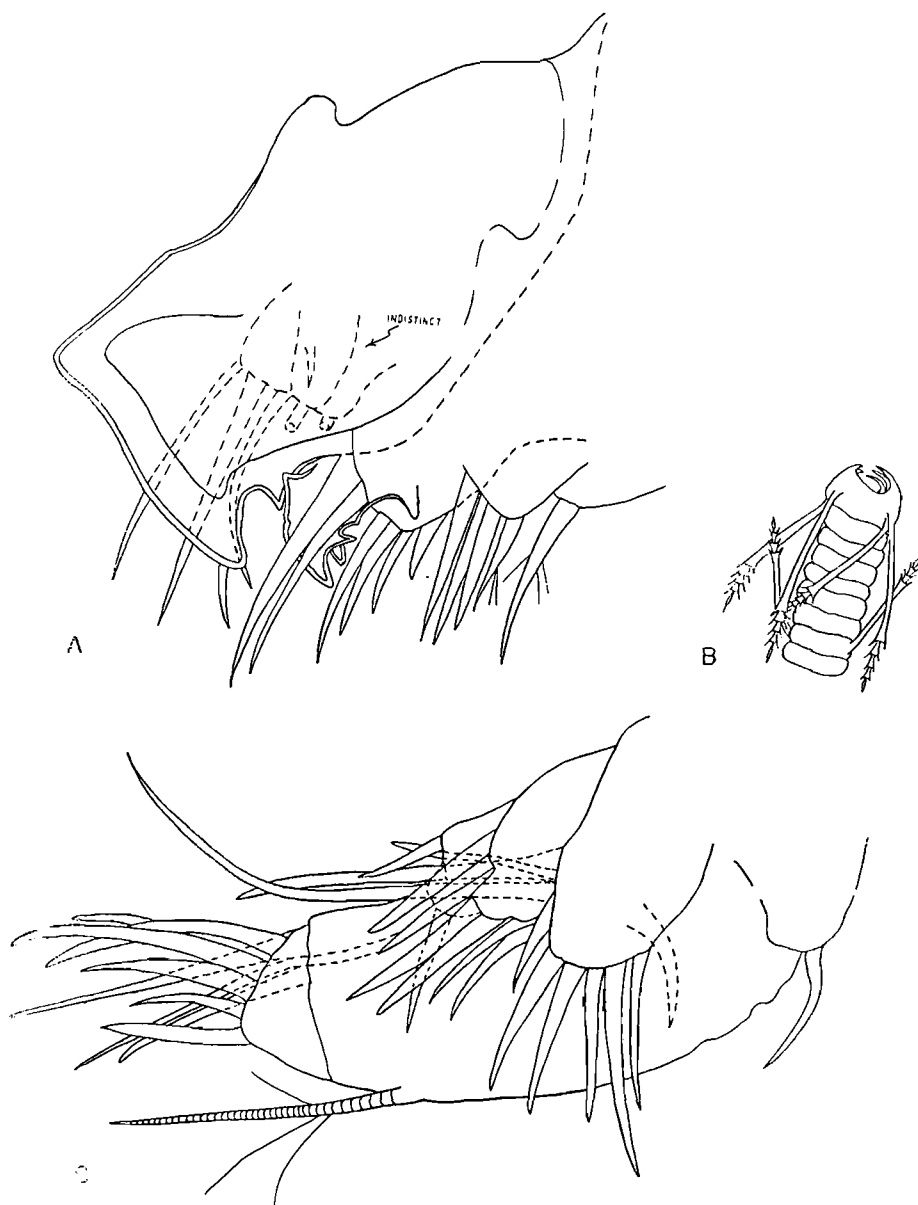


FIG. 55.

*Philomedes paucichelata* Kornicker, new species (Female).

A. Portion of fifth leg. Specimen No. 156-5.

B. Seventh limb. Specimen No. 156-5.

C. Portion of maxilla. Specimen No. 156-5.

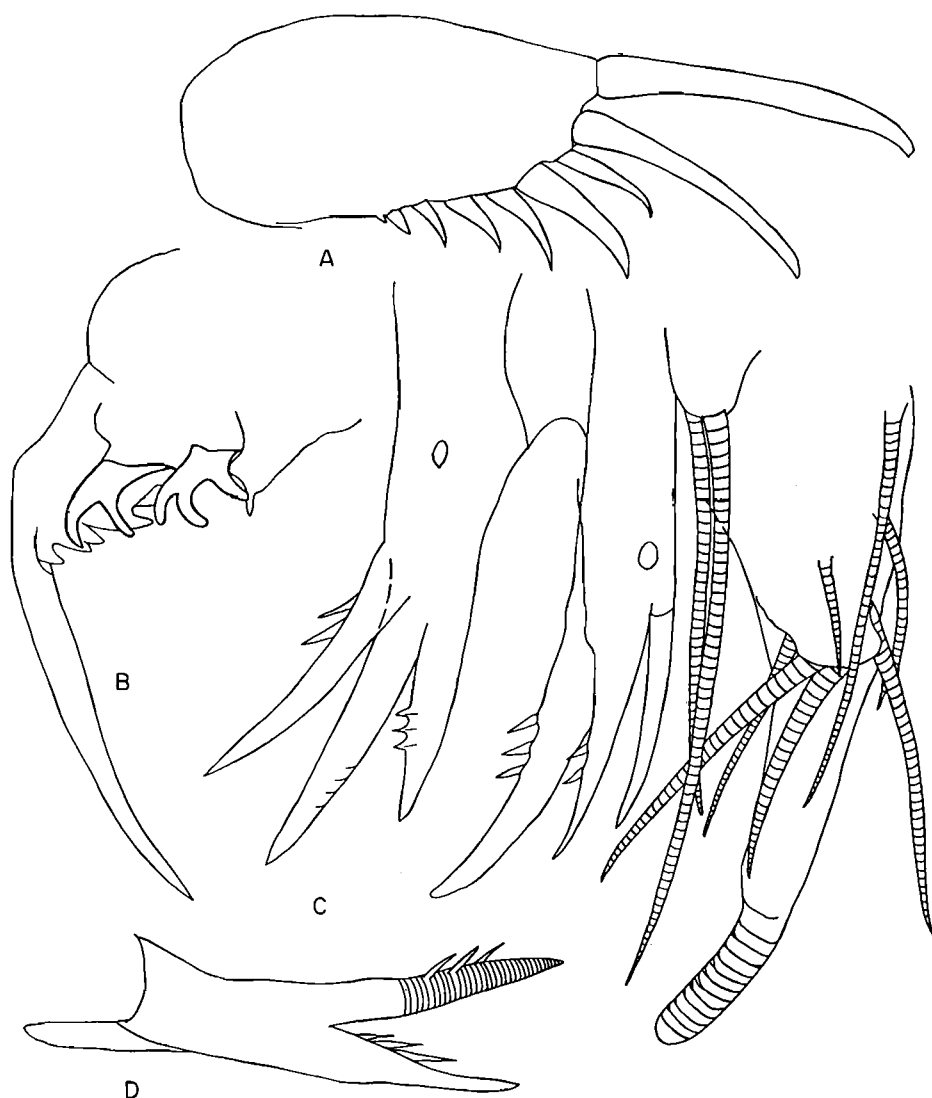


FIG. 56.

*Pseudophilomedes ferulana* Kornicker, new species (Female).

- A. Furca. Specimen No. 118B-2.
- B. Distal portion of fifth limb. Specimen No. 118B-3.
- C. Distal portion of maxilla. Specimen No. 118B-3.
- D. Mandibular palp. Specimen No. 118B-3.

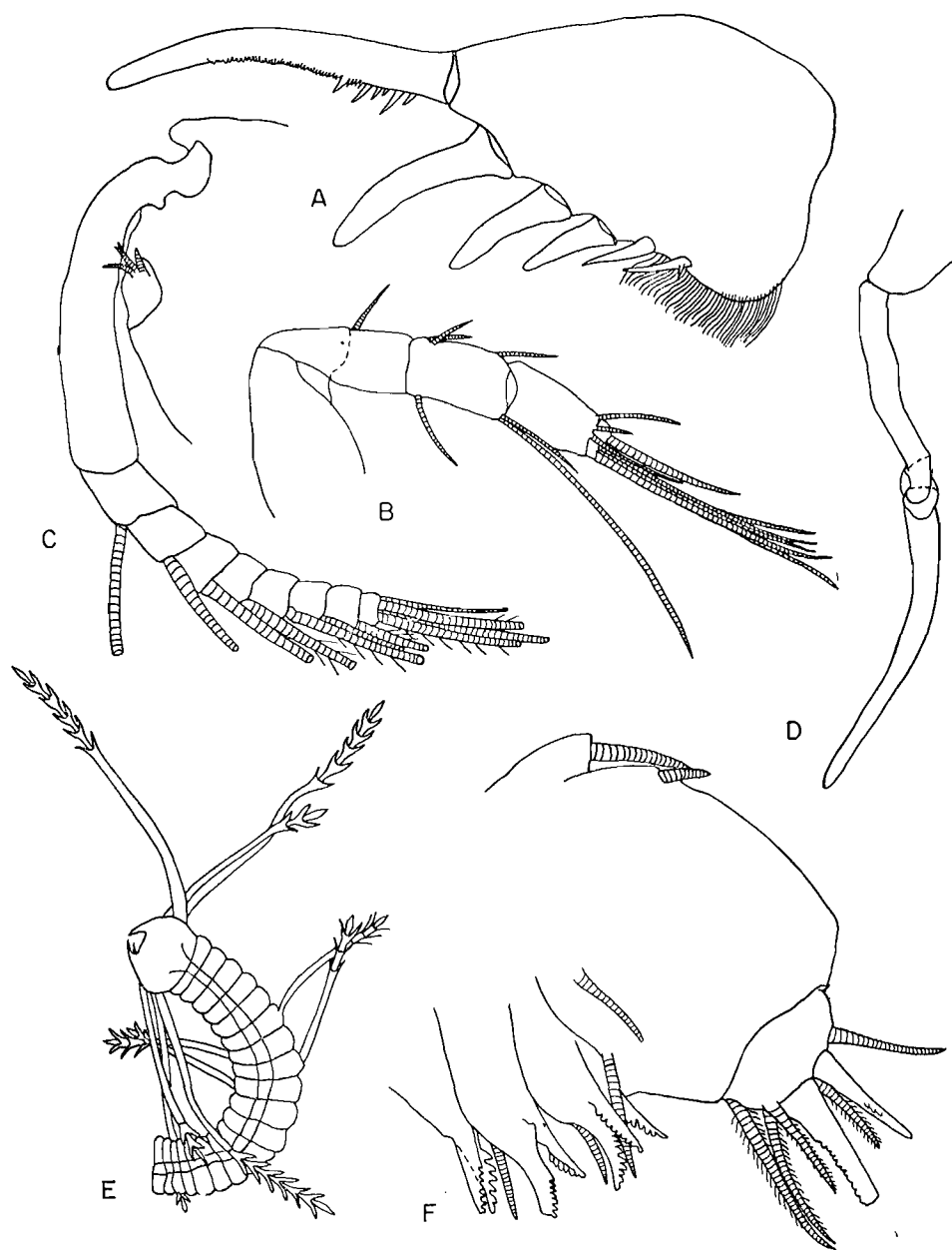


FIG. 57.

*Rutiderma (Rutiderma) dinochelata* Kornicker, new species (Female).

- A. Furca. Specimen No. 247-10.
- B. First antenna. Specimen No. 247-10.
- C. Second antenna. Specimen No. 247-10.
- D. Frontal organ. Specimen No. 247-10.
- E. Seventh limb. Specimen No. 247-10.
- F. Portion of maxilla. Specimen No. 247-10.



FIG. 58.

*Rutiderma (Rutiderma) dinochelata* Kornicker, new species (Female).

- A. Fifth limb. Specimen No. 247-10.
- B. Mandible. Specimen No. 247-10.
- C. Setae of fifth limb. Specimen No. 247-10.
- D. Mandible. Specimen No. 247-10.

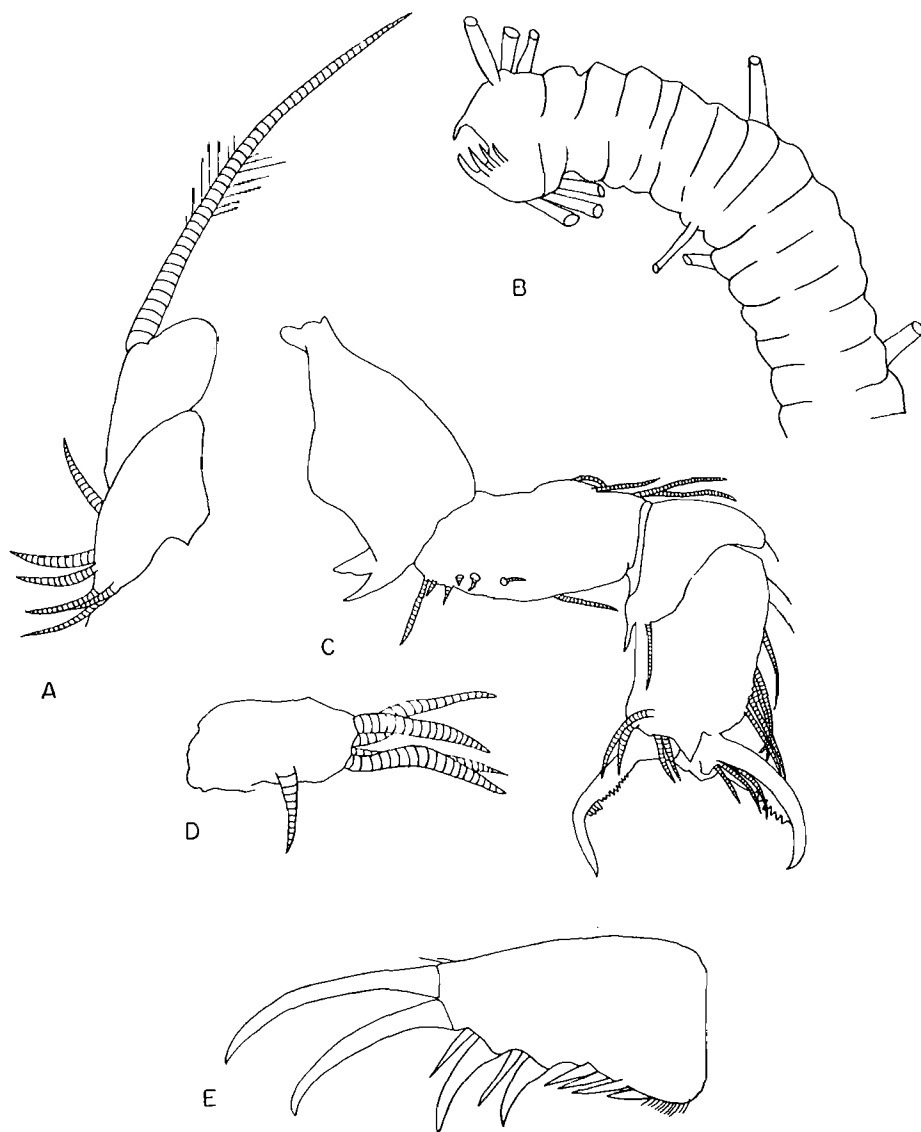


FIG. 59.

*Rutiderma (Alternochelata) polychelata* Kornicker, new subgenus, new species (Sex unknown).

- A. Secondary branch second antenna. Specimen No. 110-2.
- B. Seventh limb. Specimen No. 110-2.
- C. Mandible. Specimen No. 110-2.
- D. Proximal joint of secondary branch of second antenna. Specimen No. 110-2.
- E. Furca. Specimen No. 110-2.



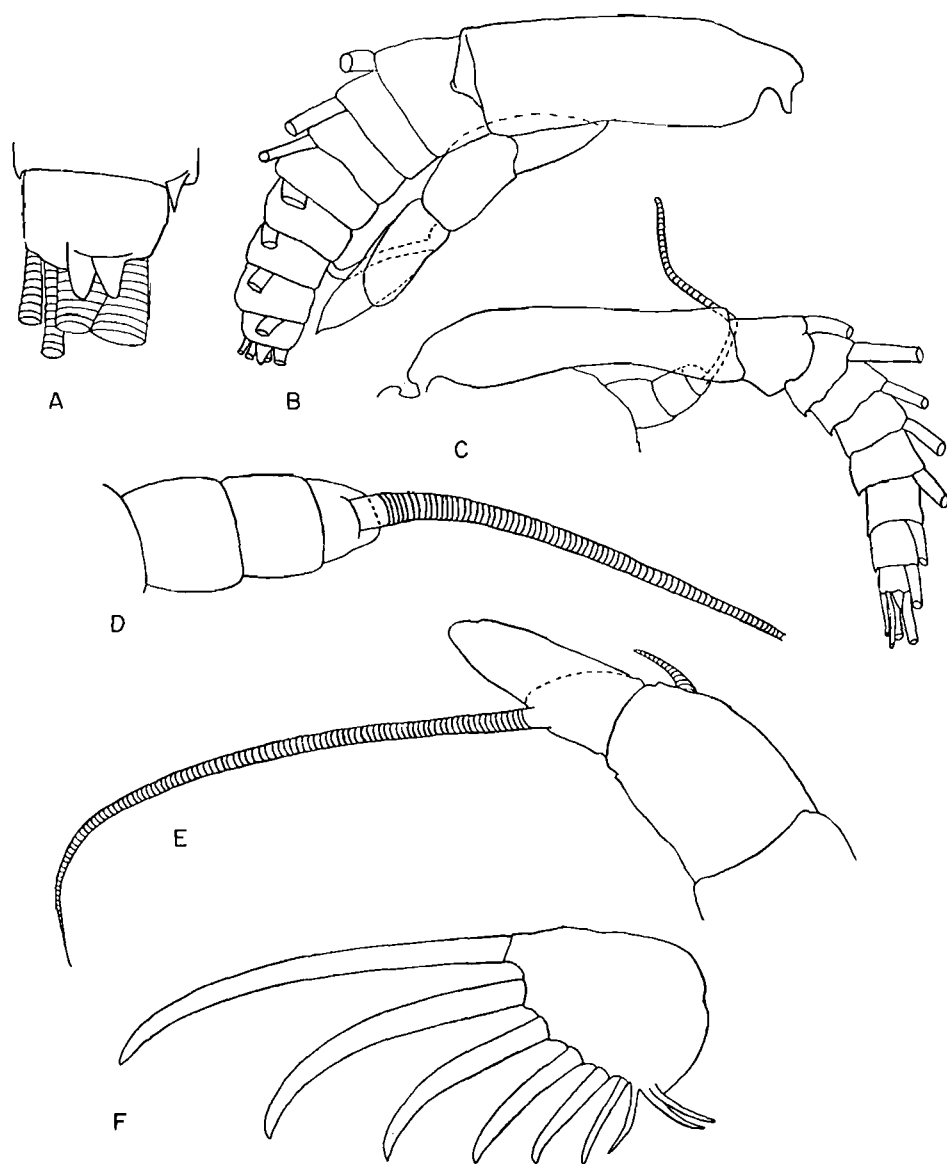


FIG. 60.

*Asteropina mulleri* (Skogsherg) (Sex unknown).

- A. Distal end of scrold antenna. Specimen No. CP5-3.
- B. Second antenna. Specimen No. CP5-3.
- C. Second antenna. Specimen No. CPAC-1.
- D. Secondary branch of second antenna. Specimen No. CPAC-1.
- E. Secondary branch of second antenna. Specimen No. CP13-1.
- F. Furca. Specimen No. CPAC-1.



FIG. 61.

*Asteropina mulleri* (Skogsberg) (Female).

- A. First antenna. Specimen No. CP5-1.
- B. Mandible. Specimen No. CP5-1.
- C. Sixth limb. Specimen No. CP5-1.
- D. Mandibular process. Specimen No. CP5-1.
- E. Maxilla. Specimen No. CP5-2.
- F. Distal end of seventh limb. Specimen. No. CP5-2.

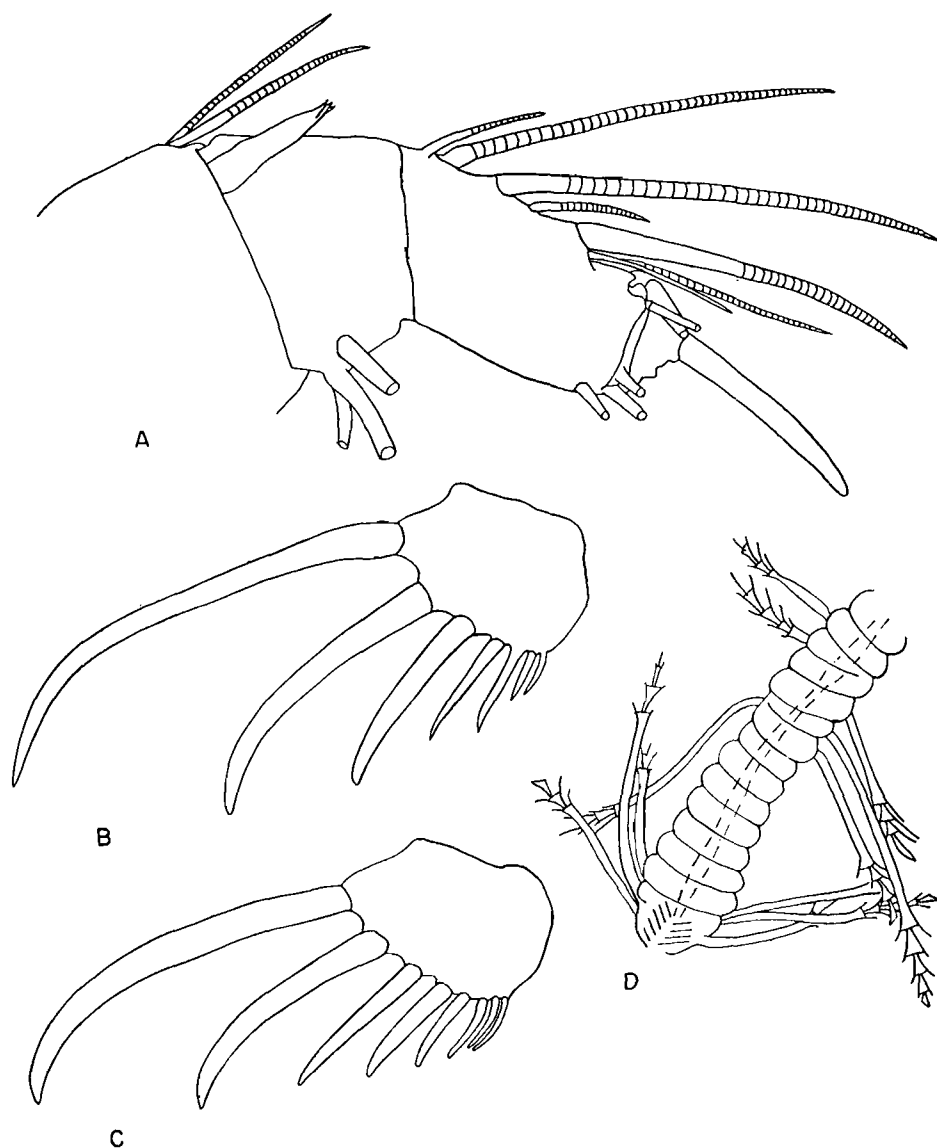


FIG. 62.

*Asteropina setisparsa* Kornicker, new species (Female).

- A. Mandible. Specimen No. 246-3.
- B. Furca. Specimen No. 120C-1.
- C. Furca. Specimen No. 122D-3.
- D. Seventh limb. Specimen No. 246-3.

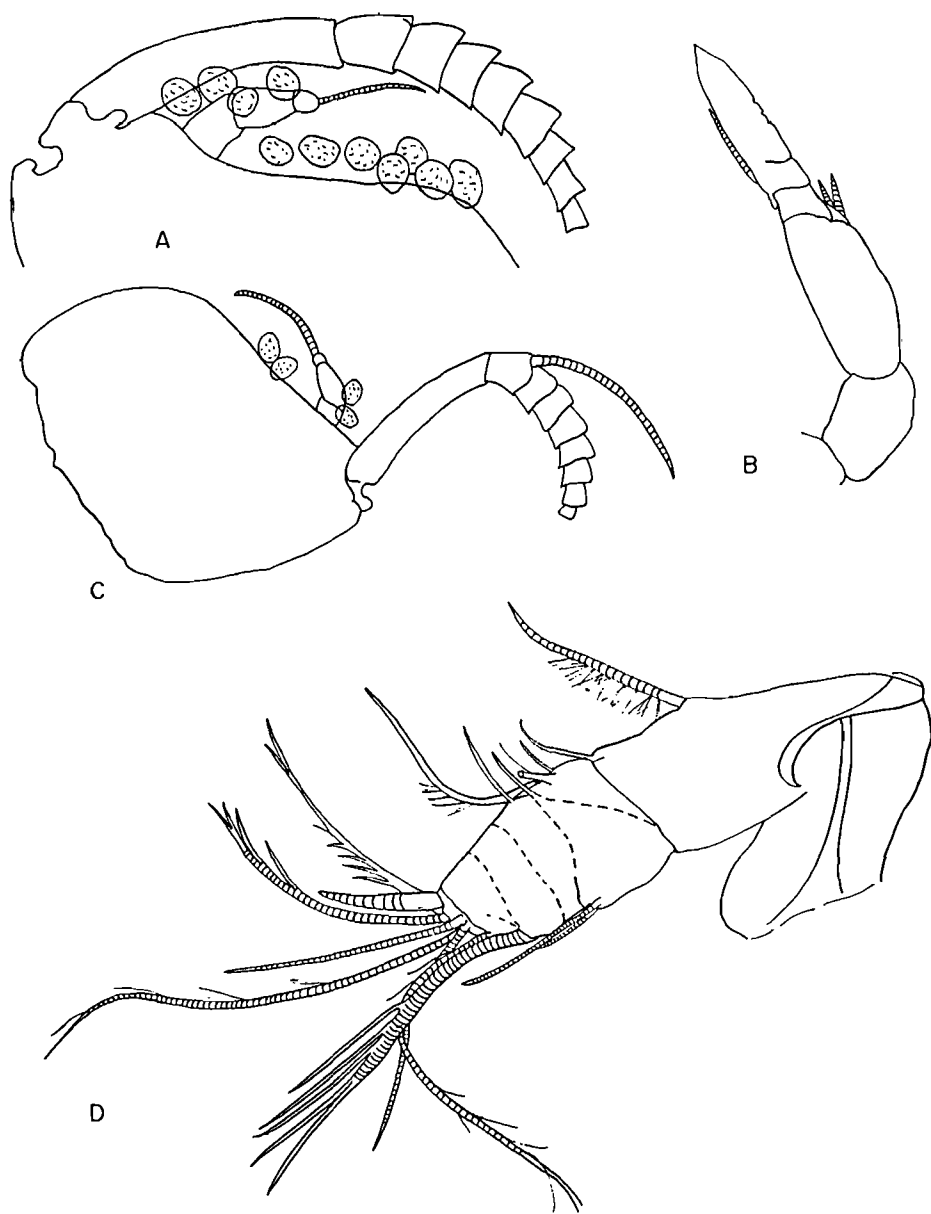


FIG. 63.

*Asteropina setisparsa* Kornicker, new species (Female).

- A. Second antenna, sensory bristles not shown; round objects are parasites. Specimen No. 122D-3.
- B. Secondary appendage of second antenna. Specimen No. 246-3.
- C. Second antenna with one sensory bristle shown; round objects are parasites. Specimen No. 122D-3.
- D. First antenna. Specimen No. 246-3.



FIG. 64.

*Asteropina setisparsu* Kornicker, new species (Female).

- A. Maxilla. Specimen No. 122D-3.
- B. Fifth limb, not all setae shown. Specimen No. 122D-3.
- C. Mandibular process. Specimen No. 122D-3.
- D. Sixth limb. Specimen No. 122D-3.
- E. Sixth limb. Specimen No. 122D-1.

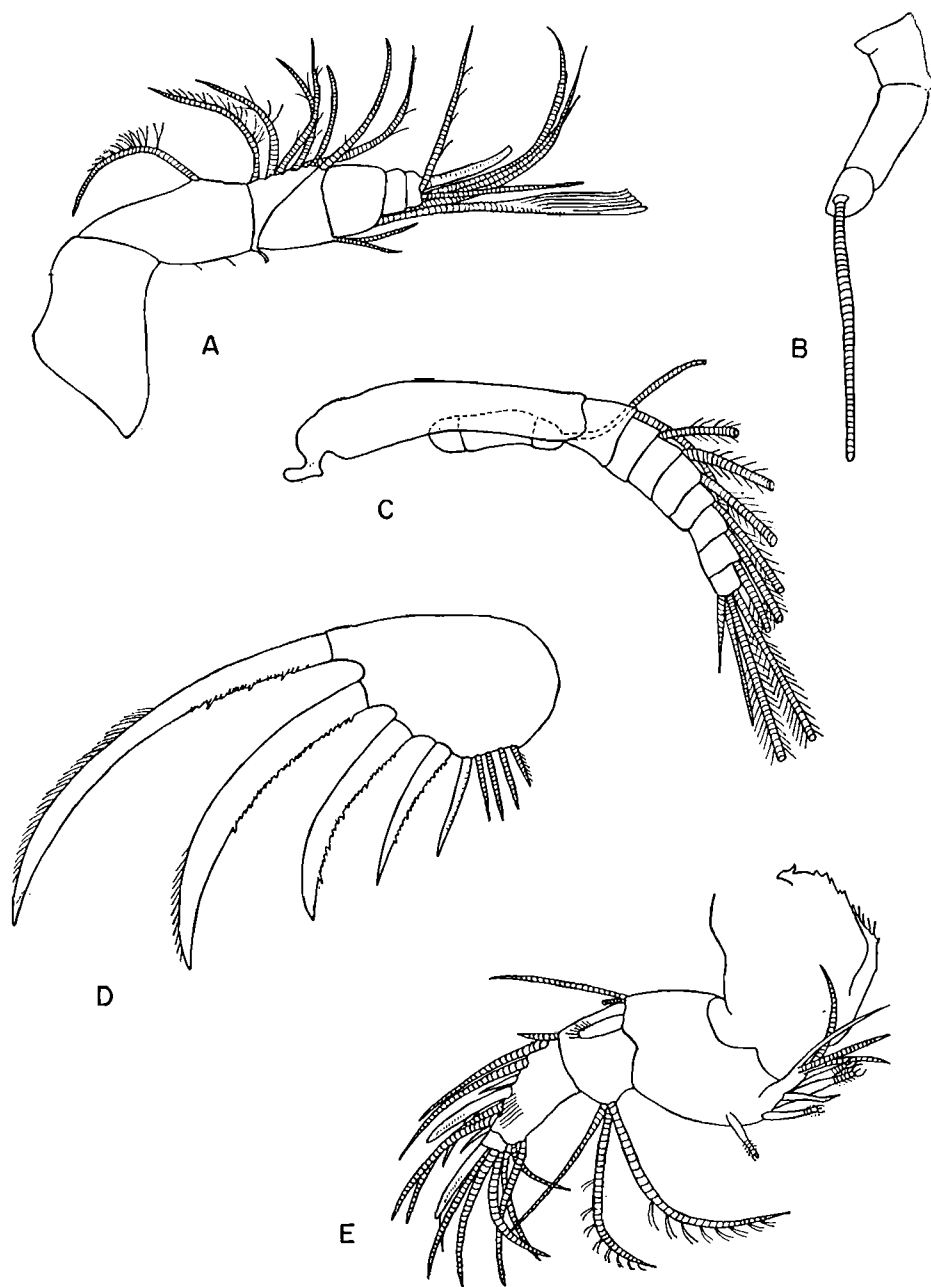


FIG. 65.

- Asteropina extrachelata* Kornicker, new species (Female).  
A. First antenna. Specimen No. 118-1.  
B. Secondary branch of second antenna. Specimen No. 118-1.  
C. Second antenna. Specimen No. 118-1.  
D. Furca. Specimen No. 118-1.  
E. Mandible. Specimen No. 118-1.

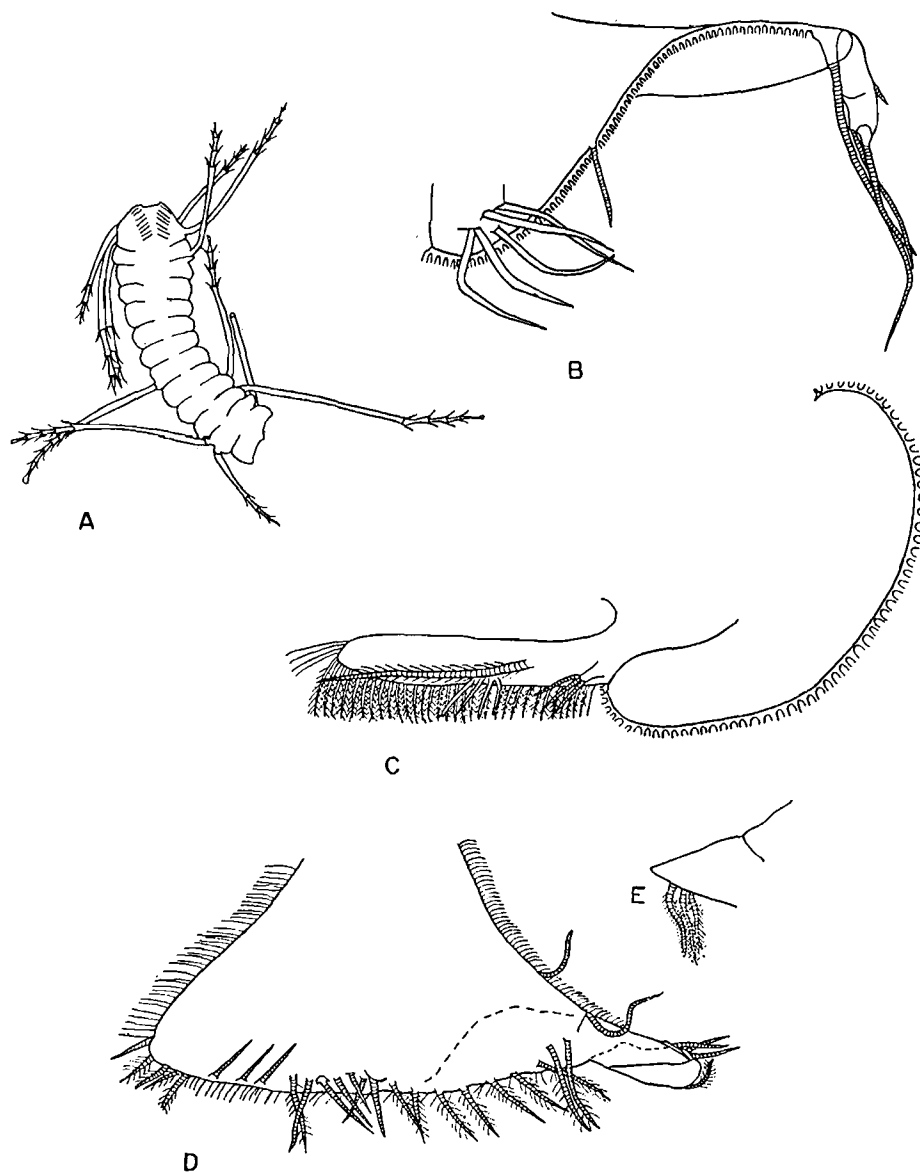


FIG. 66.

*Asteropina extrachelata* Kornicker, new species (Female).

A. Seventh limb. Specimen No. 118-1.

B. Maxilla. Specimen No. 118-1.

C. Fifth limb. Specimen No. 118-1.

D. Sixth limb. Specimen No. 118-1.

E. Antero-ventral corner of other sixth limb. Specimen No. 118-1.

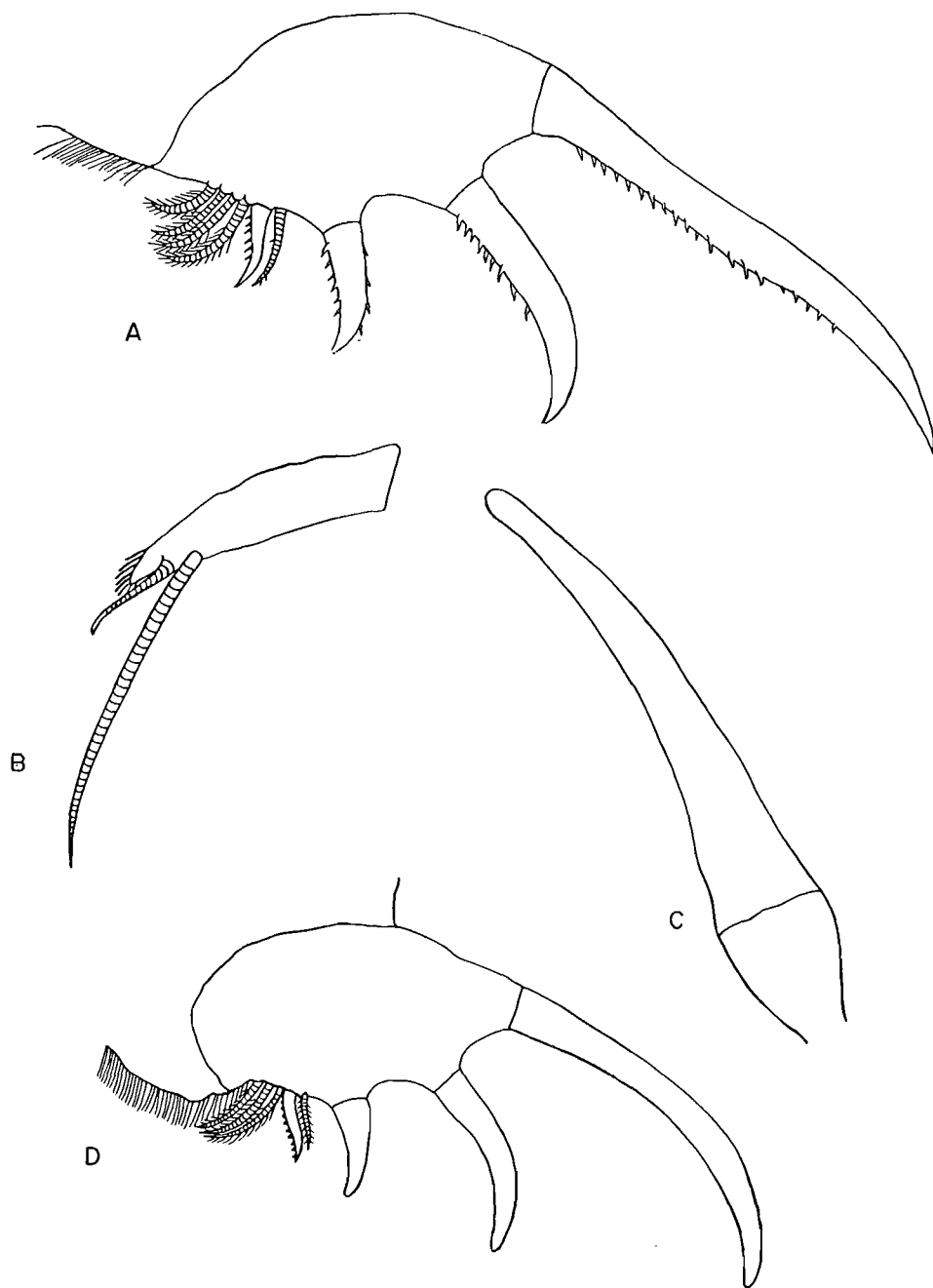


FIG. 67.

*Cycloberis biminiensis* Kornicker, new species (?Female).

- A. Furca, Specimen No. 177-1.
- B. Falciform process on mandible, Specimen No. 177-1.
- C. Frontal organ, Specimen No. 177-1.
- D. Furca, Specimen No. 177-2.



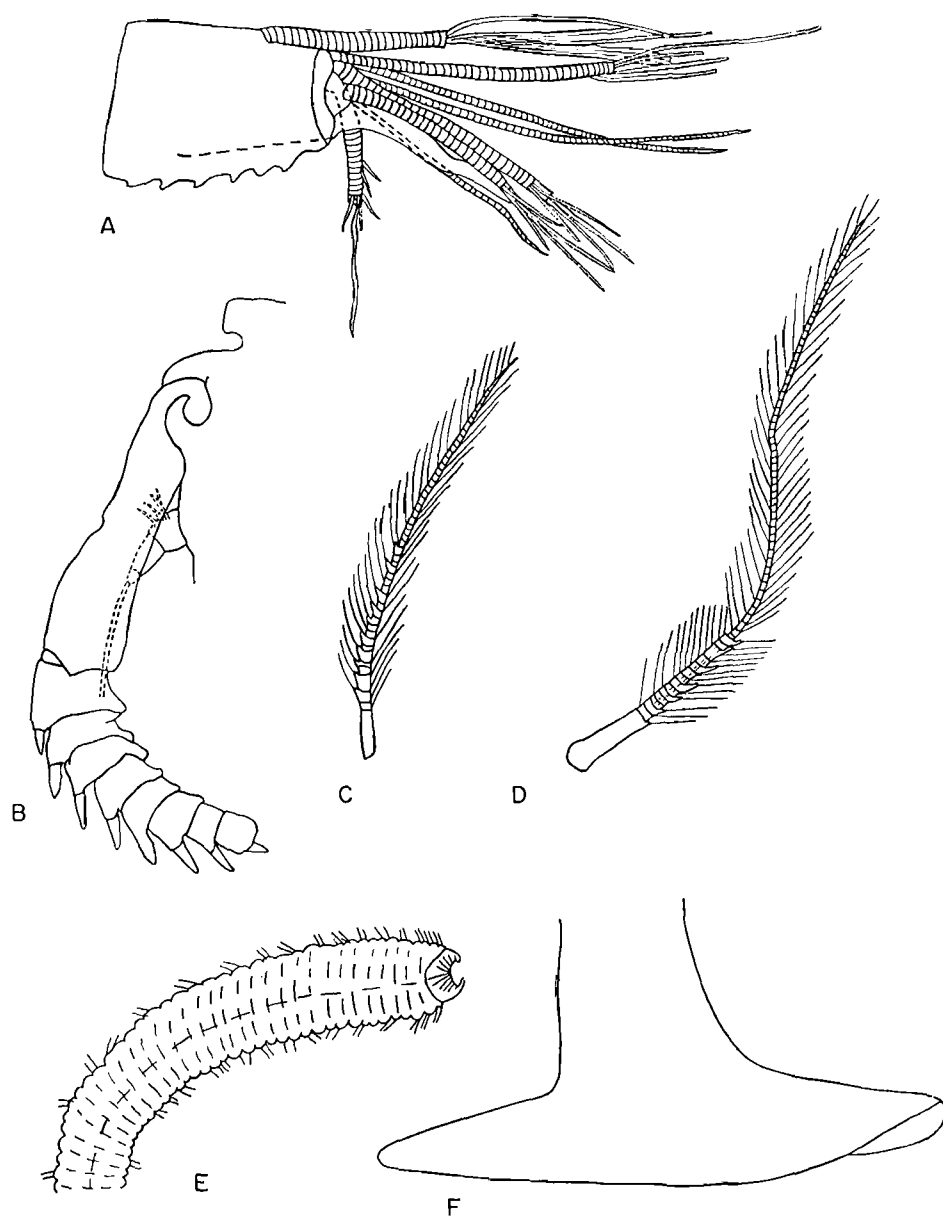


FIG. 68.

*Cycloberis biminensis* Kornicker, new species (?Female).

- A. Distal end first antenna. Specimen No. 177-1.
- B. Second antenna, setae not shown. Specimen No. 177-1.
- C. Bristle from third joint of second antenna. Specimen No. 177-2.
- D. Bristle from third joint of second antenna. Specimen No. 177-1.
- E. Seventh limb, stumps only shown of setae. Specimen No. 177-1.
- F. Outline of sixth limb without bristles. Specimen No. 177-2.

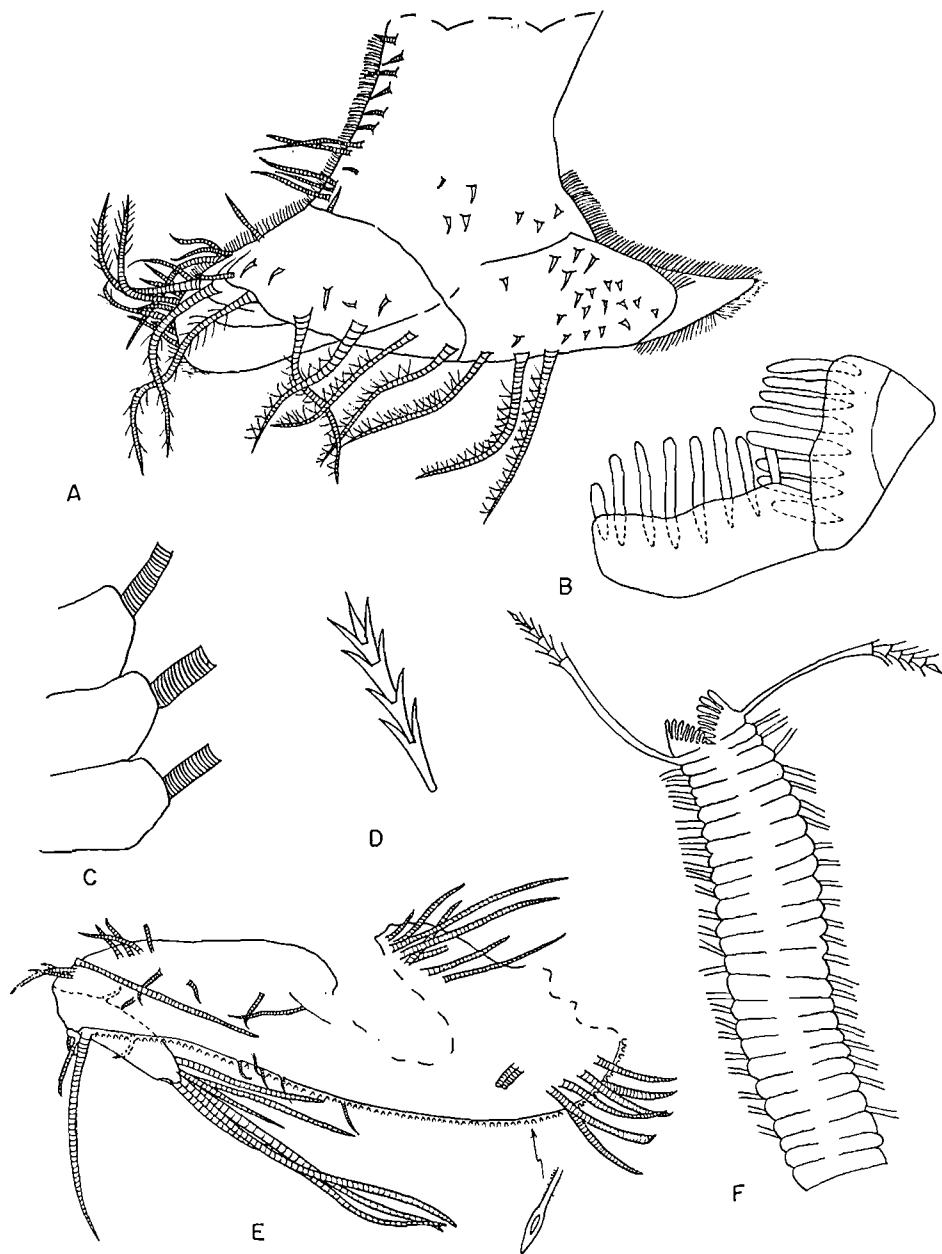


FIG. 69.

*Actinoseta chelisarsa* Kornicker, new genus, new species (Female).

- A. Sixth limb. Specimen No. CP38-2.
- B. Distal end of seventh limb. Specimen No. CP38-2.
- C. Portion of segments of seventh limb. Specimen No. CP38-2.
- D. Distal end of setae on seventh limb. Specimen No. CP38-2.
- E. Maxilla. Specimen No. CP38-2.
- F. Seventh limb. Specimen No. CP38-2.

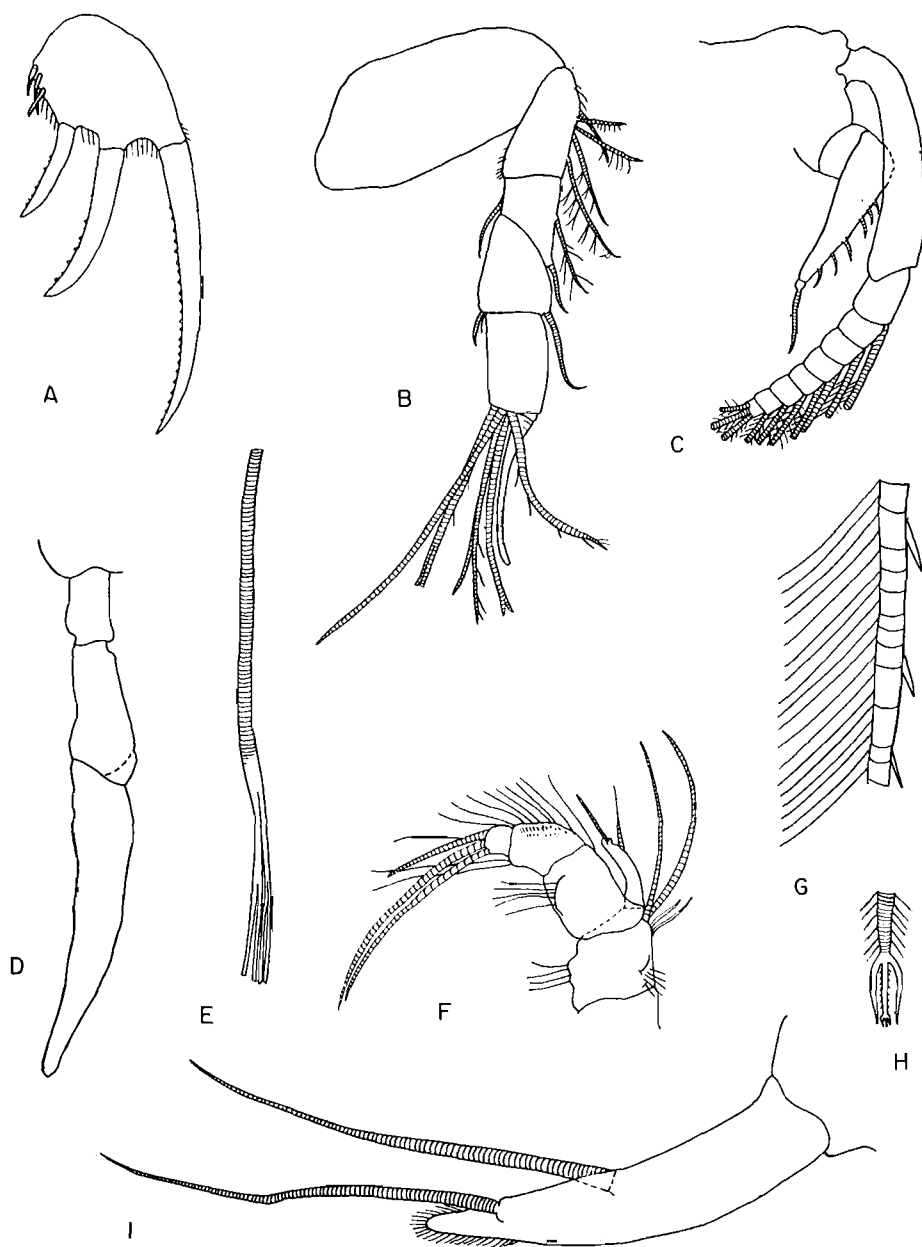


FIG. 70.

*Actinoseta chelisparsa* Kornicker, new species (Female).

- A. Furca. Specimen No. CP52-6.
- B. First antenna. Specimen No. CP38-2.
- C. Second antenna. Specimen No. CP38-2.
- D. Frontal organ. Specimen No. CP38-2.
- E. Sensory bristle of first antenna. Specimen No. CP52-6.
- F. Mandible. Specimen No. CP38-2.
- G. Part of distal half of setae on second joint of second antenna. Specimen No. CP38-2.
- H. Mandible bristle. Specimen No. CP38-2.
- I. Falciform process on mandible. Specimen No. CP38-2.

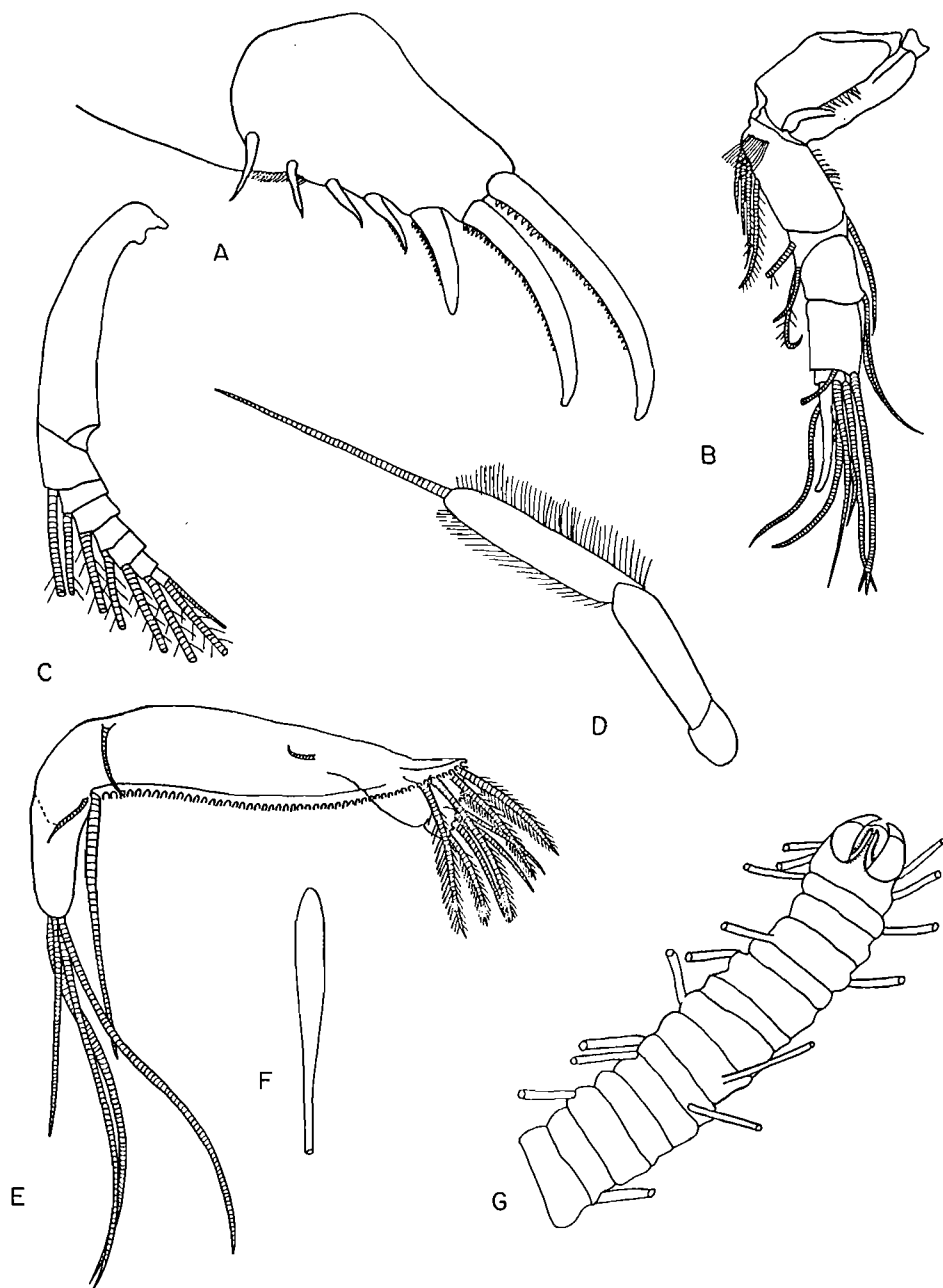


FIG. 71.

*Asteropteron monambon* Kornicker, new species (Female).

- A. Furca. Specimen No. CP52-4.
- B. First antenna. Specimen No. CP52-4.
- C. Second antenna. Specimen No. CP52-4.
- D. Secondary branch of second antenna. Specimen No. CP52-4.
- E. Maxilla. Specimen No. CP52-4.
- F. Paddle-shaped tip of maxillary bristle. Specimen No. CP52-4.
- G. Seventh limb. Specimen No. CP52-4.

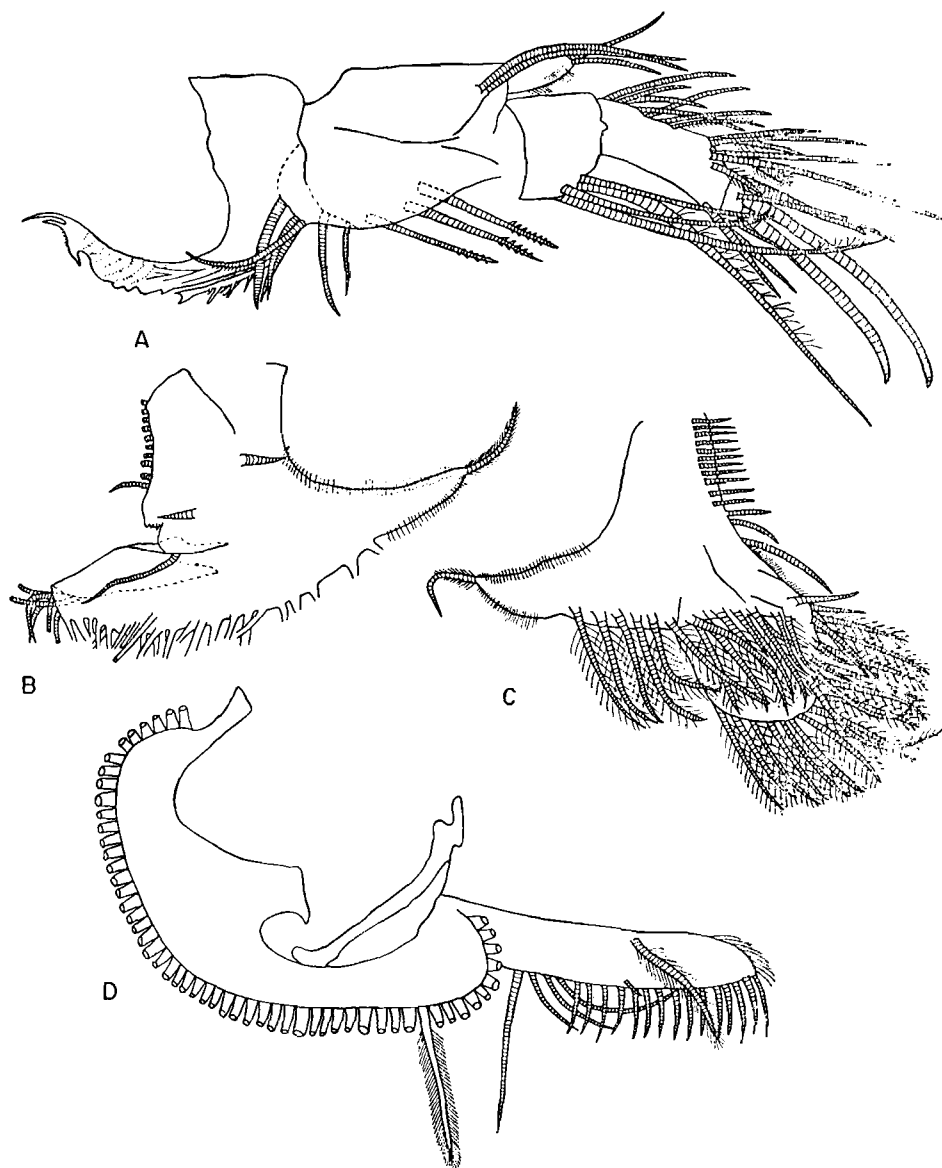


FIG. 72.

*Astropteron monumbon* Kornicker, new species (Female).

- A. Mandible. Specimen No. CP52-4.
- B. Sixth limb. Specimen No. CP52-4.
- C. Sixth limb. Specimen No. CP52-4.
- D. Fifth limb. Specimen No. CP52-4.

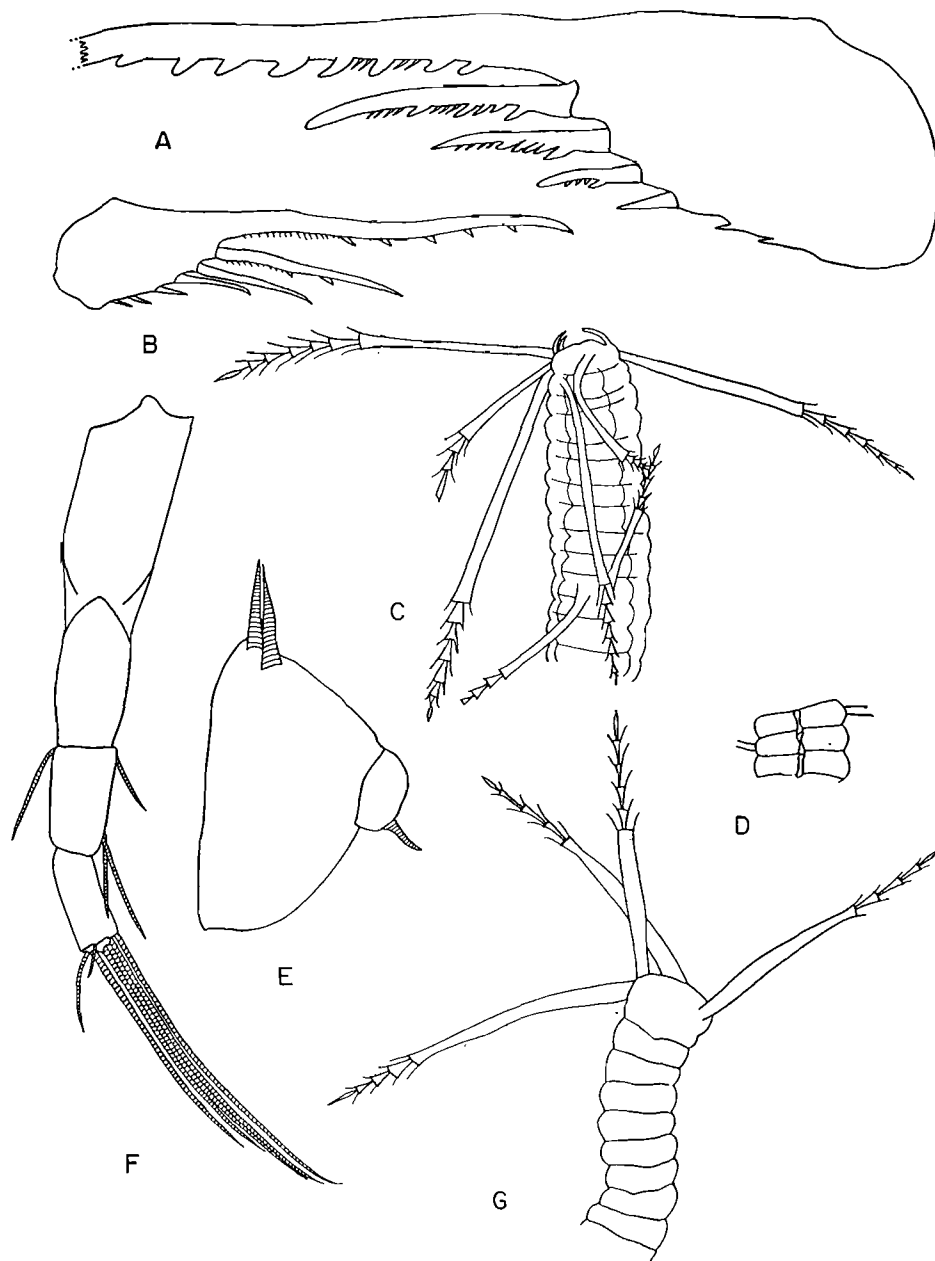


FIG. 73.

*Sarsiella carinata* A. Scott (Female).

- A. Furca. Specimen No. CP38-13.
- B. Furca. Specimen No. CP38-5.
- C. Seventh limb. Specimen No. CP38-13.
- D. Portion of seventh limb (mate of C). Specimen No. CP38-13.
- E. Secondary branch first antenna. Specimen No. CP38-5.
- F. First antenna. Specimen CP38-5.
- G. Seventh limb. Specimen No. CP38-5.

Note: Specimen No. CP38-5 is yolling instar.  
Specimen No. CP38-13 is mature.

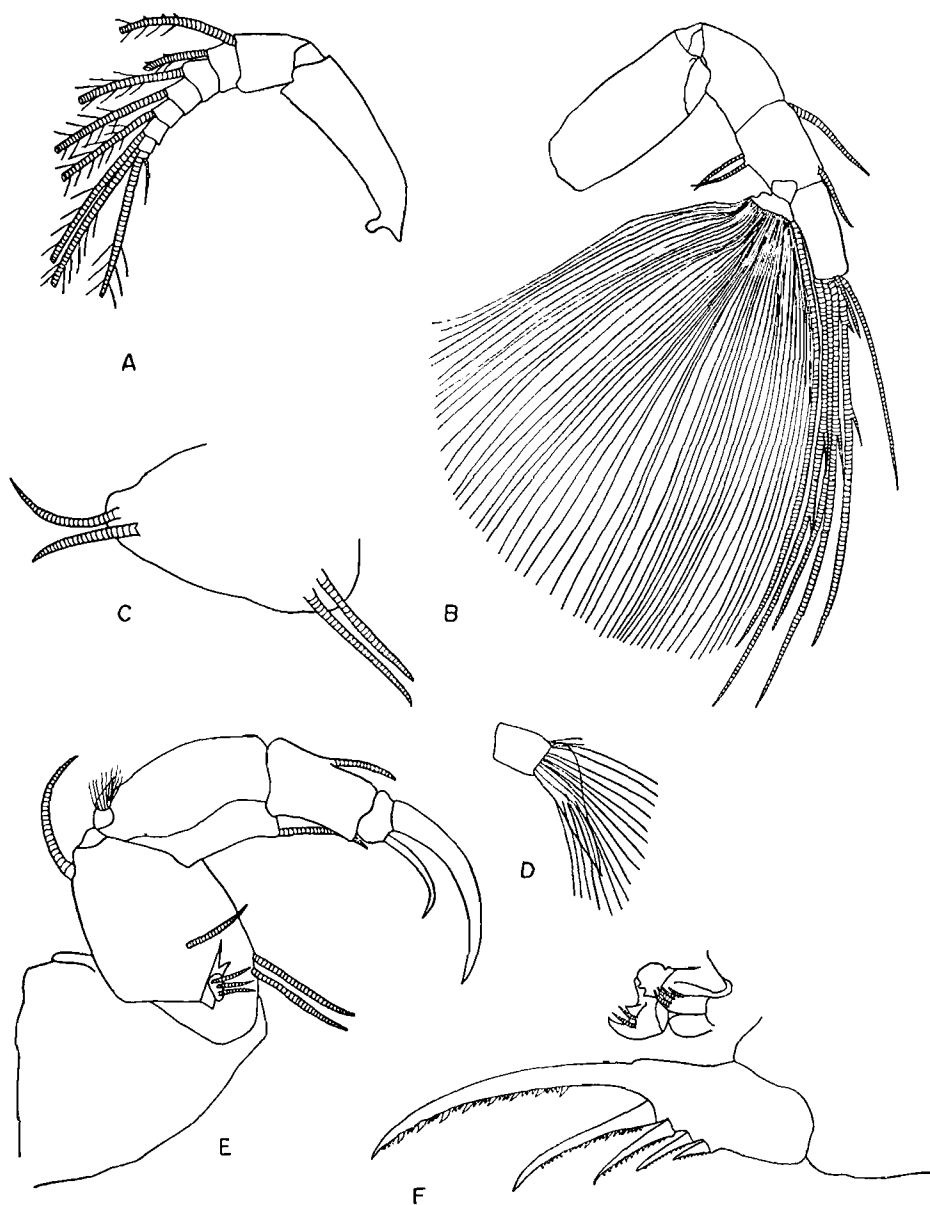


FIG. 74.

*Sarsiella carinata* A. Scott (Male).

- A. Second antenna. Specimen No. CP52-23.
- B. First antenna. Specimen No. CP52-23.
- C. Secondary branch of second antenna. Specimen No. CP52-23.
- D. Process on mandible. Specimen No. CP52-23.
- E. Mandible. Specimen No. CP52-23.
- F. Furca and penis. Specimen No. CP52-23.

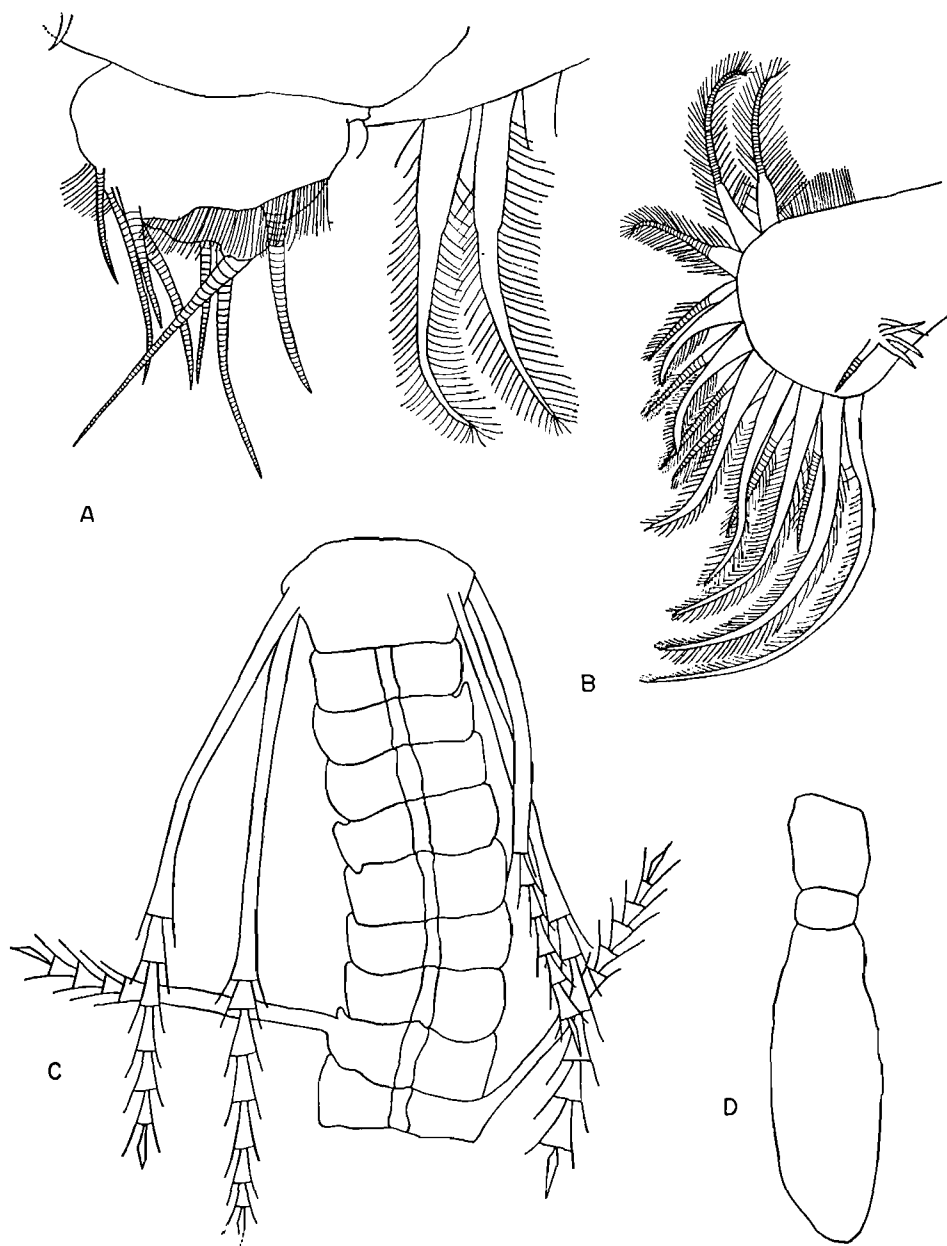


FIG. 75.

*Sarsiella carinata* A. Scott (Male).

- A. Fifth limb. Specimen No. CP52-23.  
 B. Sixth limb. Specimen No. CP52-23.  
 C. Seventh limb. Specimen No. CP52-23.  
 D. Frontal organ. Specimen No. CP52-23.



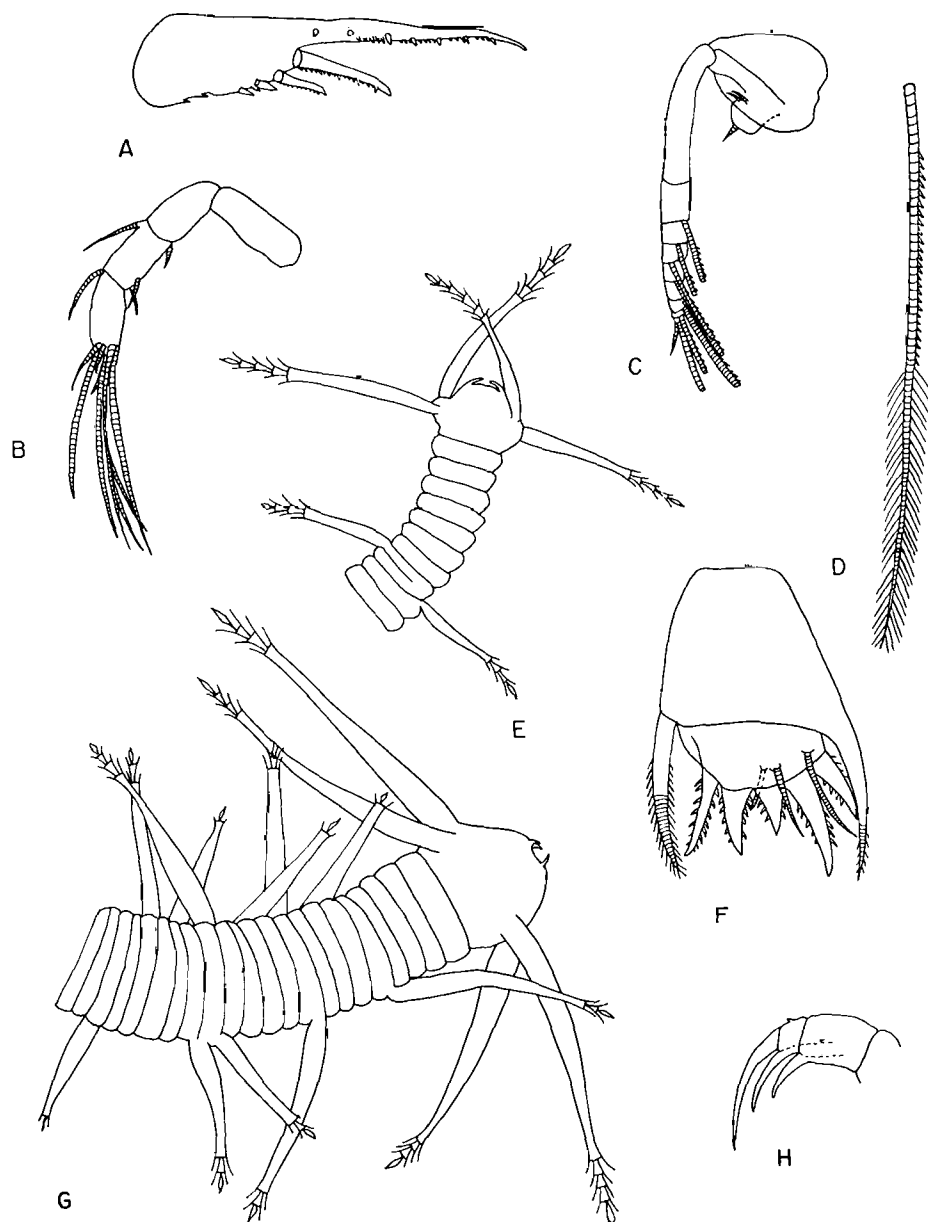


FIG. 76.

*Sarsiella capillaris* Kornicker, new species (Female).

- A. Furca. Specimen No. CP38-10.
- B. First antenna. Specimen No. CP38-10.
- C. Second antenna. Specimen No. CP38-10.
- D. Detail of bristle on seventh joint of second antenna. Specimen No. CP38-10.
- E. Seventh limb. Specimen No. CP38-10.
- F. Maxilla. Specimen No. CP38-10.
- H. Distal end of mandible. Specimen No. CP38-10.

*Sarsiella gigacantha* Kornicker, new species (Female).

- G. Seventh limb. Specimen No. S-2.

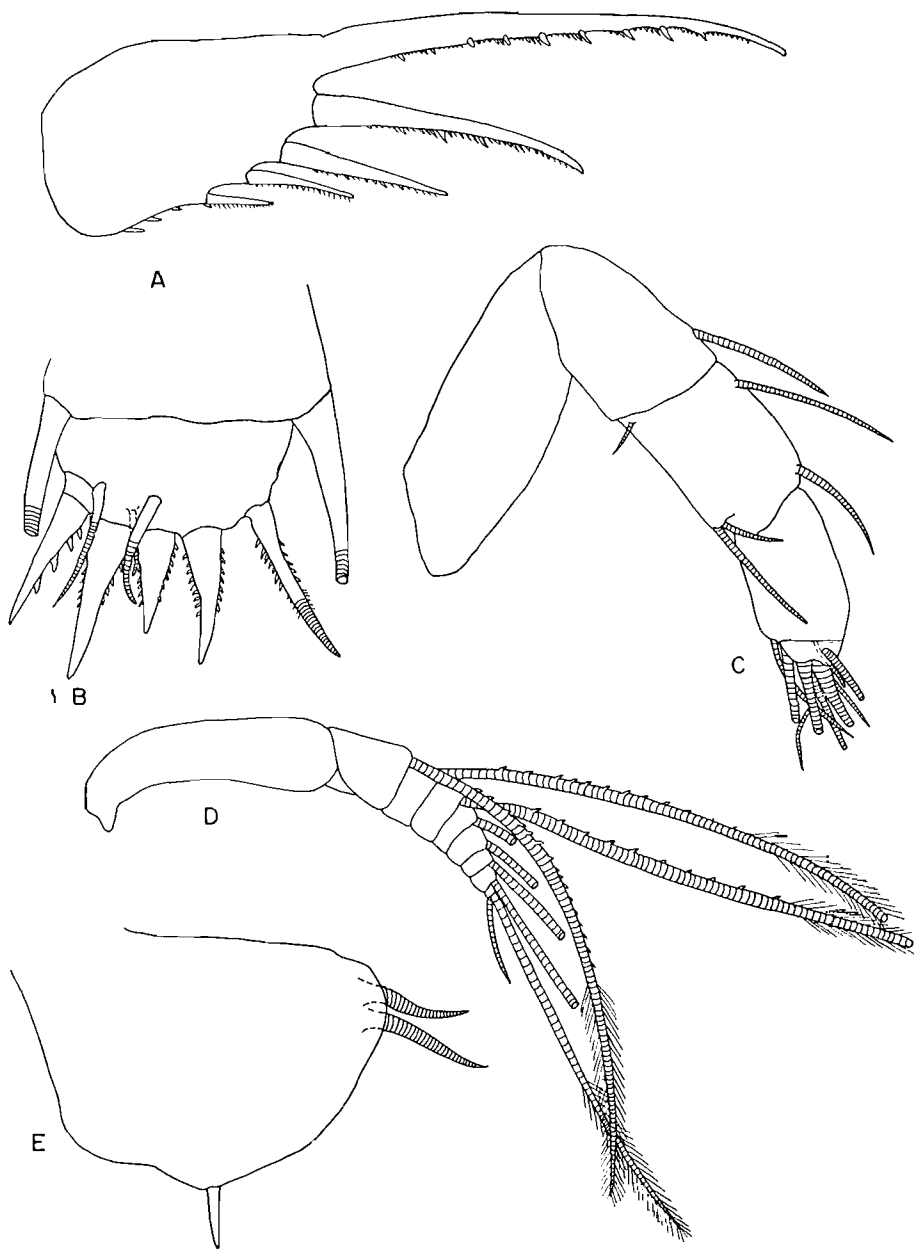


FIG. 77.

*Sarsiella gigacantha* Kornicker, new species (Female).

- A. Furca. Specimen No. S-2.
- B. Maxilla. Specimen No. S-2.
- C. First antenna. Specimen No. S-2.
- D. Second antenna. Specimen No. S-2.
- E. Secondary branch of second antenna. Specimen No. S-2.

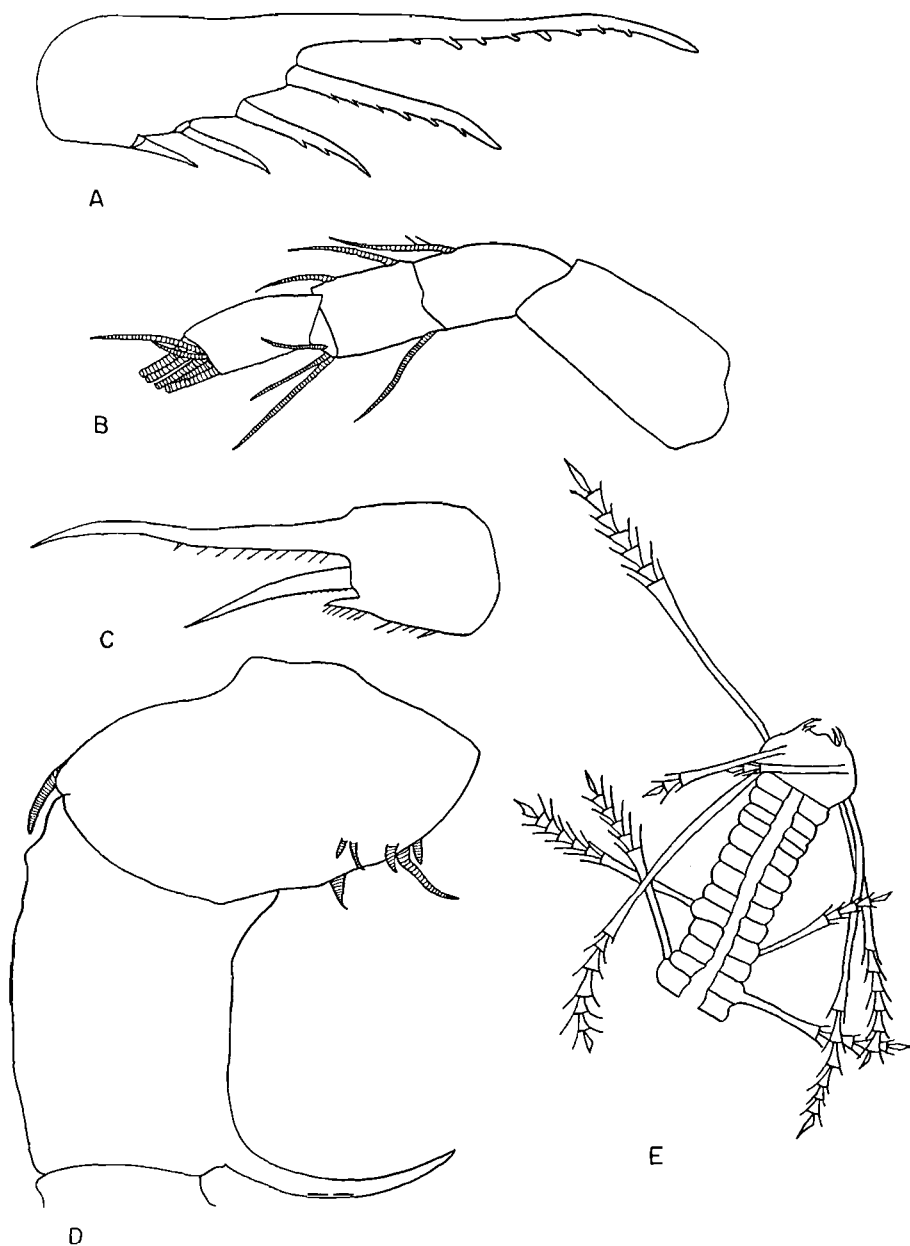


FIG. 78.

*Sarsiella truncana* Kornicker, new species (Female).

- A. Furca. Specimen No. CP52-21.
- B. First antenna. Specimen No. CP52-21.
- C. Furca (young instar). Specimen No. CP38-6.
- D. Part of mandible. Specimen No. CP52-21.
- E. Seventh limb. Specimen No. CP52-20.

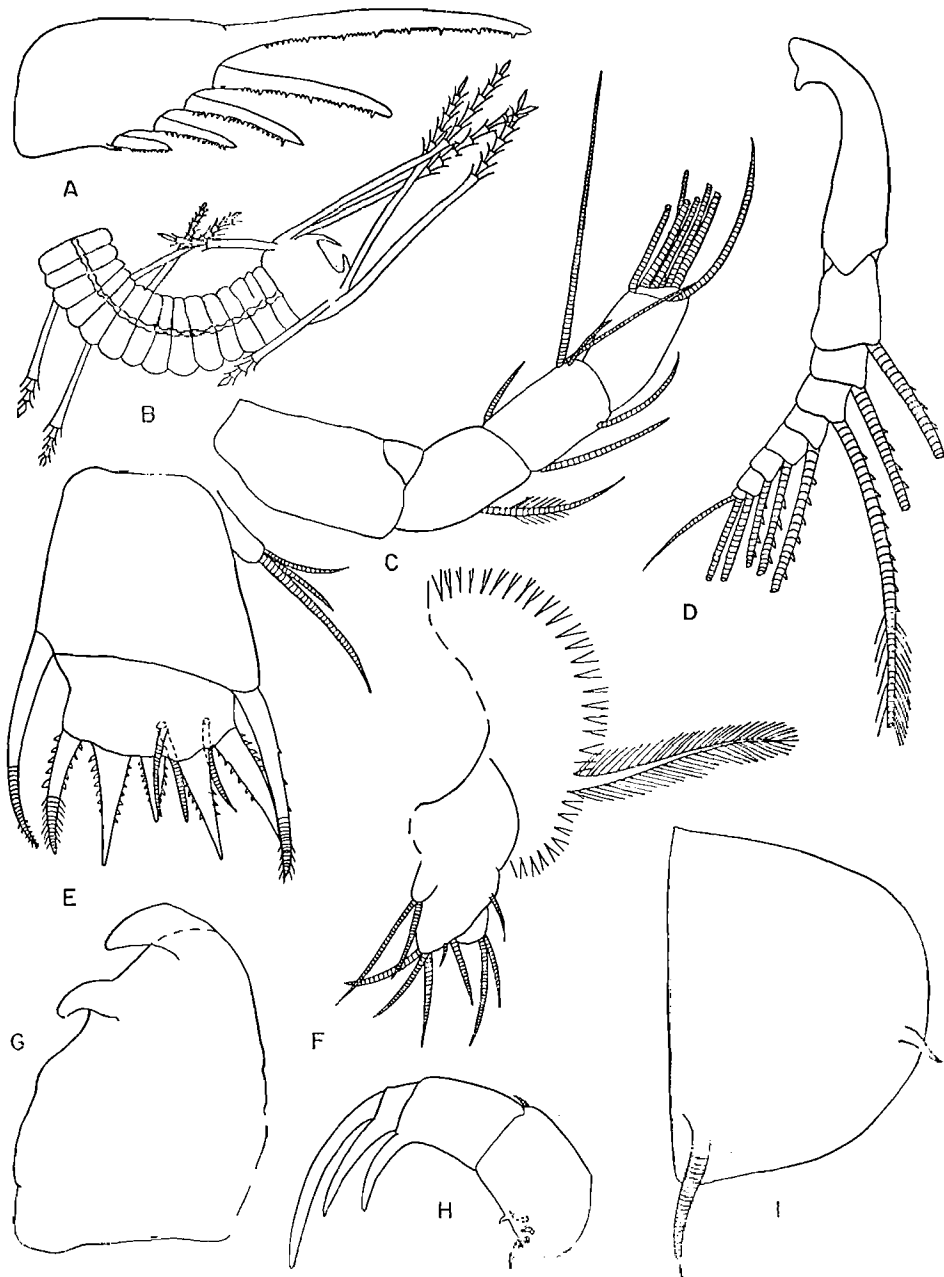


FIG. 79.

*Sarsicella punctata* Kornicker, new species.

- A. Furca. Specimen No. CP38-9.
- B. Seventh limb. Specimen No. CP38-9.
- C. First antenna. Specimen No. CP38-9.
- D. Second antenna. Specimen No. CP38-9.
- E. Maxilla. Specimen No. CP38-9.
- F. Fifth limb. Specimen No. CP38-9.
- G. Penis. Specimen No. 119A-1.
- H. Mandible. Specimen No. CP38-9.
- I. Secondary branch of second antenna. Specimen No. CP38-9.

Note: Specimen No. CP38-9 is male.

Specimen No. 119A-1 is female.

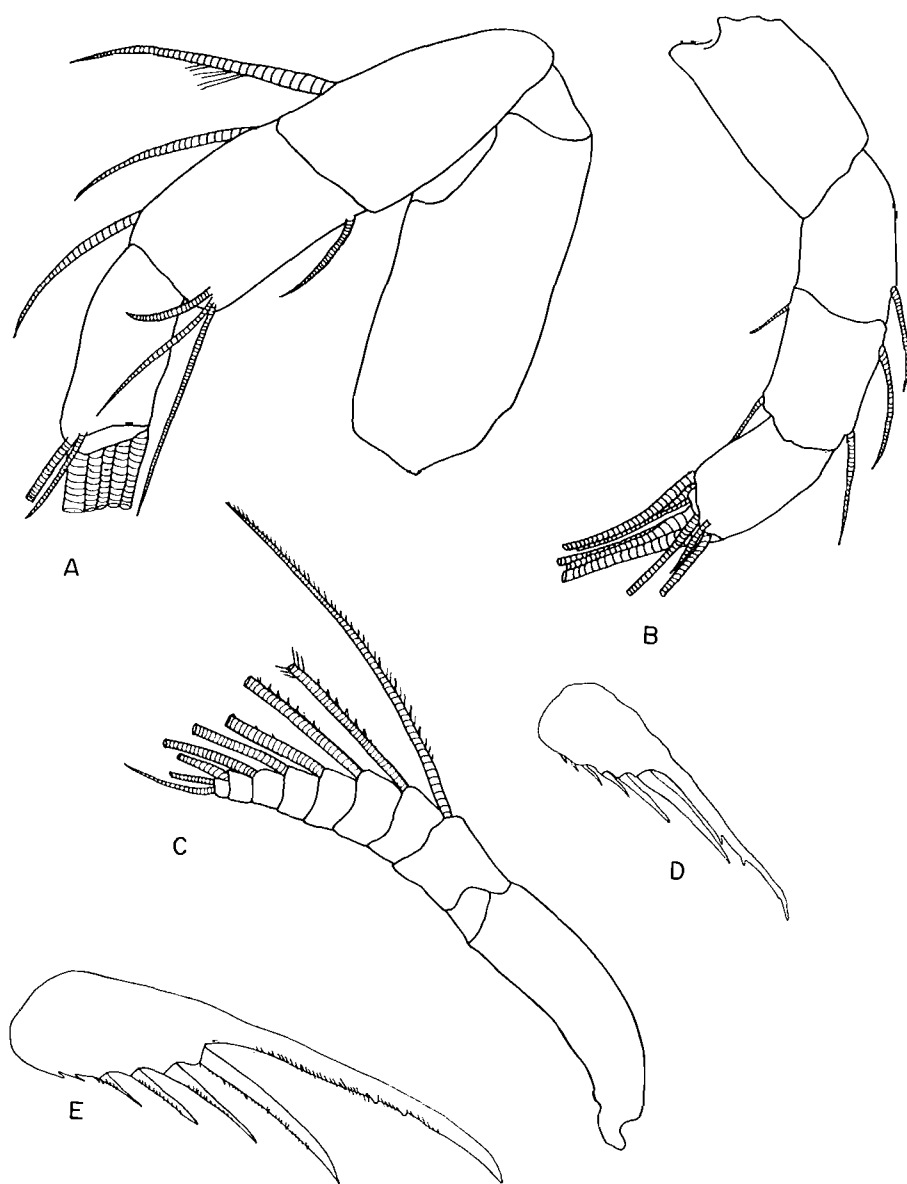


FIG. 80.

*Sarsiella costata* Kornicker, new species (Female).

- A. First antenna. Specimen No. CP52-19.
- B. First antenna. Specimen No. CP38-8.
- C. Second antenna. Specimen No. CP38-8.
- D. Furca. Specimen No. CP38-8.
- E. Furca. Specimen No. CP52-19.

Note: Specimen No. CP38-8 is young instar.  
Specimen No. CP52-19 is mature.

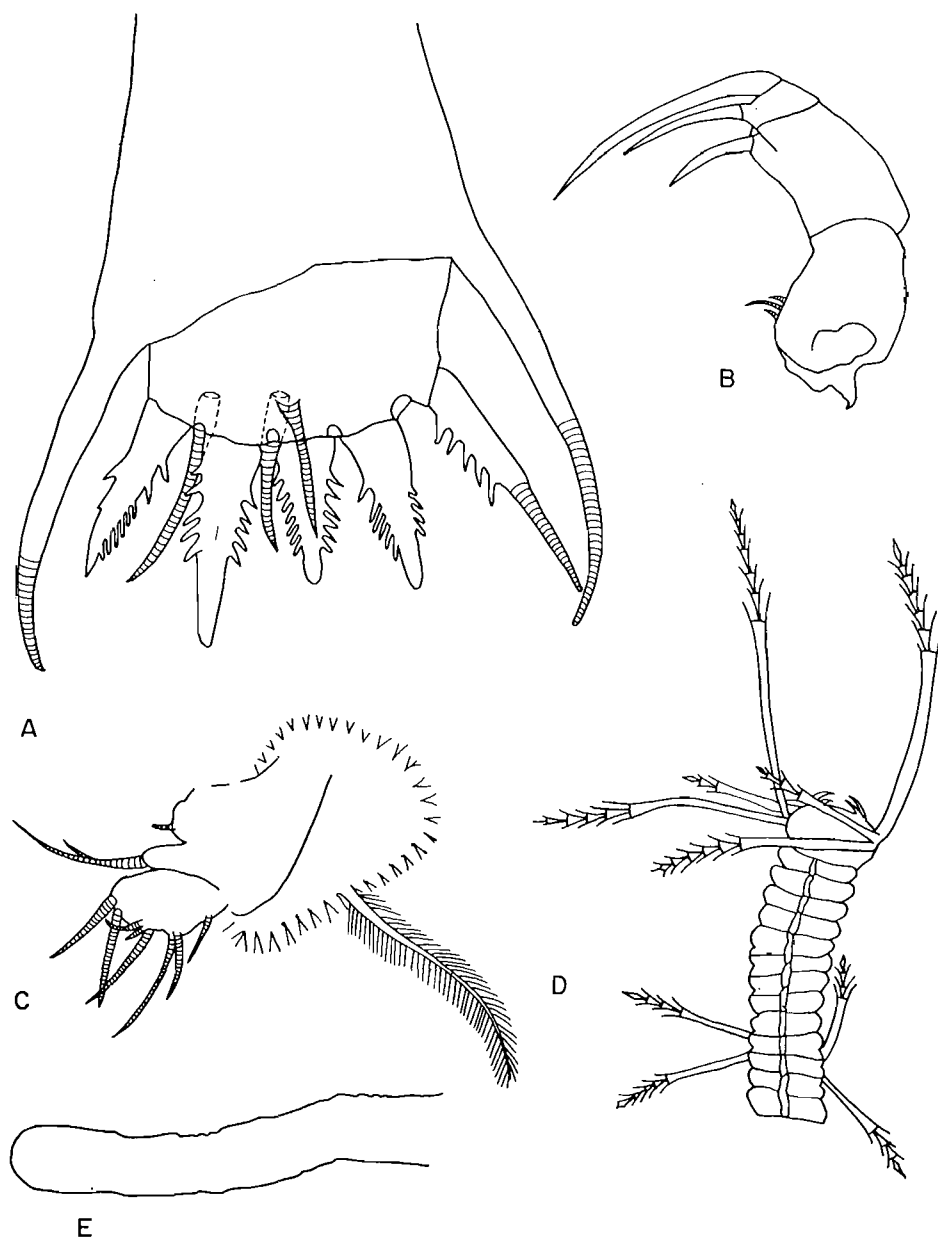


FIG. 81

*Sarsiella costata* Kornicker, new species (Female).

- A. Maxilla. Specimen No. CP38-8.
- B. Mandible. Specimen No. CP38-8.
- C. Fifth limb. Specimen No. CP38-8.
- D. Seventh limb. Specimen No. CP52-19.
- E. Seventh limb. Specimen No. CP38-8.

Note: Specimen No. CP38-8 is young instar.

Specimen No. CP52-19 is mature.

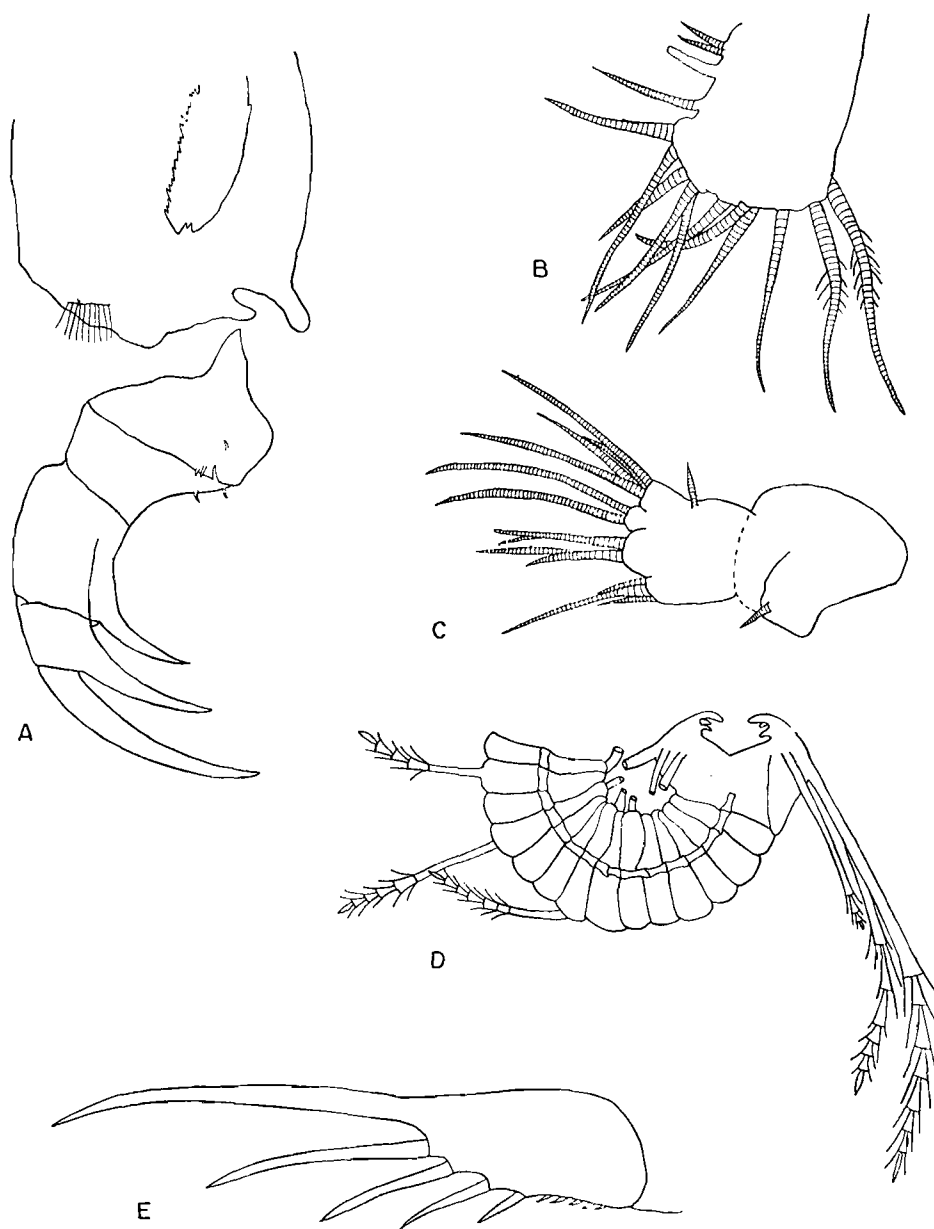


FIG. 82.

*Chelicopia arostrata* Kornicker, new genus, new species (Female).

- A. Mandible. Specimen No. CP38-16.
- B. Sixth limb. Specimen No. CP38-16.
- C. Fifth limb. Specimen No. CP38-16.

*Sarsiella sculpta* Brady (Female).

- D. Seventh limb. Specimen No. 177-1.
- E. Furca. Specimen No. 177-1.

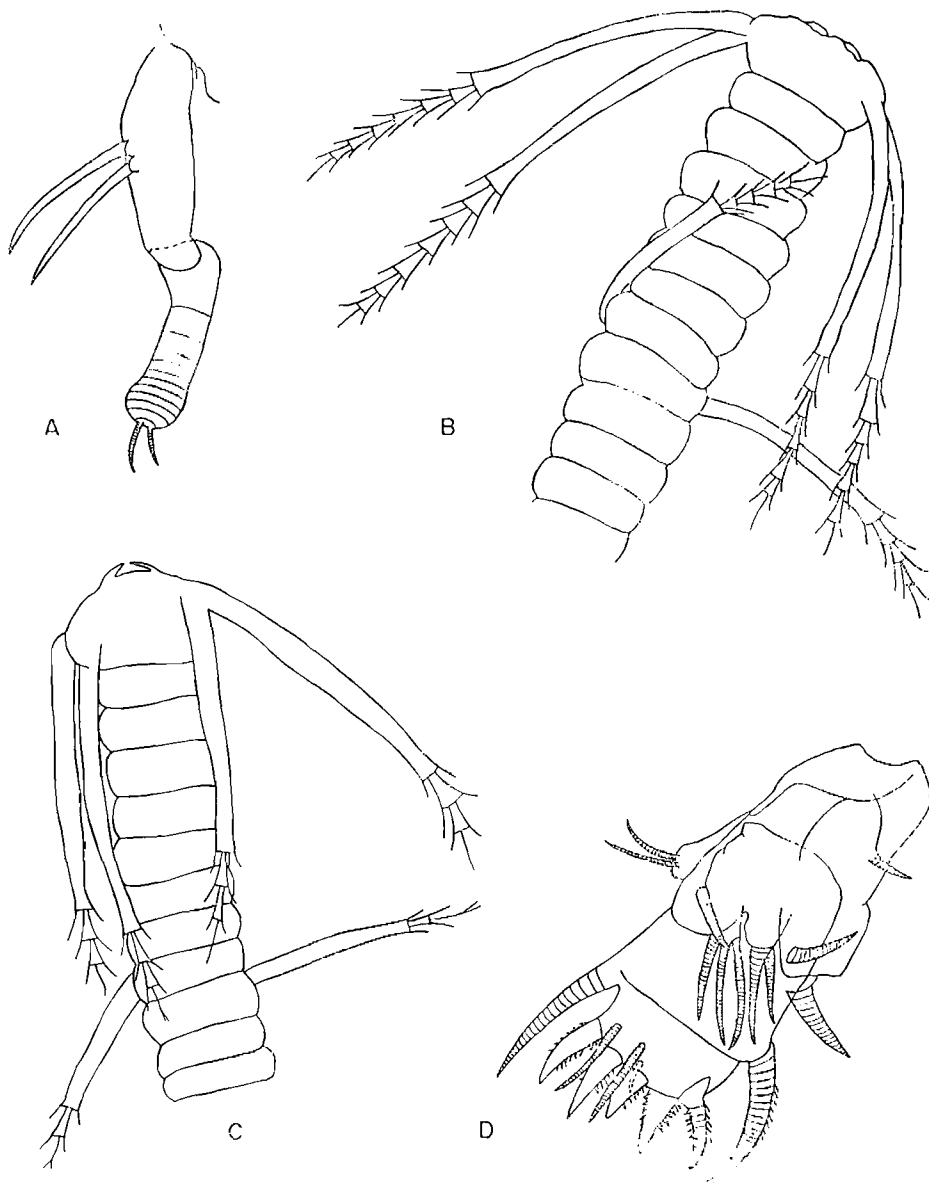


FIG. 83.

*Chelicopia arostrata* Kornicker, new genus, new species (Male).

A. Secondary branch of second antenna. Specimen No. 118A-1.

B. Seventh limb. Specimen No. 118A-1.

*Chelicopia arostrata* Kornicker (Female).

C. Seventh limb. Specimen No. CP38-16.

D. Maxilla. Specimen No. CP38-16.



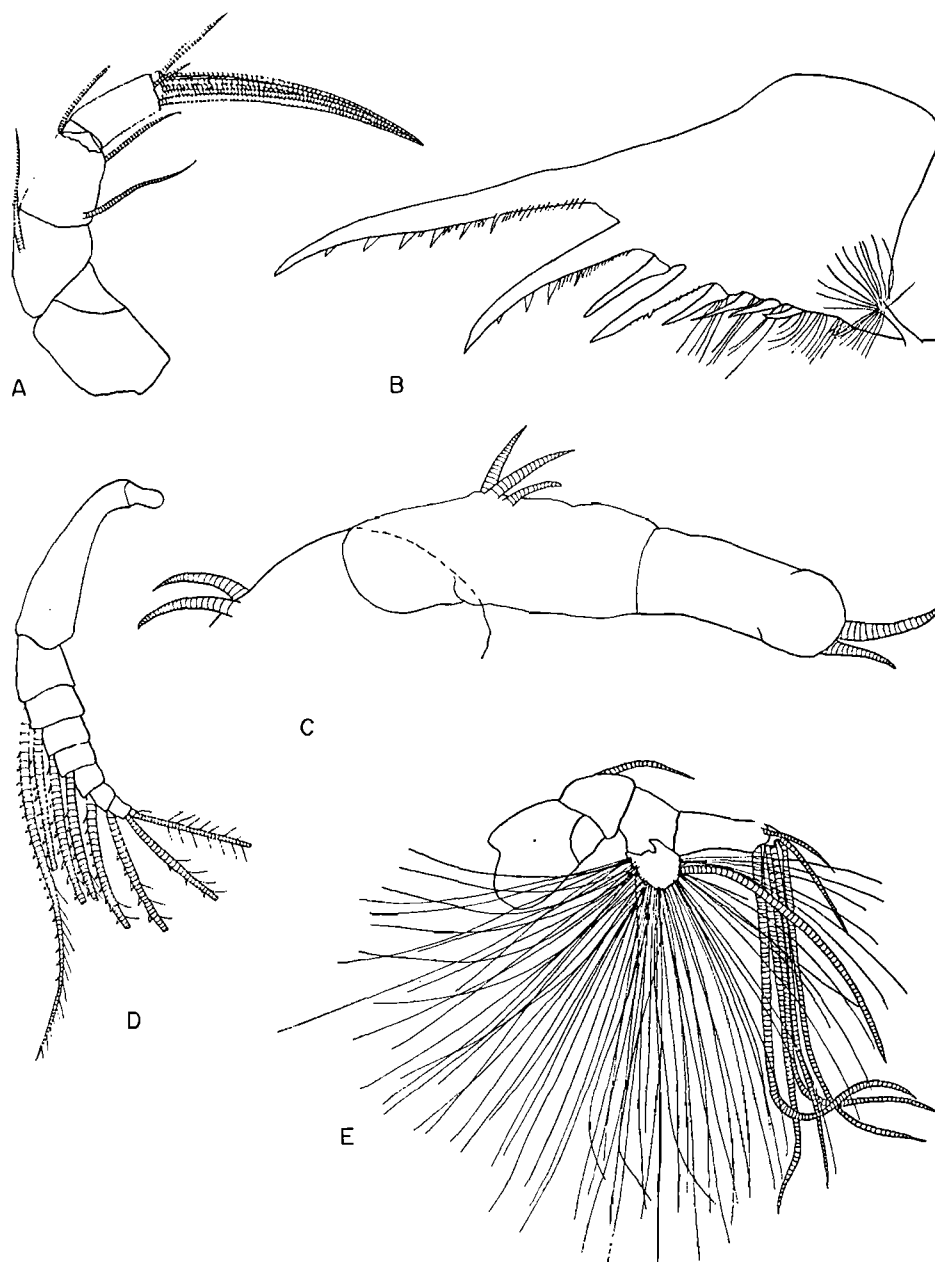


FIG. 84.

*Chelicopia arostrata* Kornicker, new genus, new species (Female).

A. First antenna. Specimen No. CP38-16.

B. Furca. Specimen No. CP38-16.

C. Secondary branch of second antenna. Specimen No. CP38-16.

D. Second antenna. Specimen No. CP38-16.

*Chelicopia arostrata* Kornicker (Male).

E. First antenna. Specimen No. 118A-1.

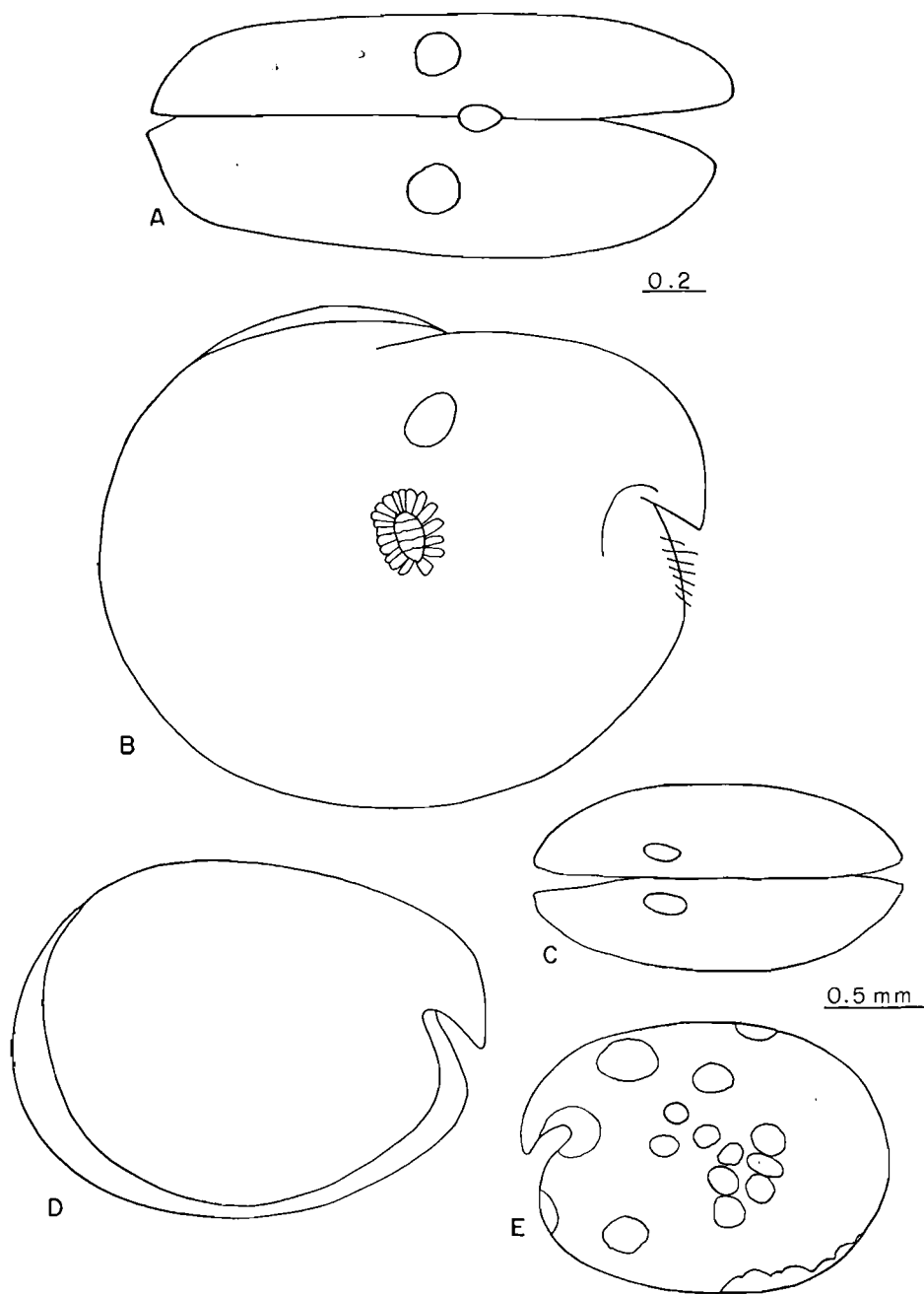


FIG. 85.

*Cycloberis biminiensis* Kornicker, new species

A. Dorsal view. Specimen No. 177-1.

B. Lateral view showing muscle scar. Crease on dorsal edge occurred after death. Specimen No. 177-1.

C. Dorsal view. Specimen No. 156-1.

D. Lateral outline. Specimen No. 177-2.

E. Lateral outline. Specimen No. 156-1. Spots on shell occurred after death.

Note: The shells of the species are soft and the above figured shells are somewhat misshapen.  
 Figures with similar magnification, A, B, D; C, E.

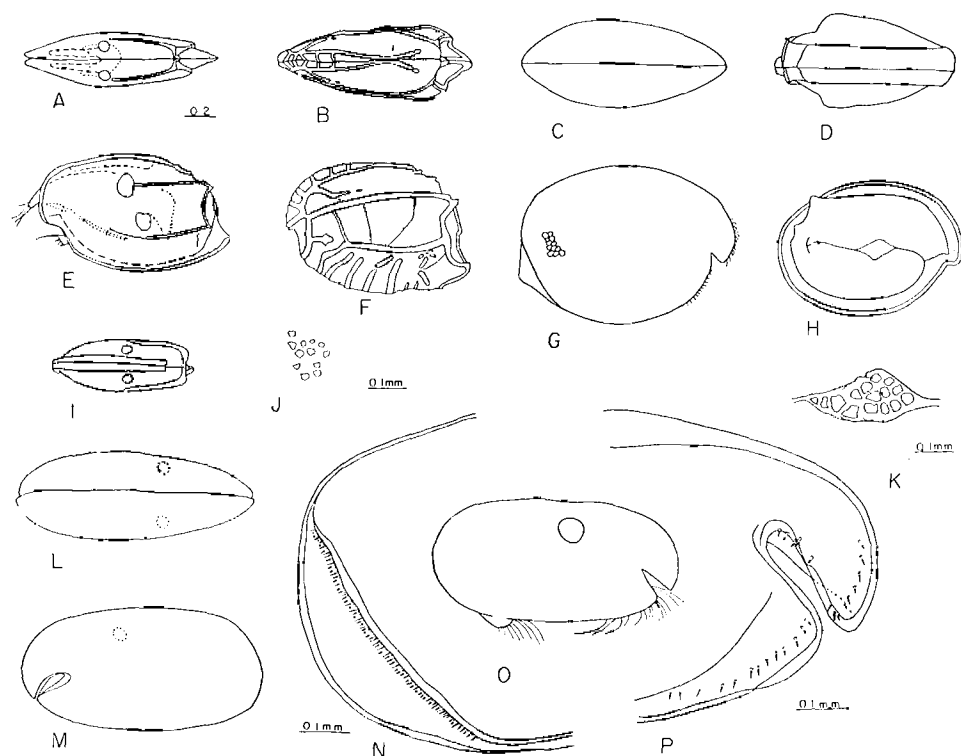


FIG. 86.

- A, E, I. *Philomedes lomae* (Juday), male. A, Dorsal view (shell slightly tilted anteriorly); E, side view. Specimen No. CP52-12. I, Dorsal view Specimen No. CP-3.
- B, F, J. *Rutiderma (Rutiderma) donochelata* Kornicker, new species, female. B, Dorsal view; F, Side view; J, Surface pits. Specimen No. 91-1.
- C, G. *Rutiderma (Alternochelata) polychelata* Kornicker, new subgenus, new species, female. C, Dorsal view; G, Side view. Specimen No. 110F-2.
- D, H, K. *Asteropteron monambon* Kornicker, new species, female. D, Dorsal view; H, Side view; K, Detail of central boss. Specimen No. 243-1.
- L, M, N, O, P. *Asteropina setisparsa* Kornicker, new species, female. L, Dorsal view; M, Side view. Specimen No. 127-G1. N, Inside view posterior end. P, Inside view anterior end. Specimen No. 122D-1. O, Side view. Specimen No. 246-3. Figures with similar magnification, A-I, L, M, O; J, K; N, P.

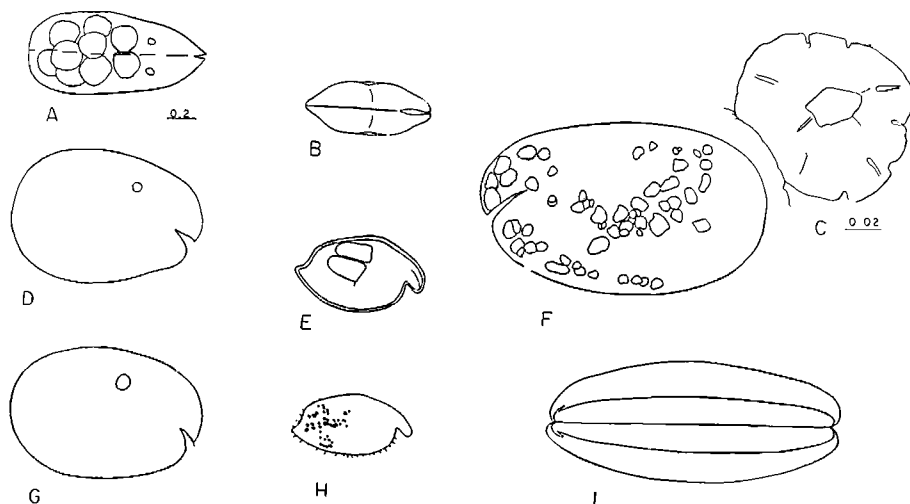


FIG. 87.

- A, D, G. *Asteropina mulleri* (Skogsberg), female. A, Dorsal view showing eggs; D, Side view. Specimen No. CP5-1. G, Side view. Specimen No. CP5-3.
- B, E, H. *Philomedies paucichelata* Kornicker, new species, female. B, Dorsal view; E, Side view (outlined areas on shell are slight depressions). Specimen No. 288-1. H, Side view. Specimen No. 156-7.
- F, I, C. *Asteropina extrachelata* Kornicker, new species, female. F, Side view (internal occurred after death); I, Ventral view with valves slightly parted; C, Detail of an internal mark. Specimen No. 118-1. Figures with similar magnification, A, B, D-I; C.

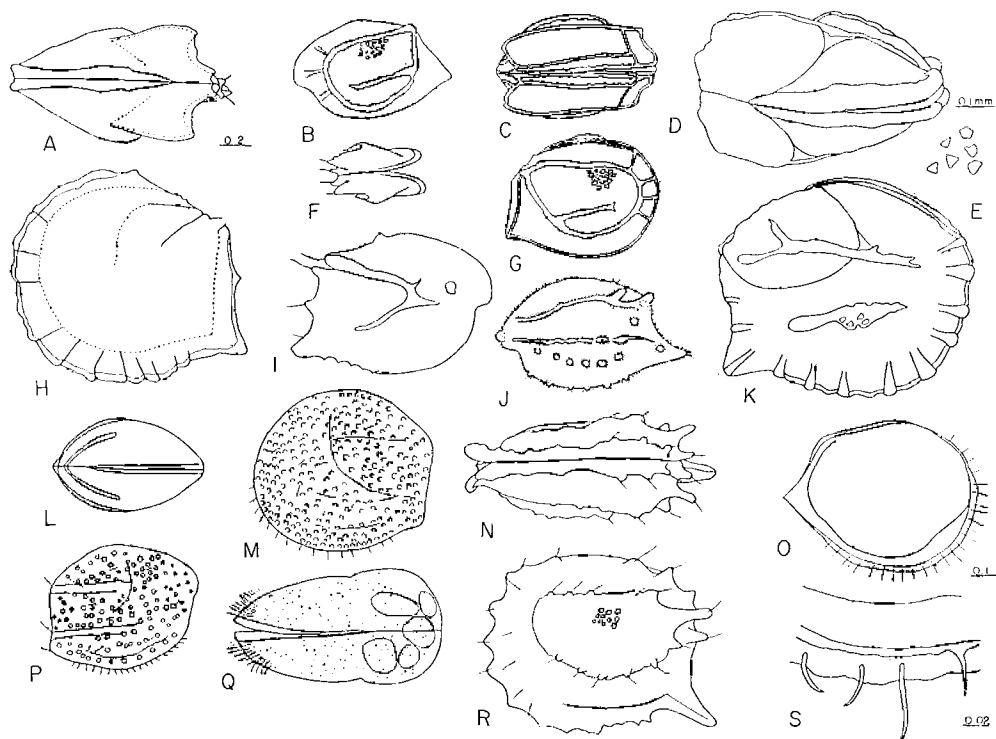


FIG. 88.

- A, F, H, I. *Sarsiella gigacantha* Kornicker, new species. A, Dorsal view; H, Side view. Specimen No. 190-1A (female). F, Dorsal view with valves partly open (sketch); I, Side view. Specimen No. 122D-2 (male).
- B, C, G. *Sarsiella costata* Kornicker, new species. B, Side view. Specimen No. CP52-7 (male). C, Dorsal view; G, Side view. Specimen No. 156-2 (female).
- D, K, E, O, S. *Sarsiella sculpta* Brady. D, Dorsal view slightly tilted; K, Side view; E, Detail of surface pits. Specimen No. 127-1 (female). O, Inside view of left valve; S, Detail of antero-ventral edge. Specimen No. CP38-8 (female).
- L, M, P. *Sarsiella punctata* Kornicker, new species, male. L, Dorsal view; P, Side view. Specimen No. 119A-1 (male). M, Side view. Specimen No. CP38-9 (female).
- J, N, R. *Sarsiella carinata* A. Scott, male. J, Side view. Specimen No. CP52-23 (Male). N, Dorsal view; R, Side view. Specimen No. 686X-2.
- Q. *Sarsiella truncana* Kornicker, new species. Q, Dorsal view showing internal eggs. Specimen No. CP52-21 (female). Figures with similar magnification, A-D, H-N, P-R; E; O; S.

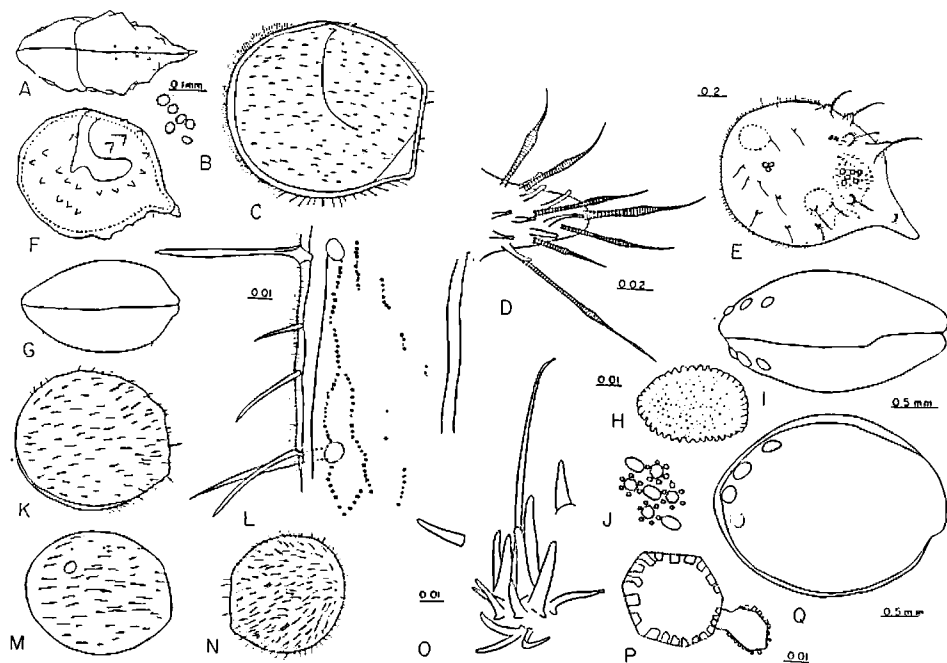


FIG. 89.

A, B, D, F, O. *Sarsiella capillaris* Kornicker, new species, female. A, Dorsal view; F, Side view; B, Detail of surface pits. Specimen No. 92-1. D, Shell hairs on posterior end of shell; O, Arrangement of clump of hairs on shell. Specimen No. CP38-10.

E. *Sarsiella carinata* A. Scott, female of immature instar. E, Side view. Specimen No. CP38-5.

C. *Sarsiella truncana* Kornicker, new species, female. C, Side view. Specimen No. CP52-21.

G, K-N. *Chelicopia atrostrata* Kornicker, new genus, new species. G, Dorsal view; K, Side view. Specimen No. 91-1. L, Inside view of detail of anterior edge (female). Specimen No. CP38-16. M, Side view (eye is bright orange). Specimen No. 118A-1. N, Side view. Specimen No. CP38-16.

H-J, P, Q. *Actinoseta chelisparsa* Kornicker, new species. I, Dorsal view; Q, Side view. Specimen No. CP38-2. J, Surface pits; H, P, Detail of surface pits. Specimen No. C-1. Figures with similar magnification, A, C, F, G, K, M, N; B; D; E; H, L, O, P; I, Q; J.