1967.

Pictured Key Nature Series

How To Know

THE MARINE ISOPOD CRUSTACEANS

George A. Schultz

Hampton, New Jersey

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Dubuque, Iowa

Sphaeroma walkeri Stebbing 1905

Serolis tropica Glynn 1976

Stegophryxus hyphalus

Synidotea berolzheimeri Menzies & Miller 1972

Synidotea acuta Richardson 1909

Synidotea spinosa anadyrensis Gurjanova 1955

Janiralata davisi Menzies 1951

Anilocra laevis Miers 1877

Alcirona insularis Hansen 1890

Lironeca menziesi Brusca 1980

Lironeca bowmani Brusca 1980

Aega deshaysiana (H. Milne Edwards, 1840)

Renocila thresherorum Williams & Williams, 1975

Aega plebia Hansen, 1897 (= A. magnoculis Rich. 1910)

Aega maxima Hansen, 1897

Parasymmerus annamaryae Brusca & Wallerstein

Colidotea findleyi Brusca, 1983

Edotea francesi Brusca, 1983

Calafia brevicornis Carvacho, 1983 (n.gen, n.sp.) } Asellota

Janatus villalobosi " " "

Ancinus daltonae Menzies & Barnard 1959

Anilocra meridionalis Richardson 1914

Aporobopyrus oviformis Shiino 1934

Arthrophryxus beringanus Richardson 1908

Cymodocella sp. Miller 1968

Colidotea findleyi Brusca & Wallerstein 1977

Cryptothir balani (Bate 1860)

Cortezura penascoensis Schultz 1977

Cassidinidea tuberculata Richardson 1912

Excirolana braziliensis Richardson 1912

Erichsonella cortezi Brusca & Wallerstein 1977

Holophryxus californiensis Richardson 1908

Holophryxus giardi Richardson 1908

Idotea (Pentidotea) kirchanskii Miller & Lee 1970

Janiralata davisi Menzies 1957

Munidion princeps Hansen

Munidion pleuroncodis Markham

Munidion cubense Bourdon

Munidion irritans Boone

Munidion longipedis Markham

Nerocila excisa Richardson 1914

+ Menzies & Glynn, 1968

+ Menzies & Kruczynski, 1983

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INTRODUCTION

This book was undertaken as an attempt to bring together for the amateur and the professional what is known of the systematics and distribution of marine isopod crustaceans from North America. There are 174 genera and 444 species recorded in the waters off the coasts of North America, and they are with few exceptions all included here. The book presents a key to all the genera and most species from North America. No such attempt has been made since 1905, or over 60 years ago, when the first "Monograph on the Isopods of North America" was made by Richardson. An attempt here is made to include all species found in North America in the book. Of course this is almost impossible in a book of this kind because some species are ill defined, others are not always made distinct from related species and certain species names are invalid. To straighten out the taxonomic tangles involved in such an assortment of species is difficult in itself so the book contains a treatment of the species as they are now defined and only the most obvious mistakes of the past are corrected. This should not reduce the usefulness of the book since it does provide a place to begin solving such problems.

An illustration of each species included is present with only a few exceptions. Species in very early times in the history of the study of animals were much more broadly defined than today's species are defined so when specimens are being compared to the illustrations discrepancies may be found. Also the places and depths at which specimens were captured were not as definite as is necessary for really good identifications, so range and depth differences must be revised by more work. Many of the old records are accurate and helpful today even though they are limited and without detail.

The taxonomic arrangement of species in the book is based on the latest available revisions in the literature. The list of genera included in the work can be considered a checklist of those genera found in North American waters, but the species list might not be complete.* A known genus that is not included in the present work was perhaps found to be a synonym or not to be really present in North American waters, because of the work of later workers. Many authors of genera during the first years of the study of isopods had

*See Reference of Menzies, R. J. and P. Glynn, p. 348.

a broad idea of what constituted a genus, and today one finds several genera under what was one old genus. Many New World species were considered to be in broadly defined Old World genera, and through revision by later workers they were placed in new exclusively New World genera.

The book contains what is essentially a key to the genera of marine isopods. The characters on which the genera were defined are used wherever possible in the key so that all species in a given genus will key out to that genus and thusly be separated from other genera. The generic key then should be valuable for other geographic regions aside from North America. The species for the most part have been only found in North America, and must be keyed out on the species characters that they have so there is only local significance to the species part of the key. It must be remembered that a species recorded from a certain place is likely to be found in the same area. It also, however, can be found north or south of the original location or anywhere that is similar to the original location in ecology even if the place is at a distance from the original location. Since a species usually can be expected to be found in or near the area where it has been found before, location can be a useful aid for the identification of a species. However, it is always necessary to consult some work which contains a morphological discussion of the species in question for a positive identification.

The author's wish was to construct a book useful for both the amateur and professional marine biologist and invertebrate ecologist. Most of the literature since 1905 on isopods was reviewed, and the newly described species and the range extensions and some new biological data were recorded and are presented here. Some species descriptions or records were perhaps overlooked by myself so it is necessary for any serious student to search the literature himself before concluding that everything is known about the species in the group that he may have under study.

There are mistakes in this book for which the author makes no apology. They are the normal mistakes and oversights of other authors that have been repeated here since the book is not intended to be a complete revision of marine isopod crustacean systematics. They will be pointed out wherever possible. There are, however, other mistakes that were points overlooked by the author, for which he is willing to take full blame. However, the book should be very useful in spite of these limitations. The work was done using the library facilities of the American Museum of Natural History and the United States National Museum.

CONTENTS

HOW IS AN ISOPOD DIFFERENT FROM OTHER ARTHROPODS AND CRUSTACEANS?

The phylum Arthropoda contains the largest number of species of any phylum in the animal kingdom. Arthropods include all animals that have a hard exoskeleton and jointed appendages. Insects and spiders are common arthropods and represent two classes of that phylum. The crabs and shrimp are also common arthropods; however, they are not in the same subgroups as insects or spiders. They form a group of equal taxonomic rank to the spiders and insects, and are in the class Crustacea along with many other subgroups of Crustacea including isopods. In order to place an isopod crustacean in the proper place in the phylogenetic tree of the animal kingdom, it is a good idea to briefly review the relationship between the familiar arthropods that are closely related to the crustaceans then review the crustaceans that are closely related to the isopods. The relationship shown in Fig. 1 is discussed briefly here.

Insects make up the largest number of arthropod species and they are found on land. The most primitive arthropods were the trilobites which today are known only as fossils. The trilobites, one of the earliest known inhabitants of the earth, inhabited the ancient

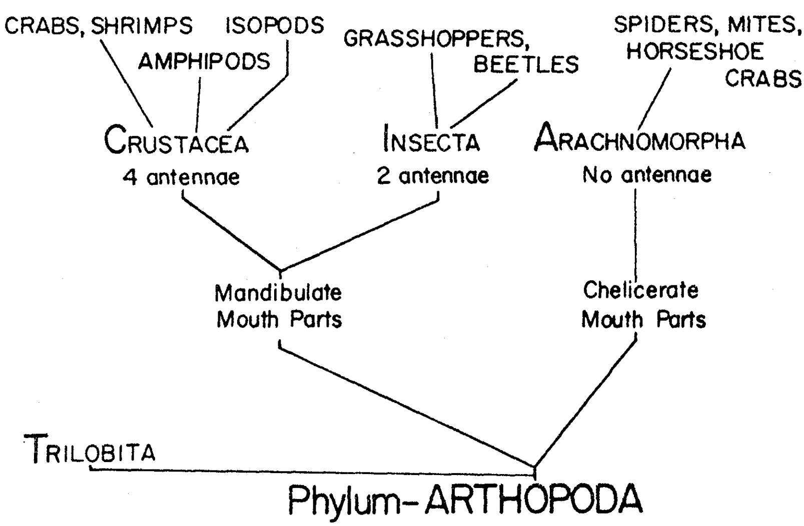


Figure 1. Evolution of the Phylum Arthropoda.

ocean bottom in deep and moderately deep water. The present day crustaceans evolved from the trilobites (Fig. 2) or from an ancestor that was very much like the trilobites in appearance. The crustacean species, which for the most part are inhabitants of the sea, also constitute a most primitive subgroup of arthropods. The spiders and insects are found almost exclusively on land today, but they also evolved from primitive marine ancestors. The crustaceans, however, for the most part remained in the sea, and many species evolved in the various ocean habitats just as many species of spiders and insects evolved in the various terrestrial habitats. Most crustaceans have remained in the sea, but there are freshwater forms apparently derived from marine species found in the near shore habitats, and which invaded the brackish water of river mouths and evolved in the habitats in rivers and lakes where they are found today.

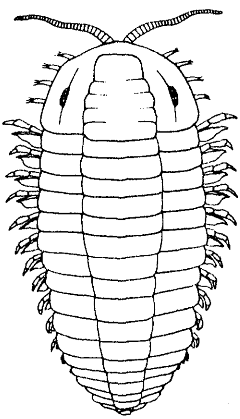


Figure 2. A trilobite, found only as a fossil. There is very little differentiation of the cephalic appendages towards being mouth parts.

There is a terrestrial group of isopods, probably the most successful terrestrial crustaceans other than land crabs and some tropical amphipods, that has invaded the land. They form the suborder Oniscoidea. Terrestrial isopods have become well adapted to land where they have evolved a hard, calcareous exoskeleton which protects the isopod from the drying power of air. They will be the subject, along with the freshwater species, of another "Picture-Key Nature Series" book. The crustaceans have evolved calcareous exoskeletons; whereas, the insects and spiders have evolved chitinized coverings with a wax coating that protects them from desiccation.

The spiders are more widely different from the insects than are the crustaceans. Spiders and their relatives have the cheliceral appendages of the mouth parts well developed instead of the mandibular mouth parts (Fig. 3). The chelicerae are usually developed as piercing structures, and the mouth parts as a whole are modified for piercing and sucking. In most crustaceans and insects the mandibles are well developed, and are generally modified for biting, so that even if it were not for the other obvious differences, the isopods would not be confused with the insects.

The crustaceans and insects each have specialized sensory appendages, the antennae, which are lacking in the spiders. The insects have only one pair of antennae and the crustaceans have two pairs. The type or principal mouth parts of the animals and the absence or presence of antennae are not the only differences that

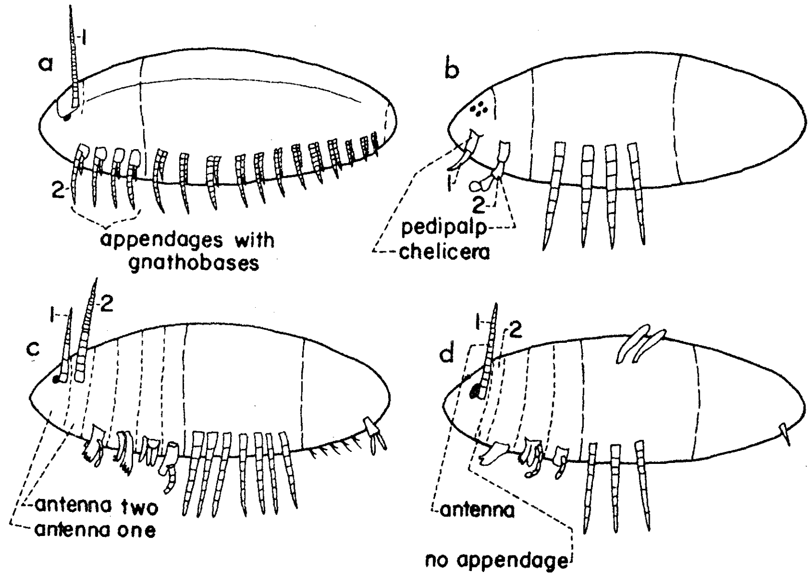


Figure 3. The cephalization of some Arthropoda compared. a. Trilobita. b. Arachnomorpha. c. Isopoda. d. Insecta.

set the spiders apart from the insects and crustaceans, nor are the presence of one pair of antennae only in the insects and two pairs in crustaceans the only difference between the groups. These differences and similarities are what are called key differences of key characters—differences that can be used to "key out" or identify the different groups. More will be said about key characters and other characters later (p. 41).

HOW IS AN ISOPOD DIFFERENT FROM OTHER CRUSTACEA?

There are many different kinds of crustaceans and isopods are only one large group of a large number of groups of crustaceans. The isopods are generally considered to be in the subclass Malacostraca, or the higher crustaceans, rather than in the lower crustaceans (several different subclasses). The Malacostraca are supposed to be composed of animals like the crabs and shrimps and isopods that are phylogenetically more advanced (they exploit more habitats and have more defined species) than the lower crustaceans. The crabs and shrimps (the Decapoda—key character 10 legs) are considered phylogenetically the highest developed superorder of Malacostraca--the Eucarida. The other superorders of

Malacostraca that are most closely related to the Isopoda are the Syncarida, the Pancarida and the Peracarida which are generally considered to be related according to the phylogenetic arrangement shown in Fig. 4.

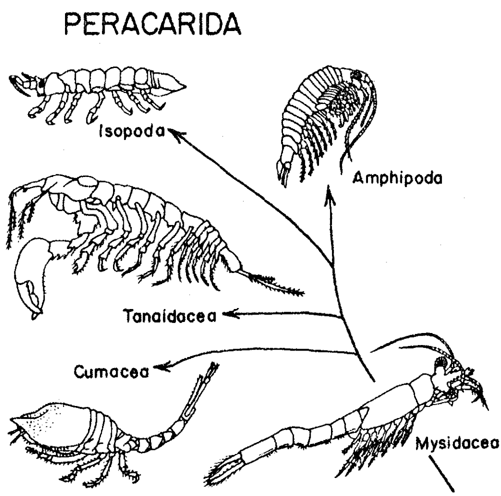
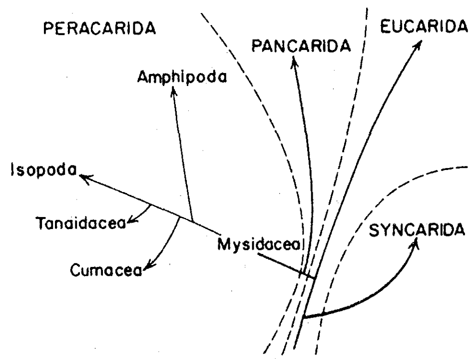


Figure 4. Evolution of the Malacostraca (After Siewing).

Only the Peracarida will be discussed briefly here because the other groups are only indirectly related to the isopods, each being on its own branch of the phylogenetic tree. The Peracarida, the superorder that contains the order Isopoda, is characterized by animals that have no carapace or only a small carapace. They have oostegites which are structures which enclose the cavity in which the eggs are laid and which form a brood pouch in the female where the young are hatched and reared until they are able to fend for themselves. The animals with the characteristic peracaridal characters are divided into five orders including the Isopoda, Mysidacea, Cumacea, Amphipoda and Tanaidacea. The isopods are considered to be phylogenetically the most advanced order of Peracarida. The phylogenetic relationship within the superorder is shown in Fig. 5 which also contains an illustration of a species of each order.

The animals that have been most frequently confused with the isopods are the amphipods which are frequently caught in the same habitats as isopods. However, the body of most amphipods is laterally compressed and the appendages are quite different. Amphipods are easily told from isopods in the fields because they normally have a smooth body that is curved as well as being later-



note: this differs from fig. 4 !

Figure 5. Evolution of the ~~superorder Peracarida.~~ Malacostraca

ally compressed. Amphipods frequently hop and have a characteristic swimming motion which is rarely associated with isopods. Other animals less frequently encountered with isopods are the almost exclusively planktonic marine mysids (comparatively long animals with a shrimp-like appearance and large stalked eyes), the bottom dwelling cumaceans (comparatively rare animals, in the near-shore habitats at least, which have a characteristic appearance, the anterior half being much longer than the thin tail-like posterior half) and the tanaids. The tanaids resemble the isopods so closely that they were formerly classified in the same order, and it was not long ago that they were separated and placed in a separate order near the isopods.

The order Tanaidacea which contains the tanaids is characterized by species which have the cephalon or head and the first thoracic or peraeonal appendage fused to form a small carapace. The species have a true chelate first appendage and multiarticulate uropodal rami (Fig. 6). These characters are never found in

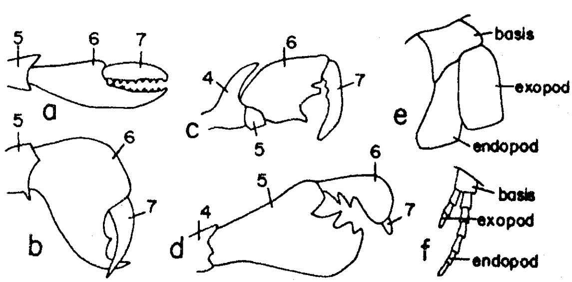


Figure 6. Types of chelipeds and uropods in some crustaceans. a. True chelipeds (Decapoda). b. True chelipeds (Tanaidacea). c, d. Subchelate peraeopods I (Isopoda). e. Uropods with rami of single segment (Isopoda). f. Uropods with rami multiarticulate (Tanaidacea). (See Fig. 29 also).

isopods. There are other differences, but these three if kept in mind will serve to separate the most closely related group, the tanaids, from the isopods. The tanaids are very abundant in near-shore habitats and are also found on the bottom in the deep-sea. They live, for the most part, in tubes and burrows and are many times

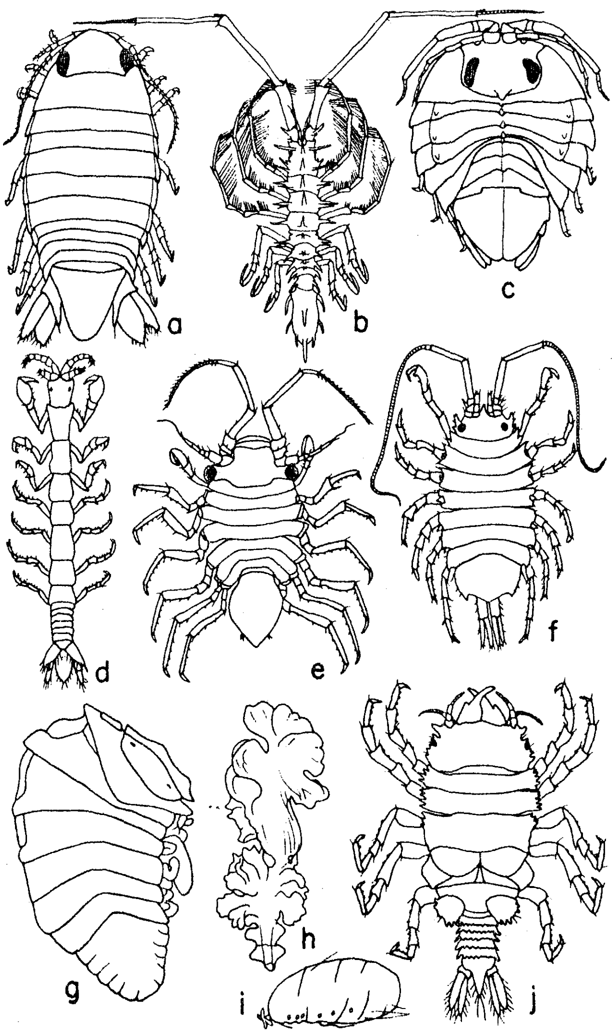


Figure 7. Examples of Isopods. a. *Cirolana* (Flabellifera). b. *Arcturus* (Valvifera). c. *Serolis* (Flabellifera). d. Anthurid (Anthuridea). e. *Munna* (Asellota). f. *Janiralata* (Asellota). g. *Bopyrina* (Epicaridea). h. *Cancrion* (Epicaridea). i. *Faba* (Epicaridea). j. *Gnathia* (Gnathiidea).

abundant in areas occupied by many different species of isopods, especially the anthurids. At times they are known to share the same burrows, and for the most part their general ecological preferences are known to be similar to those of isopods. It is no wonder that they were formerly classified with the isopods.

As is immediately apparent from a look at Fig. 7, the isopods are quite different from one another in general appearance although close inspection will show that they all have the same three body tagmata—the cephalon, the peraeon and the pleon. The three divisions are not apparent in the highly modified endoparasites, the entoniscids, and the highly modified cryptoniscids (Fig. 7h, i), but for the entoniscids the body is divisible into three body regions (Fig. 559). The tagmata are quite different in appearance in the different species, but they each have a very similar basic structure. Fig. 8 contains a picture of an archetype or primitive hypotheti-

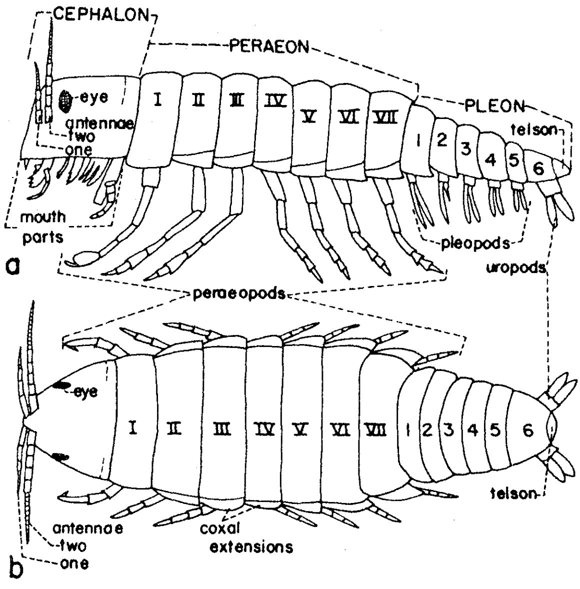


Figure 8. The archetype isopod with nomenclature of parts. a. Lateral view. b. Dorsal view.

cal isopod. It most nearly resembles a cirolanid, not a present day cirolanid, but what an early or primitive one might have looked like. The figure is a generalization or an extrapolation of what the ancient isopod might have looked like arrived at by determining the most primitive structures or forms of structures of many present day isopod groups.

The cephalon, or head, of the ancient species was apparently composed of fused segments. On trilobites and other primitive lower crustaceans the fusion of the cephalic parts had not taken place yet, and it was only after the fusion took place that the crustacean could begin to be called an isopod. Primitively the seven peraeonal segments with appendages were without any major differences, and the six pleonal segments plus a telson were free and without major differences also. As we shall see later some anthurids and bopyrids still retain many of the primitive features of the archetype species. With the exception of the sixth pleonal segment fused to the telson, the other general features of the archetype corresponds closely to the cirolanid isopod type. Terrestrial species are derived from a cirolanid-like ancestor and resemble the archetype or primitive isopod also. The phylogenetic tree of the isopods is shown in Fig. 9, and it serves to illustrate some fundamental

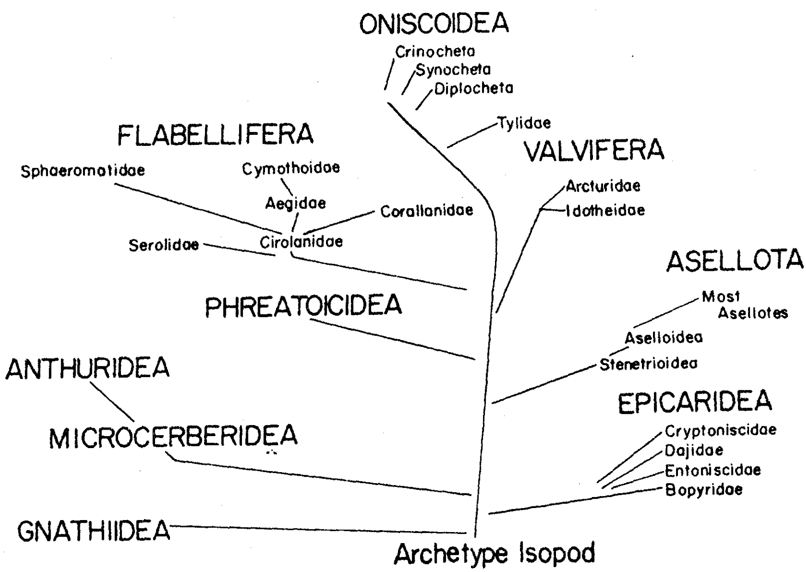


Figure 9. The evolution of the suborders of the order Isopoda (only major subgroups or families are shown).

morphological differences and similarities among major groups of isopods and the evolutionary steps are put in a time dimension. The key to the higher suborders of isopods begins on page 47, and is in part based on the archetype figure.

GENERAL ECOLOGY AND ECONOMIC IMPORTANCE

Marine isopods are of considerable economic importance to both the economy of man and the economy of nature. The role that isopod speices play in their respective habitats is generally that of reducer organism; i. e., they take the dead and dying whole organisms and parts of whole organisms and reduce them to smaller particles (Fig. 10). The isopods as a group are said to be omnivores because they eat both plant and animal matter. There are true herbivores (plant-eaters) as well as true carnivores (animal-

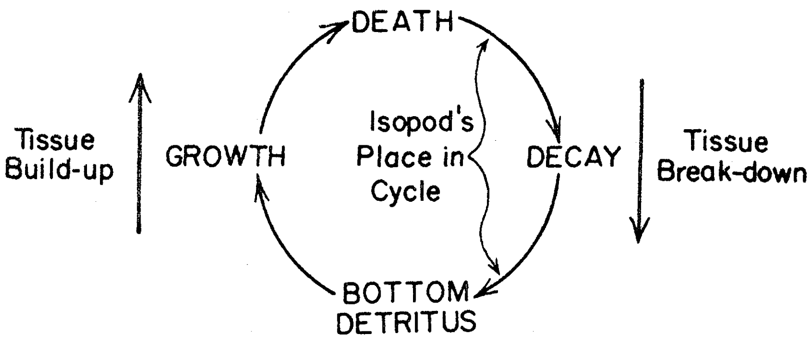


Figure 10. The place of isopods in the general scheme of organic turnover and energy flow in an ecosystem.

eaters) among the isopods, but they are few in number when compared to the total number of omnivorous (plant and animal) species.

The wood-boring species are probably the most economically important isopods to man because of their destruction of wooden marine structures that are placed in the sea and estuarian waters. The structures include wooden boats, wharves and piers and pilings that support bridges. No wooden structure is immune to isopod attack and much money is spent each year to replace the decayed pilings that once supported bridges and other marine structures and were weakened by the borings of the isopods. Much money is also spent on research on how to treat wood to prevent attack by the borers. Trees and shrubs that fall into marine water after storms and other natural causes also are soon subjected to attacks by wood-boring isopods.

The role in nature of the majority of other isopods is not so dramatic, at least not on the face of it, as is that of wood borers. However, in the overall economy of nature their combined role as reducer organisms is much greater than that of all wood borers combined. The isopod species are in one of the most important and little understood places in the general economy of nature, that of making smaller particles out of dead or decayed plants and animals. The role of many vertebrate organisms is well known and their contribution to the energy cycle of their ecosystems is at least superficially understood. The role of invertebrate organisms (e. g., crabs, insects and isopods) is not as well known however. That isopods are very important animals in the invertebrate ecosystem is an indisputable fact once their number in population and their number in species in the various ecosystems are known. They are among the most important and dominant organisms found on the bottom in deep and very deep parts of the ocean.

Isopod species constitute some of the most important scavengers of the ecosystem. Dead fish in the intertidal zone and in any part of the ocean for that matter, are soon reduced to small particles. First the particles serve as food for the isopods; then when the isopods excrete the residue, it is utilized by smaller organisms until it is finally reduced to chemicals that are utilized by the plants and which are eaten by animals (sometimes isopods) which eventually die and are eaten by the isopods. A large dead fish can be reduced to a skeleton in a few hours by a population of isopod scavengers. The isopods do not confine their scavenger habits to dead fish, but also eat other dead organisms including other crustaceans and plants. Certain of the isopod species confine their plant eating to particular plants. Some boring isopods confine their activities to particular species of algae. Some large brown algae, for instance, are destroyed because the isopods bore large numbers of holes in their holdfasts and the large algae become free and are washed away from where they originally grew (Fig. 11).

Many isopods eat animal and plant matter that has first been broken down by other animals. This is probably true of most deep sea species. They eat the particulate matter, dead plankton and other matter, which filters down from the open ocean and accumulates in large amounts on the bottom. The bottom mud and sand is strained through either modified mouth parts or the modified anterior peraeopods of particular species of isopods.

The mouth parts most frequently modified for straining food are the second maxilla (Fig. 38), although other mouth parts like the maxillipeds in gnathiids (Fig. 348) or the legs of arcturids (Fig. 49) can be so modified. Some species filter sea water and others filter their food from the bottom mud and sand. If the water from the sea is filtered, not only are small organic particles filtered from the water, but live planktonic plants and animals are filtered as well. The plankton is eaten alive in the near shore habitats, but in the deep sea it arrives only after dying or having been trans-

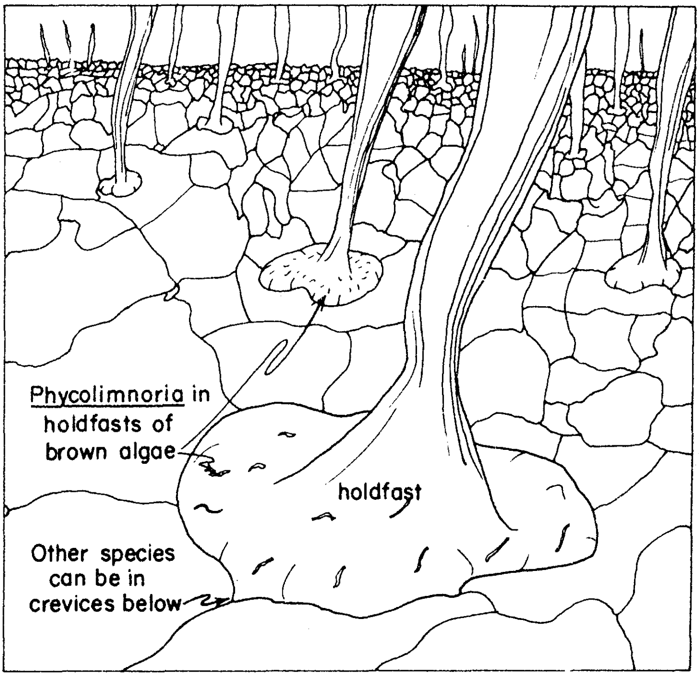


Figure 11. "Forest" of laminarian (brown) algae with large holdfasts penitrated by *Limnoria (Phycolimnoria)* species.

formed by other organisms into particulate matter which rains down from above and is either eaten directly or mixed with the bottom mud and sand which is then filtered by the isopods. Isopods are of course not the only filter feeders in any environment, but they are one of the most numerous and important groups of filter feeders. Some isopods live on top of the mud and sand (general benthic species), some live in tubes (tubiferous species) and some burrow in the bottom (fossorial species). Some parasitic species are also found on the bottom where they apparently spend time between bottom fish hosts.

Parasitic isopods play their part in influencing the lives of their hosts which include fish and other crustaceans including other isopods. The fish that are parasitized by the isopods include many economically important species. Some bottom fish, haddock, halibut, flounders and skates, are parasitized by one group of isopods. They (e. g., *Rocinela* spp.) are temporary or non-obligate parasites for the most part. They are found apparently free living on the bottom when they are not found on fish hosts. Apparently they can easily make a transfer from one host to another since they live on the bottom with the fish hosts.

There is another group of isopod parasites of fish of the near-shore and open sea. The species are found on jacks, tuna and sharks. Their attachment to the host fish is permanent and many times they are found inside the mouth and/or the throat cavity of the host fish (Fig. 12i). Although they can live without being attached to the host, they are rarely found unattached and soon

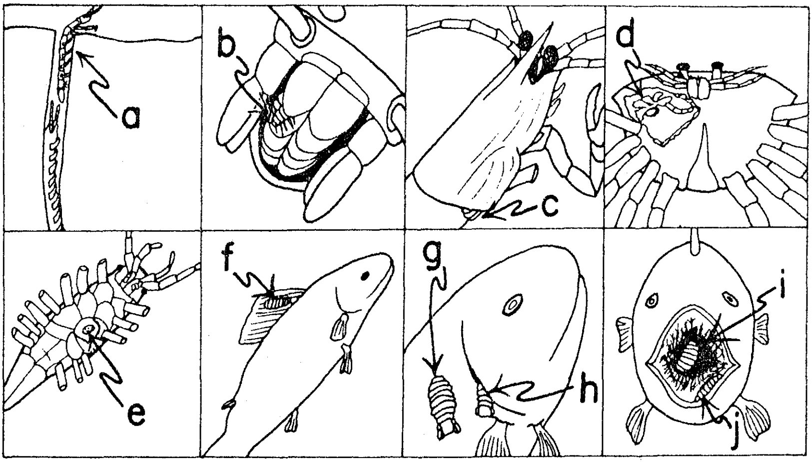


Figure 12. Different types and degrees of parasitism by isopods. a. Living in burrow of another animal. b. Living on other isopod (*Iais* species on pleopods of sphaeromatid). c. Bopyrid in branchial cavity of shrimp. d. Entoniscid (a true endoparasite) in body cavity of crab. e. Cryptoniscid in marsupium of another isopod. f. Cirolanid on fin of fish. g. Ectoparasite on skin of fish (Aegid). h. in the gill slit. Parasite in throat of fish. j. Parasite on lip of fish.

reattach themselves if they are detached. The isopods never directly kill their fish host, at least not average or strong hosts, but they probably have some influence on the regulation of numbers of the host fishes.

The isopods that inhabit the body of other crustaceans also apparently influence the numbers of their hosts. However, very little is known about the parasite-host relationship in regard to numbers. Occasionally as many as 50% of some crab populations in a given location are found to be parasitized by isopods, but it is rare to find the parasites in such a large percentage and they are usually found in less than 5% of the host population. The isopods are found as ectoparasites as well as endoparasites of the other crustaceans. Isopods with little body modification are found attached to the body of their crustacean hosts. If the isopods are found within the body of the host, mainly the internal cavity of crabs (haemocoel), they are greatly modified (Fig. 12d). The external, branchial cavity parasites, are usually indicated by a bulge or distortion of the body of the host (Fig. 12c). The endoparasites rarely distort the body of the host and are usually only found to be present by the presence of a small hole leading to the body cavity of the crab.

An interesting aspect of the isopod parasites is that they are able to affect the sex, and sexual development of their crustacean hosts. A host is of one sex and it can be changed to the opposite sex by the presence of an isopod parasite. Often the complete sexual identity of the host crustacean is destroyed when parasitized by an isopod. This is called parasitic castration. There is also evidence that the sex of the juvenile is influenced according to whether or not it remains on the host and also by the sex of other isopod parasites on the same host. The chemical or hormonal processes involved are not well understood and the subject must be studied further.

Since isopods which are parasites on other crustaceans are much more modified morphologically than isopods that parasitize fish, they are most probably phylogenetically much older than the parasites of fish. In some groups like the gnathiids only the juveniles are fish parasites. Some isopods are parasites on other isopods. Certain species are found exclusively within the burrows of other species and are apparently commensal with them (Fig. 12a). Commensal means that they share the food of the host in one way or another. Other species are found exclusively among the pleopods of larger isopods. *Iais californica* is thought to live exclusively among the pleopods of *Sphaeroma pentodon,* for instance (Fig. 12b). It almost always is found in its burrows if not on the sphaeromatid itself. Another parasitic species is found in the marsupium of the female of a free living isopod species (Fig. 12e). At first glance it looks just like another egg, but on closer examination it is an egg mass itself or really a female parasitic isopod sometimes with a male attached. Other species are attached to the host and appear to be only an egg mass (Fig. 548).

GEOGRAPHIC DISTRIBUTION OF ISOPODS AND SOME ASPECTS OF THE HISTORY OF THEIR STUDY

The geographic area covered by this book on marine isopods includes the waters around the continent of North America beginning in the north with the Arctic Sea and extending to Panama (Map, Fig. 13). The eastern boundary is Greenland and the western most of the Aleutian Islands forms the western boundary. No

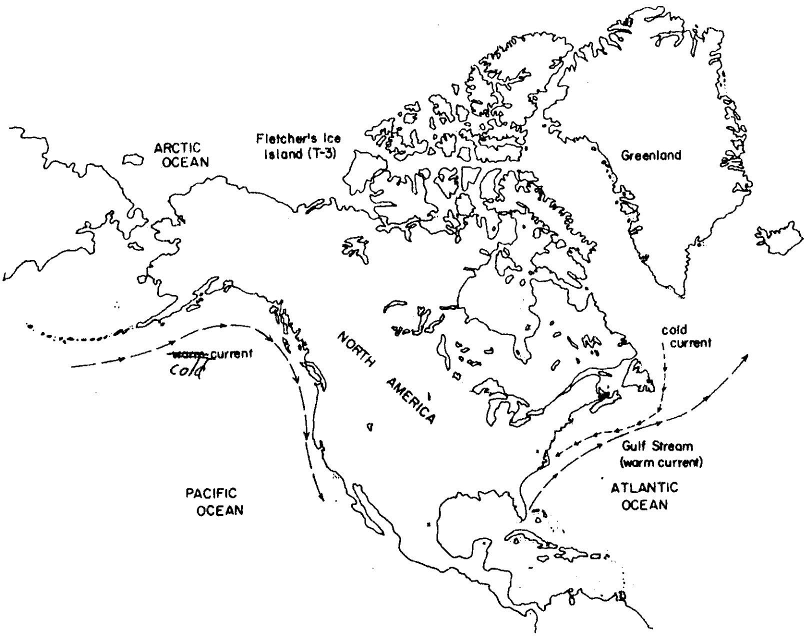


Figure 13. Map of region included in the book. Some ocean currents that influence isopod distribution are shown.

Hawaiian or open ocean species near Hawaii are included, but some species found far from the coast of western United States, Mexico and Central America are included. Species are recorded that were collected in the Arctic Sea from the ice island T-3 or Fletcher's Island, and some were collected along the northern coast of Alaska. Specimens have been collected north of Thule, Greenland, in the body of water that separates that island and North America proper. Other specimens were taken in the deep sea at about the same latitude as the southern tip of Greenland.

Specimens have been recorded from the Atlantic Ocean off North America from relatively long ago, but one of the first series of collections was made about the turn of the century by the steamer *Albatross*. The voyage of the *Albatross* included taking some specimens from the Gulf and Caribbean region. Other expeditions made collections in Bermuda, and some recent collections were made in southeastern United States.

The *Albatross*, in several voyages, sailed from northern United States through the newly opened Panama Canal along the Pacific coast to Alaska and the Aleutian Islands. The early collections made on the Pacific coast are thus as extensive in far from shore species as are those on the Atlantic coast. The collections were extensive in the Aleutian Islands and the Bering Sea since the *Albatross* expedition to the region was made after the purchase of Alaska as the first floral and faunal study.

Most early collections made in colonial times in North America were sent to Europe and were described by the European scientists. Several of the earliest collections made in the United States were made on the New Jersey coast at Egg Harbor, by the American naturalist Thomas Say in the early 19th century (1818). He was associated with the Academy of Natural Sciences founded in part by Benjamin Franklin in Philadelphia. The more recent near shore collection locations are found near the marine laboratories that were established. The marine laboratory established in the late 19th century at Woods Hole on the southern Massachusetts coast was the collection location for many species of isopods. Extensive work was also done at the Hopkins Marine Laboratory in Monterey Bay in the late 1800's and early 1900's. More work was done at Scripps Institute for Oceanography at La Jolla, and by the Allan Hancock Foundation, both in southern California. Other individuals made extensive collections from the near shore habitats on the mid- and southern California coasts in more recent times.

Many near-shore species were described from the Pacific coast and the number exceeds that of the species described from the Atlantic coast. Few collections were made in the Gulf and Caribbean regions of eastern North America. Much work remains to be done on tropical isopod distribution. The number of species recorded on the east coast of North America perhaps will exceed the number from the west coast when the eastern tropical region is studied. The southern boundary of the region covered in this book is Panama where some collections were made at about the time that the canal was opened. It extends east to Trinidad where only a few collections were ever made. Some northern South American forms, namely some from Guyana (British Guiana), are included because they are of some interest since they will probably be found in other parts of the West Indies region.

The geographic habitats where collections were made in addition to being divided into eastern and western coasts are roughly divisible into marshes, brackish water estuaries, near shore intertidal and shallow water areas, continental shelf and deep sea. There is no rigid distinction made between the regions because the people who made many of the early collections did not always make a very clear reference to the places and the depths at which their specimens were collected. More about the specific ecology of where species were found is included in the "Where to Look for Marine Isopods" section.

An interesting aspect of the distribution of isopods is the way that some marine species are distributed in freshwater habitats.

Map (Fig. 13) has "X's" on it where certain members of the family Cirolanidae were found. The species are blind and found in fresh-water in caves. If one draws a line connecting the points, what is geologically the boundary of an ancient sea is revealed. The species were apparently found on the edge of the sea as are most cirolanids today. When the sea retreated and the shore line changed, they remained as the inhabitants of caves that soon became fresh-water habitats and there they remain today.

One of the most important things to keep in mind when studying the distribution of isopods is the local peculiarities in climate, depth and water currents and other geographic features. They distort what would be an otherwise perfect picture of north-south, low water-deep water, etc., distributional pattern. Thus isopods, both deep water marine and near shore species are regularly found further north on the Pacific coast with its south flowing current (it originates in tropical Asian waters), than the species on the Atlantic coast with the south flowing current (the cold Labrador current). Subtropical species are found further north (to North Carolina at times) because of the warm water of the Gulf Stream on the south-eastern coast of United States. Another interesting aspect of geographic distribution correlated with temperature and depth is that species found in very deep water locations in tropical regions are sometimes found in shallow water in northern locations. As one goes from the shore to deeper waters in the tropics, the water gets colder and it is ecological similar to going north from the same location. The deep sea environment is almost uniform as far as temperature, light and salinity are concerned regardless of latitude or longitude, so species from the deep sea are sometimes wide-spread and found in more than one ocean.

WHERE TO LOOK FOR MARINE ISOPODS

Marine isopods are found from the seashore to the deep sea floor (Fig. 14, 15 and 16). They are sometimes found in the marine drift or debris that accumulates above the beach. Isopods from the marine drift must be adapted to withstand periods of drying, although they are usually able to crawl around and hide during the dry periods in wet vegetation and sand. They are more abundant on rocky shores and are also found on shores where the for-

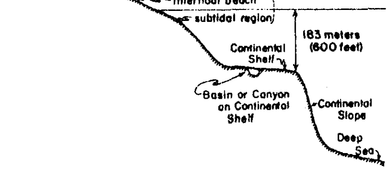


Figure 14. Profile of places where isopods are caught.

est or dense vegetation comes down to the shore itself as in the tropics. The leaves and grass that accumulate in tidal marshes also contain certain species.

In the sand of beaches several different species of isopod are found. One species is very tiny and lives in the cavities between the sand grains. Other species burrow in the sand much like some of the mollusca and small beach crabs. Still other species are found on top of the sand. On muddy or sand-mud areas of the bottom in shallow water where the environment is at least seasonally stable, there species are found that are elongate like worms and that have more or less permanent burrows in the substrate.

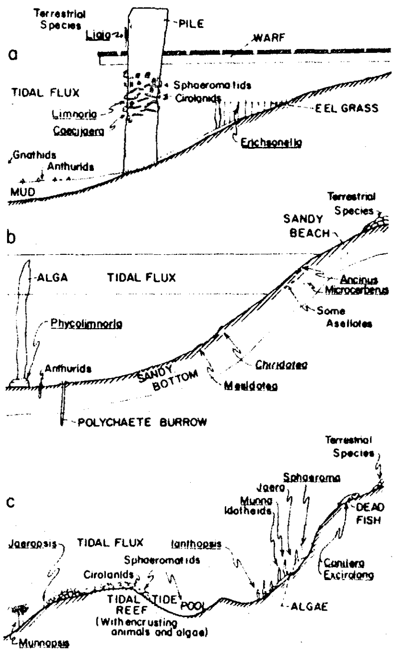


Figure 15. Isopod habitats. a. Common encrusting organisms on and in a wooden pile. b. In and out beyond sandy beach. c. On rocky beach with tide pool and reef.

Wherever there are plant and vegetable matter on the bottom of lagoons and bays and sometimes in the ocean itself, there are species that cling to and eat the live or dead vegetation. Any dead animals found there are also eaten by other species of isopods. It is not meant to imply that isopods are the only animals that perform the aforesaid functions, it only means that they are part of the animal group of many species which perform the functions.

Isopods are sometimes encountered in the surf of beaches and in the sargassum weed (an alga) that floats for long distances and is occasionally found in abundance on the southeastern North Atlantic and the Gulf coast of the United States. Sargassum is also found washed up on the shores of many islands of the West Indies. The surf of some tropical islands is the home of a cirolanid isopod that bites swimmers. The bites are not dangerous, but they can be quite annoying if many animals are biting. The open ocean, in general, either near-shore or far from land, is a very poor habitat for isopods. With few exceptions; e. g., *Anuropus* spp., the only planktonic isopods are parasites of fish or other crustaceans. They are mainly larval or juvenile stages of the parasitic adults. Most

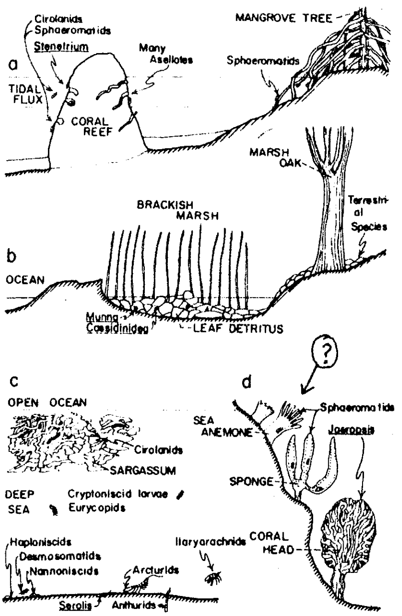


Figure 16. Isopod habitats. a. Coral reef and tropical shore. b. Woodland brackish marsh. c. Open ocean and deep sea floor. d. In and among hollow or colonial organisms.

isopods rear their young to juveniles in the brood sacs of the females, but the parasitic forms which undergo a great metamorphosis are free living and at times well represented in the plankton. The relations between the plankton, the isopod and the host animal are just beginning to be explored.

When man builds wharves, piers and jetties on marine coasts, he also makes habitats for many marine isopod species. Not only do the marine structures form refuges in themselves to shelter isopod populations, but they also attract plants and sessile animals such as algae and barnacles that themselves become the habitat for more isopods. In fact, it will be shown that many animals common in the marine habitats, especially those with large cavities either formed within the animal as a coelenterate or formed of colonies of animals such as sponges, can contain isopods, and in some instances the isopods are very specific in their choice of host although they are non-obligate parasites. This is also especially so in the coral habitat of the tropics and southern temperate regions of North America.

One of the most interesting isopod habitat is that which is found around and in a wooden piling. The many animals and plants that cling to the outside of the pile form habitats that contain several species of isopod. The pile itself serves as a substrate into which other species bore holes. Other species can share the burrows, and thus one wooden pile that has been in seawater for a time long enough to collect many encrusting animals and plants is likely to be the habitat of many species of isopod. On rock jetties that stick out into the marine water, there are other species of plants and clinging animals and usually other isopod species. Some species are even known to bore into concrete of the jetty, and of course into the natural stone of the right type on the marine shore. The calm water provided by the jetty and the sandy area of the protected beach are also habitats of particular species which are many times different than those of unprotected beaches.

Although isopods are rarely found in the open-sea, the deep-sea bottom is an environment where a very large number of isopods and isopod species are found. Of course it takes special equipment to collect there, but specimens are provided by an increasing number of deep-sea collecting expeditions. Knowledge of deep-sea species is essential for a complete understanding of isopod systematics and distribution, since they play such an important role in the ecology of the deep-sea bottom. As one collects further from the coast of the continent of North America, the first isopods are encountered in the near-shore habitats, next they are encountered on the continental shelf, isopods of the continental slope (the edge of the continental shelf) are next, and then the isopods of the deep-sea are encountered. In each of the geographic areas there are many isopods on the bottom in the sand and mud and they are generally divided into species of the near-shore, the shelf, the slope and the deep-sea. Most of the species from beyond the shelf are blind. In the deep-sea itself there are many different habitats from the Arctic seas to the tropical seas including all the temperate region between. However, the physical factors in the deep-sea are very uniform and there is not too much difference in the "climate" 2000 meters deep off Greenland or 2000 meters deep off northern South America near Panama. The bottom however can be mud, sand, rock or any of the protozoan oozes (purely or in any combination), and there are many different kinds of habitats possible.

One of the most abundant groups of species of isopods is composed of parasitic species. Isopods are parasitic on bony fish and sharks. They are also parasites on squid and perhaps on other large molluscs such as clams and octopuses. Crustaceans, including other isopods, are one of the most extensively parasitized groups of animals that serve as isopod hosts. The isopods are both endo- and exoparasites of fish and other crustaceans. They are found in the gill chambers and in the throat of fish and in the branchial (gill) chambers and among the posterior appendages of the crabs and other crustaceans.

Their presence can cause much distortion of the shape and damage to the host on which they are parasites. Many isopod parasites are also distorted in their own shape and are many times twisted along their major body axis when they are attached to or detached from their hosts. One group of parasites undergoes an even more radical change becoming almost unrecognizable as an animal let alone an isopod. They were only classified as isopods when their development and larval form were revealed. Isopods travel with the host animals; and, although most of their ancestors were marine species, they are sometimes found to be parasites on animals that move from the sea to brackish or freshwater.

A LIST OF PLACES TO LOOK FOR MARINE ISOPODS

Marine isopods are found in a wide variety of places and, except in rare instances, they are not usually abundant where they are found. One might look for many hours on a sandy or rocky beach before finding a specimen. Here is a check list of 24 places where isopods might be caught in the marine environment:

1. In the maritime drift along a beach or shore line.
2. In the sand and also between the grains of sand on a beach (the part of the beach that is continually wet by waves or covered by water at high tide).
3. Among and under stones on a beach, especially in tide pools.
4. On wooden piles and other wooden marine structures (in the encrusting plant and animal material and in the wood of the pile itself).
5. In eel grass (*Zoraster*) and other sea and marsh grass habitats.
6. In algae and other marine plants on rocks, jetties and other marine structures.
7. In and under the holdfasts of large algae (especially in southern California).
8. Under bark of trees that have fallen into the marine water.
9. On and in drift wood.
10. On the bottom of bays, sounds and lagoons among the debris.
11. In the leaf debris and dead aquatic vegetation in marine marshes.
12. In the burrows of other animals on mud flats.
13. Under shells, rocks and other debris on mud flats and marine beaches.
14. Under and in dead marine animals found along the intertidal shore.
15. In the surf on tropical beaches.
16. In drifting algae such as sargassum weed.
17. In coral reefs and other coral structures.
18. Among the roots of mangrove and other trees at the shore next to salt water.
19. In plankton (only a few are found).
20. In the nets of fisherman and shrimpers (look both for large free living species and for those parasitic on fish or crustaceans).
21. In the gill chambers and on the bodies of other crustaceans (including the marsupium of other isopods).
22. On fish and in the gill cavity and throat of many large fish.
23. In the body cavities of coelenterates, sponges and other hollow marine animals.
24. On the deep-sea bottom (of course very specialized equipment is needed to collect in this location!)

HOW TO COLLECT MARINE ISOPODS

Isopods can be collected with a minimum of equipment and effort for the common species at least. For species found in the deep sea and those in coral reefs, special equipment is needed which consists mainly of ship transportation to get to the collection locations. A pair of forceps and a vial of 70% ethyl alcohol is all that is generally needed, however, and the isopods are simply lifted from their hideouts of under a rock on an intertidal beach or from encrusting animals on a wharf or pile, etc., and put into the vial of alcohol. For collecting isopods it is just a matter of ingenuity as to how to seek out the species and remove them from their habitats (see section on Where to Collect Marine Isopods).

If isopods are to be found in beach sand, then much sand must be sifted through a suitable strainer. If the species are to be sought in seaweeds and/or marine plants, then the plants must be gathered with as little disturbance to them as possible and they must be placed in a container of clean sea water and washed or rinsed. The sea water then must be examined for the isopods that were hidden in the vegetation. Rocks, especially those covered with encrusting organisms, from the shore can also be washed in a bucket of clean sea water. After several rocks are washed the water can be examined for isopod specimens. Encrusting plants and animals can also be washed in a similar manner although prying tools are necessary in order to remove the hard material from large rocks and piles.

Sometimes if a small amount of formalin is added to the wash water additional animals will be freed. This should be done only after the material has been washed several times without the formalin since many animals will die still hidden in their hiding places in the washed material. The dead and dying animals many times will be washed out, although it is sometimes necessary to pick them out after separating the material. This is best done under a binocular microscope. Dead leaves and grass from marshes can also be washed. In coral reefs, a piece of coral with many holes in it can be similarly treated, but it also should be broken apart in the laboratory with a hammer. Fragments of coral fly in all directions when hit hard enough to break with a hammer so be careful.

For sand and mud habitats on the bottom of shallow water bays and estuaries, a commercial bottom grab sampler (Fig. 17) or dredge (Fig. 18) can be used. Productive regions usually can be reached by small outboard motor power boats, and the boats can be used to pull a small dredge. The grab and dredge can also be employed in a larger vessel in deeper water and in the deep sea (Fig. 19), but for the amateur this is not practical.

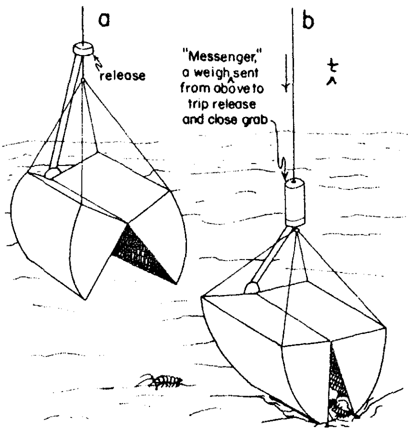


Figure 17. A grab for collecting bottom samples. a. Descending. b. Tripped on bottom by weight from above.

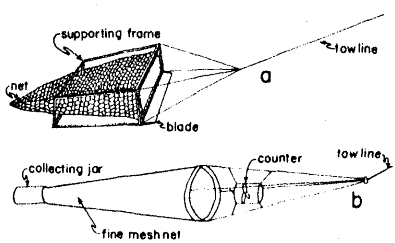


Figure 18. a. Dredge. b. Plankton net.

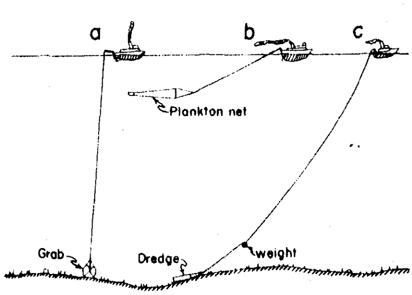


Figure 19. Research vessels. a. With grab. b. With plankton net. c. With bottom dredge.

Sometimes baiting can be employed; i. e., dead fish or other marine animals can be placed in the sand or anchored on a beach. If the bait is anchored under a wire mesh on an intertidal beach and the tide is allowed to cover the bait, then at the next low tide when the bait is exposed, it can be examined for isopods. This might be tried when the bait is exposed at night as well as in the daytime.

It is very difficult to make collection suggestions that apply exclusively to catching only isopods, but part of the fun of collecting isopods will be to see the vast array of other animals that are encountered in the search. After isopods are collected and sorted they should be placed in fresh 70% alcohol for storage since the alcohol used for collecting has probably been diluted with sea water. Specimens should never be stored for any length of time in formalin since the calcium carbonate is removed from their bodies and they become soft and difficult to identify. A number written on a small piece of 3 x 5 inch index card should accompany the specimens in the vial. The numwith date, place of collection, collector and a short ecological note should be recorded in a field notebook *in the field* so that there is never any doubt as to the date, or where, or general ecology of the specimens collected.

THE CULTURE OF MARINE ISOPODS

The water that is used to raise marine isopods should be taken from the general area where the species to be raised was caught because it will at least be of a tolerable salinity. The plankton and small fish that are in the natural water will die causing the water to foul unless it is filtered before it is used. Ordinary chemical filter paper is suitable for the process. Estuary water should be used if the animals were taken in estuaries, and full strength sea water should be used if the species were taken from the sea. Natural sea water can be diluted to the desired salinity with glass distilled water. Artificial sea water can perhaps be used, but so far its usefulness in raising isopods has not been determined. Aeriation and/or recirculation of the water are useful and at times necessary, especially for the more active species. Sometimes for tropical species a heating device to raise the temperature can be used. At other times the light and temperature can be controlled in special cabinets, but they are usually too expensive and not available to the amateur.

For species that bore into wood, any common soft wood that is placed in the water with the species will soon be invaded by them. Balsam wood tied together in sheets can be used so that the sheets can be separated later revealing the burrows of the species. It must be remembered that any species except those found in the intertidal zone or shallow swamps, must be raised at a lower temperature than room temperature so some control of the temperature will be necessary for most species. It should be mentioned that the methods that are used to raise fish in salt water tanks can probably successfully be adapted to raising isopods. The number of species that can be raised at once, the particular species that can be most successfully raised and the number of individuals that can be raised in one tank must be worked out for the equipment and the species concerned. Whether species can be raised through a complete life cycle is still a question for most isopod species.

Since there has been very little concentrated effort at raising isopods, it should be an interesting and rewarding undertaking. The general rule to keep in mind is to raise the animals in artificial conditions that most nearly approximate their own natural habitats. Temperature, salinity and light are very important considerations. Other conditions such as the absence or presence of certain algae and other aquatic plants is also important. Some isopods might also require the presence of other animals which would provide a substrate or a hiding place for the species.

If the isopod to be raised occurred in or on a plant, the plants after being washed in sea water should be included in the tank where the isopods are to be raised. If an isopod were obtained from a sandy bottom, it would probably be a mistake to attempt to raise it in a tank with a mud bottom and vice versa. Many of the standard apparatus used to raise tropical fish can be applied to raising isopods (Fig. 20). The things to avoid are the extremes of temperature and salinity and one must provide the right kind of biological environment. The food for the isopods should be in part produced by the environment in the tank where the species are raised; but pet fish food, especially artemia eggs and small worms, would perhaps form an acceptable additional source. Experiments must be made on choice of food, since there has been very little work done on isopod culture. Do not use too much additional food because it will cause the water to foul. With patience and an experimental approach, much will be learned about isopod culture. Good Luck!

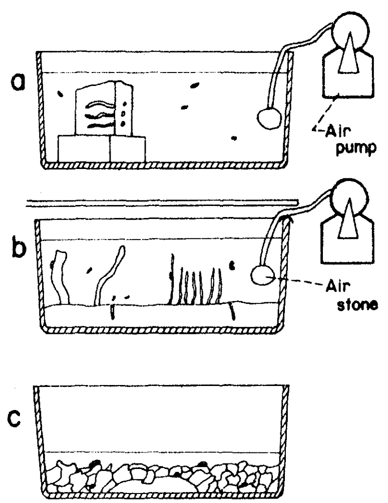


Figure 20. Aquaria for raising isopods. a. Boring isopods in a block of wood. b. Bottom and algae living isopods. c. Detritus from bottom containing isopods.

THE MARSUPIUM AND THE DEVELOPMENT OF MARINE ISOPODS

There are three primary types of brood pouches found among the species of marine isopods. The normal, most common type is sometimes quite modified, but in most species it consists of oostegites which are structures that arise from the bases of the peraeopods on peraeonal segments I to V and form an enclosed cavity called a brood pouch or marsupium. There are generally five oostegites present, but species of *Serolis* have four and species of *Neastacilla*, which have an elongate peraeonal segment IV, have only one oostegite forming an elongate brood pouch (Fig. 55). There are other variations of oostegite number also. Most gravid females, or ovigerous females, have a conspicuous egg mass ventrally located on the peraeon (Fig. 21).

The second type of brood pouch is found in sphaeromatids (Fig. 22), and it consists of special invaginations that fold into the body cavity and form internal (not actually part of the body cavity) brood pouches which have a small opening to the outside that is covered by oostegites. The third type is found in gnathiids (Fig. 23 and 360c), and it is formed as a hollow in segments IV, V and VI and is usually stuffed with eggs and/or embryos. Oostegites are present, but they serve only to cover the openings to the brood pouches. The cavity takes up a large volume of the female body, and eggs can usually be seen through the translucent wall.

Most epicaridean, or parasitic isopods, are known only as gravid females, non-gravid females never having been recorded. The cavity that contains the eggs makes up most of the volume of the species and even houses the male. Some cryptoniscid females are composed mostly of eggs, and most of the body in non-gravid females is composed of little more than the structures forming the brood pouch. In these species there are sometimes five oostegites apparent (Fig. 492), or an undetermined number (Fig. 548).

Very little will be said here about the development of marine isopods other than to say that they have a direct embryonic development. The female lays an egg in the marsupium. Fertiliza-

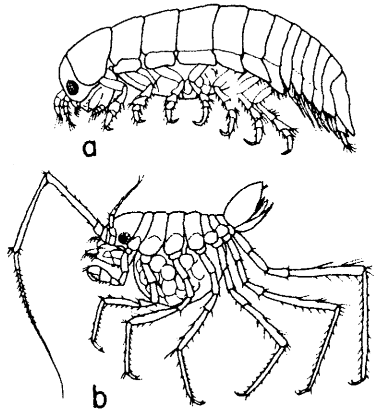


Figure 21. Gravid females (lateral views of females with marsupia). a. *Limnoria*. b. *Munna* (Both after Sars).

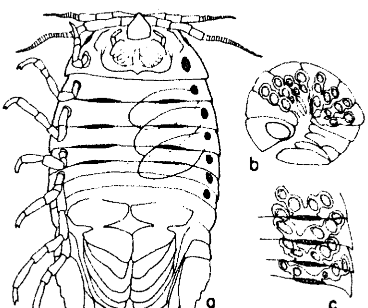


Figure 22. Special marsupium of sphaeromatids. a. Ventral aspect. b. Lateral aspect. c. Detail of marsupium (Modified after Grunner).

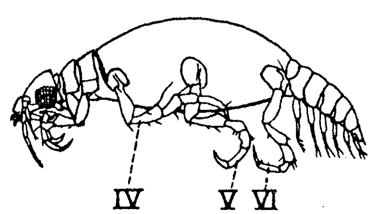


Figure 23. Gnathid female (After Grunner).

tion has already taken place if it is to take place. Some species have eggs that develop parthenogenetically; i. e., without sperm. The egg develops into an embryo and then to a juvenile without passing through an elaborate metamorphosis that is characteristic of crabs and shrimps. When the young free themselves from the marsupium, they look much like their parents, but usually they are at a larval stage and they have only six, not seven, peraeonal segments. At least two genera of anthurids remain at the six segmented stage into adulthood, but most species molt to a seven segmented stage soon after being freed from the brood pouch. They thus become miniature adults. Some species care for their young after they get out of the brood pouch, but most species do not exercise any parental care. Arcturid carry their young on their antennae too for some time after they emerge (Fig. 50).

The species continue to molt at short intervals, and even after they become sexually mature. The molt consists of two stages—first the anterior part of the body is shed then the posterior part. There can be several days between the two stages. The period between complete molts gets longer as the animals become larger. Females lose and regain their oostegites at the molts so they apparently grow larger between broods. In some species there is a change of sex at a molt stage. Some change from males to become females. Other species (especially Asellota) go through an intersex stage at which time they are neither male nor female (Fig. 366). There is much yet to be learned about isopod development, brood times and brood number and also about changes of sex during development.

HOW TO OBSERVE ISOPOD SPECIMENS FOR PURPOSE OF IDENTIFICATION

Many common isopods can be determined to species through the use of a simple binocular microscope. However, for very fine detail such as antennal flagellar article number, the structure of the male reproductive pleopod, or the mouth parts, a regular compound monocular microscope is very useful. For viewing most specimens, a small dissecting dish (a watch glass or Syracuse dish—Fig. 24a) is best because it is heavy, easy to handle and does not jar easily. If a piece of cotton is put in the bottom, and the watch glass is filled with alcohol to completely cover the specimens, then with the proper lighting the speci-

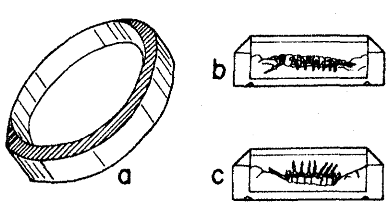


Figure 24. Watch glasses for dissecting isopods. a. Watch glass. b. Isopod for viewing dorsal surface. c. Isopod for viewing ventral surface.

mens can be viewed from any angle using the cotton to prop the the specimen at the angle desired (Fig. 24b,c). Petroleum jelly (vaseline) can also be used as a prop for small specimens. The petroleum jelly should be put into a dry watch glass and then the specimen and the alcohol should be added. The petroleum jelly is solid enough to hold the specimen, but soft enough so that it can be positioned without injuring it. The petroleum jelly can be quickly removed from the specimen by passing it through a petroleum liquid distillate (gasoline, kerosene or what is probably best, model airplane paint thinner). The specimen should not be allowed to remain in the petroleum distillate because it will harden quickly and become brittle.

The background on which the animal is viewed can be changed by simply dying the cotton black or by placing a piece of plastic or colored cardboard under the watch glass. A piece of material colored black on one side and white on the other can be made if it is not already supplied with the microscope. White pigmentless specimens are generally best viewed with a black background; whereas, pigmented specimens are best viewed on a white background (Fig. 25).

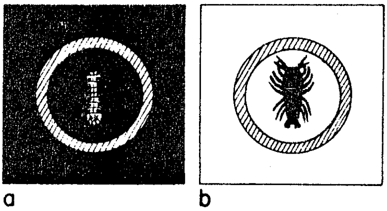


Figure 25. a. Light specimen on dark background. b. Dark specimen on light background.

The standard watch glass has the additional advantage of being able to be stacked using one glass as the cover of the other or others. Covering the specimens during the time that they are not under observation can be done simply by placing one glass on top of the other and the watch glasses will fit together snugly in a pile. If petroleum jelly is placed in between the two watch glasses, the alcohol will not evaporate and the animals can be stored for several weeks in the container thus formed.

For larger specimens larger bowls must be used, but the technique or positioning the animals for observation is about the same. Lighting can be provided by any convenient binocular microscope lamp, or, if one is not available, a reading lamp can be used or the microscope can be placed near a window. The large isopod can be manipulated and the appendages can be removed by ordinary forceps and a teasing or dissecting needle which are supplied in most general biology kits. However the fine dissecting needles described below are very useful for manipulating small specimens.

A firm support for specimens being dissected or torn apart can be made by placing modeling clay instead of cotton in the dissecting dish. The clay does not break apart in the alcohol. Of course, the dissections should take place under 70% ethyl alcohol solution (the same solution in which the specimens were collected). I say dissection should take place under the alcohol, because many people make the mistake of not covering the specimens properly and light is scattered from many wet surfaces of the specimen and fine structures cannot be properly viewed. If the specimens are completely covered with alcohol so that there is only one surface, the alcohol surface, between the viewer and the specimen, then light reflected from this surface is not reflected into the microscope and detail can be clearly seen. Under the heat of the light of the lamp, the alcohol evaporates rapidly and must be replaced to continue viewing the specimen properly and to prevent it from drying out.

Small appendages or parts of specimens that are removed can be placed on a slide in pure glycerine (available from a drug store) or glycerine jelly (available from a biological supply house), and when the cover slip is placed over them they can be viewed with a binocular microscope (lighted from above or below the specimen) or with the compound microscope with regular beneath the stage lighting. Mounting the specimens can be done on a plain slide or in a depression on a depression slide (Fig. 26).

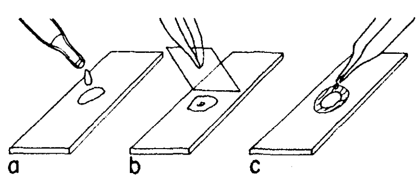


Figure 26. Preparation of specimens for viewing in a compound microscope. a. A small drop of glycerine being placed on a slide. b. Cover glass placed on after specimen added. c. Specimen being placed in a depression slide.

When the slide is viewed in the microscope with transmitted light (light coming from below the specimen), most of the details, including some internal details, will be revealed in the structure viewed. If the specimens are allowed to remain in the glycerine or glycerine jelly, in several days even more detail will be revealed, since the mounting agents are also clearing agents which take away the dark pigments of the tissue and more detail is revealed. Do not forget to properly label the slide by attaching a standard slide label or using a colored wax marking pencil. Slides with a frosted end suitable for marking with an ordinary pencil are available and are very handy for making slides that are to be stored. The slides with their specimen parts can be stored indefinitely if the edges of the cover slip are sealed with clear finger nail polish or a commercial preparation.

For very small specimen handling, very fine watchmakers forceps are best, but they are relatively expensive. Very small dissecting needles can be made from insect mounting pins. The especially fine minuten pin used for pinning very small insects works very well if it is attached to a wooden match stick. The small needle can be pushed into the end of a slightly pointed match stick and fastened with epoxy glue (Fig. 27b). A crude but effective dissecting needle can be made very easily by sticking a large insect mounting pin (or a straight pin for that matter) through the eraser of an ordinary lead pencil (Fig. 27a). A pair of teasing needles or dissecting needles that come with the standard general biological dissecting kit are very useful for handling and sorting specimens, but they are generally too large for dissecting the average size isopod.

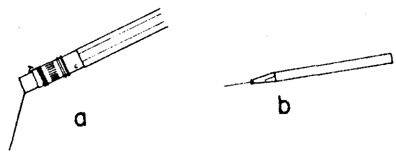


Figure 27. Dissecting needles. a. Lead pencil with insect pin (or straight pin) in eraser. b. Wooden match stick with minute insect pin in end glued firmly.

STORAGE AND LABELS

For storing specimens of isopods for any length of time, the best container is a wide mouth canning or freezer jar (available in most grocery stores). Cotton (available at drug stores in rolls) is placed on the bottom and the isopods are put into shell vials (available at most biological supply houses and some drug stores) and they are placed in the large jars. The storage jars can be either pints or quarts (Fig. 28). The advantages of placing the shell vials of specimens in the large jars are that species can be stored according to category—species, genus, family or location, etc.—and it is only necessary to watch the level of alcohol in one large container rather than many small ones. If the shell vials are stored in an

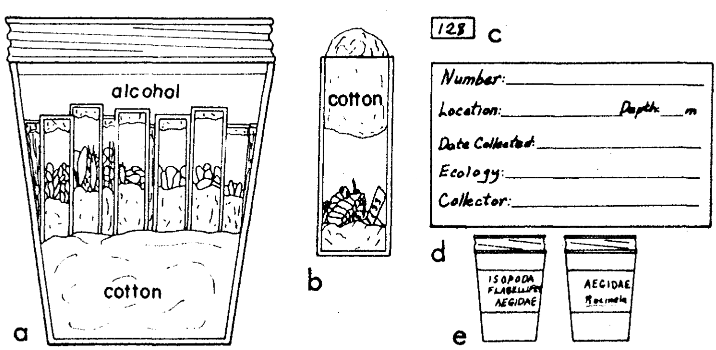


Figure 28. Storage and labeling apparatus. a. Canning or freezer jar for storage of shell vials containing specimens. b. Shell vials with specimens. c. Notebook number to be kept with specimens. d. Label form for shell vials. e. Storage jars with labels.

inverted position in the storage jars, there is less chance that the specimens will dry out if the cover is not tight and the alcohol slowly evaporates. The cotton protects the specimens from injury when they are transported in the jars.

Of course larger specimens than average can be stored in the jars directly without first being placed in the shell vials. Sometimes a crab or fish host as well as the isopod parasite can be stored in a single large container. A large collection of specimens can be stored in the jars and the jars can be stored by the dozen in the carton in which they were purchased.

One of the most important things that must be included in every collection of isopods is the label. Specimens, no matter how exotic and interesting, have very little scientific value if they are not properly labeled. The label should be made of high quality, heavy weight, watermarked bond paper or heavy white cardboard as in a 3 x 5 inch index card. The ink used to write the label should be black waterproof and alcohol proof drawing ink. Most good quality "India" inks will do.

The label should be printed and should include the name of the species (or the smallest taxonomic category to which the specimen has been identified), the collector, the date of collection and the location where the collection was made. If possible some brief ecological data should be included such as "from beach sand," "from under rocks on stony beach," "from wooden piling," etc. For deep-sea species there is always a log of scientific events kept by the chief scientist and stored at the institution which sponsored the expedition. Information from the log is generally available to an interested person. It contains all the information as to position, depth, and physical factors at the place where equipment was lowered into the sea to catch animals including isopods. As much of this information as is possible should be stored on labels with the specimens. For parasitic isopod specimens, the name of the host should be recorded. The depth at which the species or host were taken should also be recorded.

A number should also be included, and it should have been placed in the collection jar with the specimen in the field. It should be immediately recorded in a field book with as much information as is practical added at the same time. The number placed in the collection jar in the field should stay with the specimens at all times. When the specimens are observed under a microscope, the number should be included in the watch glass and it should always accompany the specimens so that there is as little chance as possible for specimens to be confused with one another.

WHAT IS A MARINE ISOPOD?

A marine isopod crustacean at first glance might look like many other marine crustaceans that are related to it, but there are certain characters that set them apart from the other animals that the isopod might superficially resemble. A list of the characters follows:

1. Body usually dorsoventrally flattened.
2. Two pairs of uniramus antennae.
3. Sessile rather than stalked eyes.
4. Four pairs of appendages modified as mouth parts. (The maxillipeds are attached to the cephalon.)
5. Lateral parts of the body segments many times extended by epimeres or coxal plates.
6. Uniramus locomotoral (ambulatory or natatory) or prehensile peraeopods on peraeonal segments seven in number. Anterior pair or pairs can be gnathal or subchelate (never truly chelate) in structure.
7. Brood pouches on female peraeonal segments formed from three (one in some arcturids) to five pairs of oostegites on that many peraeonal segments.
8. Five appendages ventral on pleotelson or pleon; first sometimes operculate and sometimes others operculate. Second always sexually modified in male, and the others respiratory in function.
9. A single pair of usually biramus uropods variously modified present on pleotelson. The rami are uniarticulate.
10. Telson flattened and usually fused with one or more than one pleonal segment.

The above mentioned ten characters are morphological aspects of the isopod that are seen without elaborate preparation of the specimen. To each of them there are interesting exceptions, but if the ten characters are kept in mind the exceptions will become known with experience.

There are several internal anatomical characters that set the isopods apart from other related crustaceans. The heart of an isopod is in the dorsal part of the pleon. The anterior part of the digestive tract is generally equipped with a gastric mill (for grinding food particles), and isopods have a straight digestive tract usually with only two pairs of digestive glands. Isopods have a circumesophageal nerve ring (a ring of nerve tissue around the anterior part of the digestive tract) from which nerves lead forward to the eyes and antennae, and two main nerve cords lead to the posterior part of the body. A thickening or ganglionic mass with connections between the cords is present in each segment. From the ganglionic thickenings small branches go to the appendages and other functional parts in each segment. Another so called "sympathetic" nerve system is present leading from the nerve ring in the cephalon to the posterior of the body. There are no thickenings in each segment and the function of the system is only beginning to be studied.

The body of an isopod crustacean is primitively divided into 19 segments each with its modified appendages. The 19 segments are divided into three major groups of segments or tagmata—the cephalon, the peraeon and the pleon. Only the segments of the peraeon and the pleon ever show in the dorsal view except in rare exceptions when one segment of the cephalon the maxillipedal segment is separated from the fused anterior group. Except for the occasional presence of the maxillipedal segmentation there is little to indicate segmentation in the cephalon of an isopod.

The next seven segments make up the tagmata called the peraeon. There are peraeopods or peraeonal appendages on the peraeon and they are modified in many ways, sometimes being only rudimentary and sometimes being absent, but mostly they are locomotoral in function. Seven pairs of peraeopods are usually present, but in the gnathiids there are seven peraeonal segments and only five pairs of peraeopods. The seven body segments to which the peraeopods are attached are in most instances indicated in the dorsal view of the isopod. The segments which contain the legs are called the

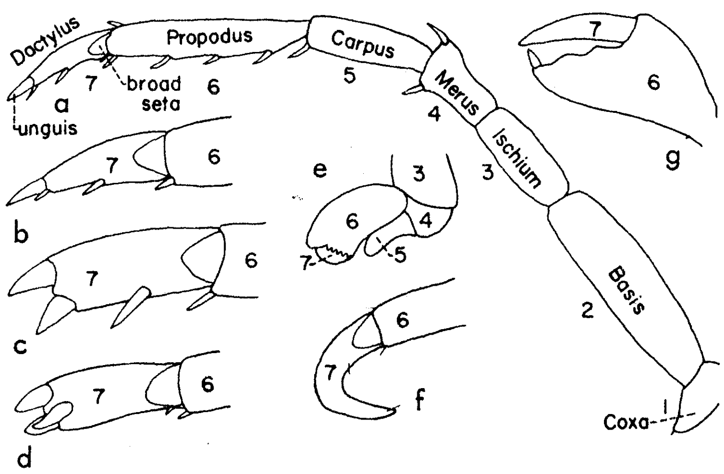


Figure 29. Peraeopod types. a-d. Ambulatory peraeopods. a. Peraeopod with segments named. b. Single unguis or claw (uniunguiculate). c. Two claws (biunguiculate). d. Three claws (triunguiculate). e-g. Prehensile peraeopods. e. Epicaridean type. f. Flabelliferan type. g. Asellotan type.

thorax in most crustaceans, but the word peraeon is coming into more use because there is much difference between the "thorax" of an isopod and the thorax containing the lungs of a vertebrate animal. The legs of the peraeon, more properly the peraeopods (Fig. 29) are modified for clinging (prehensile–Fig. 29e, f), walking (ambulatory–Fig. 29a-d) or swimming (natatory–Fig. 31).

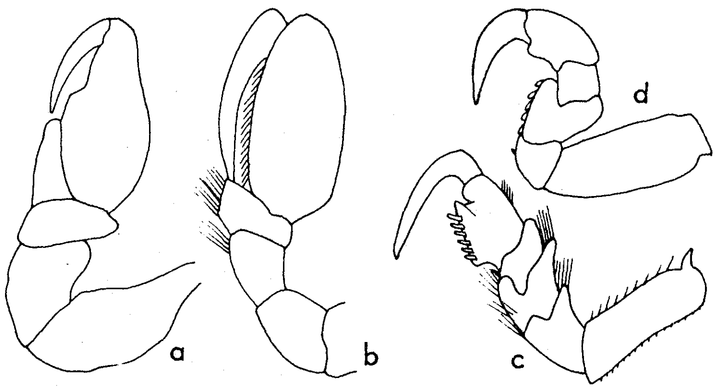


Figure 30. Peraeopod types. a. Anthurids (*Cyathura*). b. Sphaeromatid (*Tecticeps*). c. *Rocinela*. d. *Aega*.

Sometimes they are dimorphic; i. e., they (especially the first and seventh) are different in the male, female and juvenile. At times the peraeopods are modified for straining food particles (Fig. 49), and sometimes they are modified for digging (fossorial).

The oostegites that cover the brood chamber (Fig. 21) in the female are parts of the peraeopods. The isopod female is frequently longer than the male species because it is modified to carry the brood. The oostegite shape and thickness are characteristic of different groups, and their presence or absence on various segments are also characteristic in each group. Within the brood pouch or marsupium formed by the oostegites there are no indications that a glandular

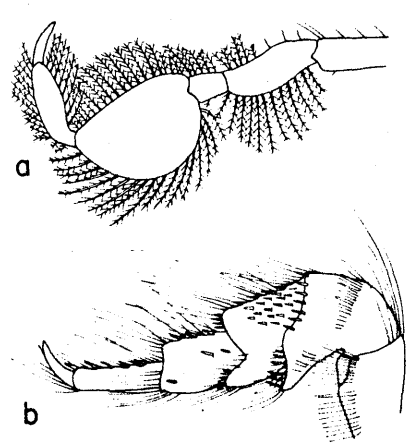


Figure 31. Peraeopod types. a. Natatory (*Ilyraachna*). b. Modified natatory (*Cirolana*).

secretion is extruded by the female (as in terrestrial isopods) to nourish the eggs and young which are hatched as juveniles within the oostegite covered pouch. They soon are released from the marsupium after they have attained suitable size.

The appendages of the pleon, the pleopods, are the sites of the breathing function or of respiratory gas exchange of the isopod. The first pleopods (more rarely the second or third) are sometimes operculate or form a covering structure to the other pleopods that are enclosed within a branchial chamber (Fig. 366). Sometimes the pleopods are fringed with long plumose setae and are said to be natatory. The second pleopod (the endopod) in the male is modified as a sexual structure in most species, and it is very characteristic of the species and can be quite effectively used in making identifications of many species.

The pleon contains a terminal structure called the telson which, in the majority of isopods, is modified by being fused to the sixth pleonal segment, and this forms a structure called the pleotelson from which the anus opens. The appendages of the sixth pleonal segment, the uropods are usually laterally or terminally located, and they are the site of many sensory setae. In the valviferans the uropods form the operculate covering to the branchial cavity (Fig. 45) which contains the pleopods. In many isopods the expanded uropods and the expanded pleotelson combined form a caudal fan which is the principal swimming and steering structure.

A much more detailed picture of the isopod follows with some account of the probable function of the structures. The cephalon has been formed by the process of cephalization of the anterior body segments of the trilobite-like primitive crustaceans. There is rarely any indication of segmentation, but the mouth parts are embryologically formed in the same manner as the peraeonal appendages or pleonal appendages. From the anterior two pairs of segments arise the sensory appendages, the antennae. Eyes also are found on the anterior segments. The anterior part of the animal receives the tactile and chemical information so that the animal knows its place in an environment and what is the chemical nature of that environment. In isopod crustaceans the antennae are uniramus; i.e., there are four antennal branches projecting from the cephalon of the isopod, not eight as in many shrimp and crayfish. There are two pairs of antennae and they are of different lengths, the second pair generally being much longer than the first pair. The second antennae are more specialized than the first to receive the tactile sensory information and the shorter first antennae are more specialized to receive the chemical information. Antenna one usually has only three peduncular segments and a varying number of flagellar articles (Fig. 32b). Special broad flat setae called aesthetascs (Fig. 33) are present on the apical flagellar articles and they function as the chemically sensitive sites on the antenna. Antenna two has five (in some species six) peduncular segments. On what is primitively the third although it might appear to be the second is a short segment, an antennal scale or squamma; it most probably represents what is all that remains of the primitive exopod of the second antenna since the antennae were primitively biramus appendages (Fig. 32a). It is found most frequently in species of Asellota (Fig. 34 and 35).

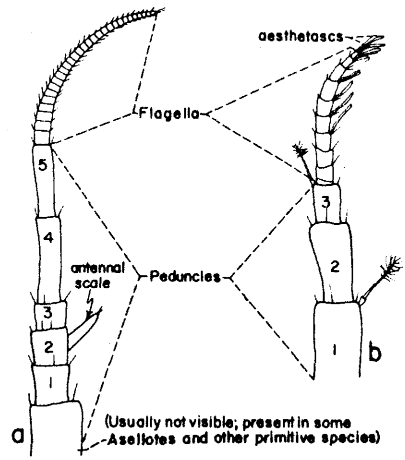


Figure 32. Antennae one and two. a. Antenna two (Sometimes the basal segment is present; *e.g.*, in some asellotes, and the numbers begin with the primitive precoxal segment thus the antennal scale, or primitive exopod, is on segment 3 not 2 according to some workers.). b. Antenna one.

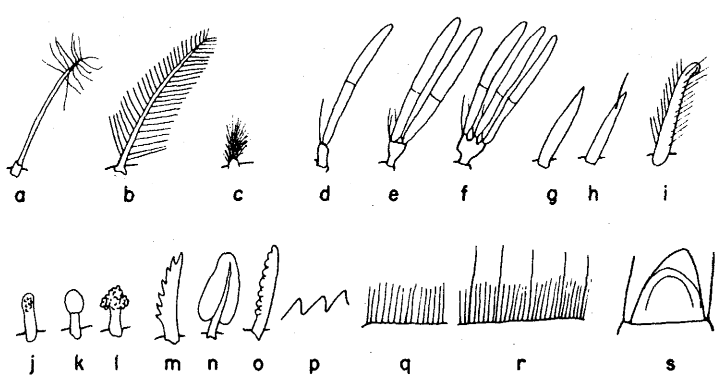


Figure 33. Setal types. a. Sensory seta. b. Plumose seta. c. Pencillate seta. d-f. Aesthetascs. d. uniramus. e. biramus. f. triramus (*Microarcturus*). g. Spine or stout seta. h. Stout seta with sensory tip. i. Special seta on peraeopod of *Paracerceis*. j-l. Coupling hook types from maxillipeds. m-o. Sensory edge of maxilliped setal types. p. Scales on sensory edge of maxilliped (*Jaeropsis*). q. simple fringing setae. r. Compound fringing setae. s. Broad propodal seta at aticulation of propodus with dactylus.

The mouth parts are found in what is a large buccal mass ventral on the cephalon. They are covered or limited anteriorly by the frontal lip (not a true appendage) or labrum (Fig. 36a). The

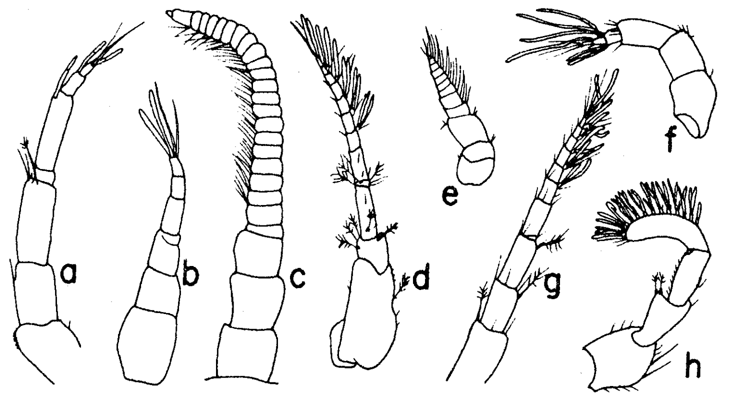


Figure 34. Antennae one types. (See Fig. 368 for Asellotan types). a. Cymothoid. b. Anthurid (female). c. Anthurid (male). d. Sphaeromatid *(Paracerceis)*. e. *Cirolana* (male). f. Flabellifera *(Limnoria)*. g. *Cirolana* (female). h. Valvifera *(Erichsonella)*.

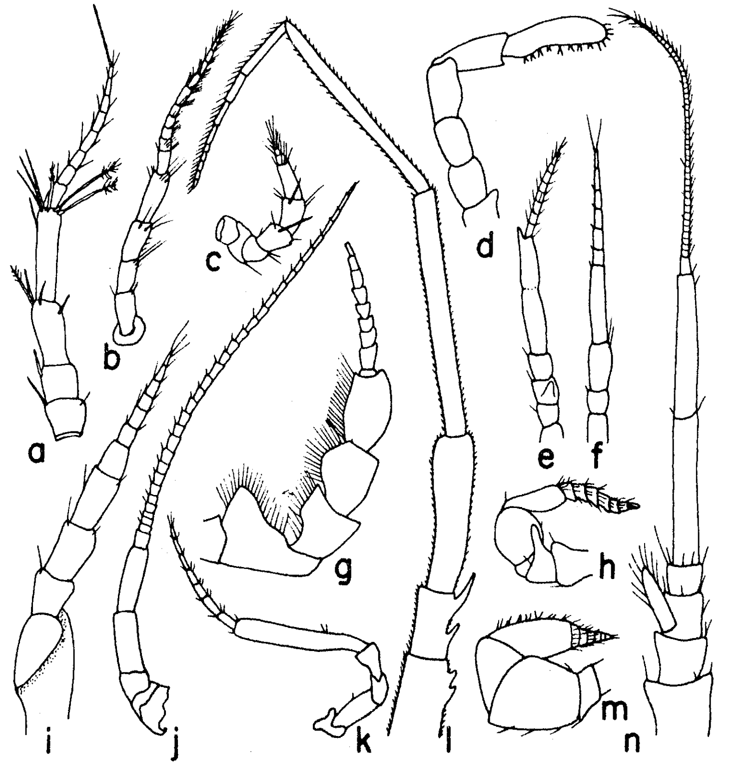


Figure 35. Antennae two types. a. Gnathiidea. b. Sphaeromatid *(Paracerceis)*. c. *Limnoria*. d. *Cleantis*. e. *Antennuloniscus*. f. *Hydroniscus*. g. *Saduria*. h. *Haploniscus*. i. Anthurid. j. Cirolanid. k. *Synidotea*. l. Arcturid. m. *Jaeropsis*. n. *Stenetrium*.

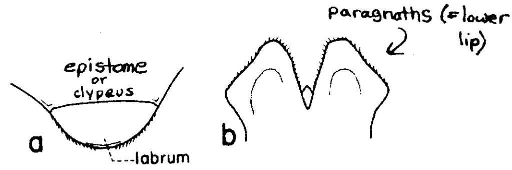


Figure 36. a. Frontal lip or labrum. b. Posterior lip or hypopharynx.

mandibles (Fig. 37) are strong and generally serve as biting or chewing structures although in some groups they are piercing and sucking instruments. In the gnathiids they probably serve in a secondary sexual capacity. The mandibles in most have a sensory palp of three articles. The palp is sometimes reduced or absent as in the Valvifera and Oniscoidea. Near the incisor process (Fig. 37) or the cutting part of the mandible, but sometimes absent on one or both mandibles, is the lacinia mobilis, a moveable appendage found in most peracarideans including isopods. Just behind the mandibles and just anterior to the entrance

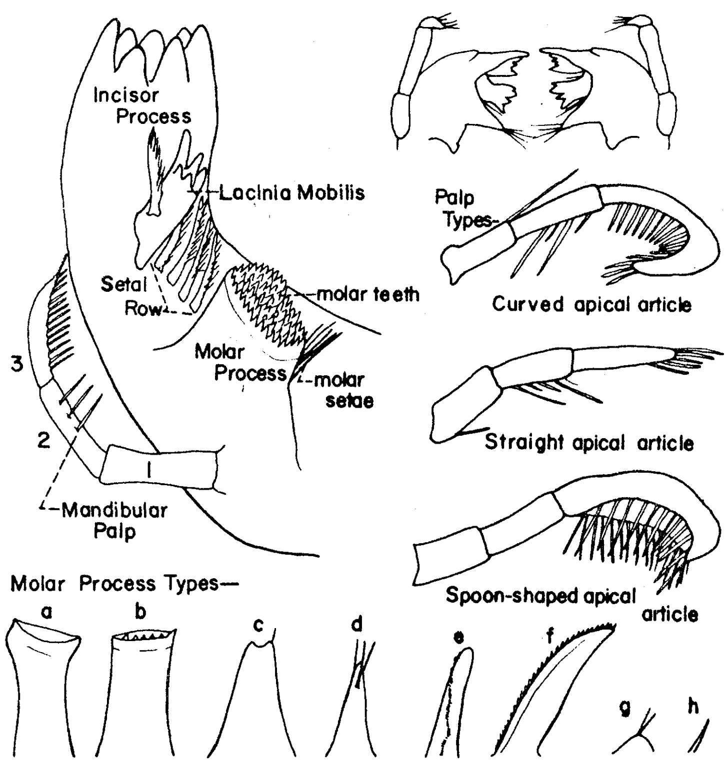


Figure 37. Mandible with palp types and molar process types. a. Broad and truncate. b. Truncate with teeth. c. Blunt pointed. d. Pointed with apical setae. e. Spiniform (*Jaeropsis*). f. Blade-like (*Cirolana*). g. Lump with setae. h. Seta only.

of the digestive tract, there is a hypopharynx, (not a true appendage) or posterior lip, which serves as a sensory and straining structure (Fig. 36b).

The next true gnathal appendage is maxilla one which is generally composed of two lobes—a sensory endopod and a biting exopod (Fig. 38b). Maxilla two generally is composed of two lobes also,

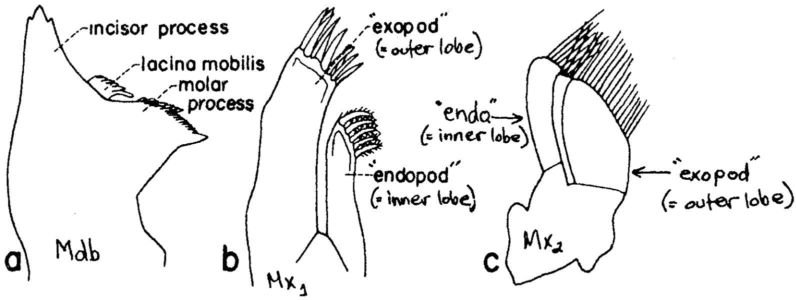


Figure 38. Mouth parts of *Sphaeroma destructor*. a. Mandible. b. Maxilla one. c. Maxilla two.

but one is generally double so that there are three lobes present (Fig. 38c). The second maxilla are food strainers when there are long setae present on them. Sometimes the lobes are fused into a single broad structure that has no long fringing setae (Fig. 215d), but that type is confined to some fish parasites and terrestrial isopods. Both pairs of maxillae have various other functions in the masticatory process, and in some species they are absent or only rudimentary structures. The maxilla are quite different in different species, but they are not used as key characters in the keys to species that follow because they are not always easy to observe.

a cymothoid maxilla!! NOT fused at all!

The maxillipeds (Fig. 39) are the covering structures to the buccal cavity containing the mouth parts. The endite or second segment is generally broad and flat with coupling hooks on the medial margin. The upper edge of the endite and the palp are sensory in function. In some species where the mouth parts

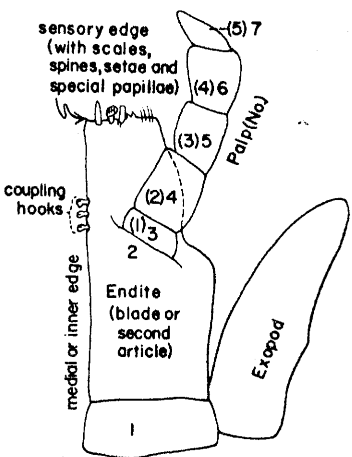


Figure 39. Maxilliped.

this is all wrong! see back fly page.

are modified for sucking and piercing, the palp is absent or reduced to only one or two articles. In some fist parasites (e.g., aegids) there are long spines or teeth on the apical article of the palp. There is much variation in the number of palp articles and the width of the palp, both absolutely and in relation to that of the second article or endite, also varies (Fig. 370). The maxilliped and its palp are very easy structures to observe in most species and can be used effectively for taxonomic discriminations, especially to help confirm the identity of a species or genus.

In the gnathiids there is an additional mouth part—the pylopod (Fig. 348). The pylopod is a special modification of the appendage of peraeonal segment I. It is operculate to the buccal cavity and has the same function as the maxilliped in other species. Apparently the true maxillipedal appendage in a gnathiid performs a food straining function and the maxillae are rudimentary.

The seven peraeopods of the peraeonal segments are variously modified according to their function (Figs. 29-31). Generally the first pair of peraeopods are modified in some manner as food handling, grasping or secondary sexual appendages. Males of many species, especially asellotes, have the first appendage modified as a secondary sexual structure. In males it is generally subchelate and is probably as useful in grasping vegetation as in grasping meals or females. At times the first three peraeopods are subchelate as in the tube dwelling anthurids. The modified peraeopods are probably aids in food gathering. The last four peraeopods are locomotoral structures in most species. They can be either ambulatory or natatory (Fig. 480).

In some ectoparasites of crabs and other crustaceans, there is a loss of some peraeopods on one side of the asymmetrical body. Many parasites that live within the host's body cavities completely lack functional appendages. The peraeopods that are found in the ectoparasitic species are small prehensile structures. The isopods that are fish parasites have peraeopods that have very sharp claws for clinging to the body of the host (Fig. 30). Some cave species have clinging peraeopods, but they perhaps are modifications for clinging to the walls of the cave, not for clinging to a host fish. Sometimes only the first pair of peraeopods are modified for clinging; sometimes all or almost any of the first three or four pairs are modified for clinging.

The peraeopods of other species (e. g., munnids) are extremely long so that the species look like daddy long leg spiders (Fig. 21). In other species the first pair are modified for gnathal functions, the third and fourth for ambulatory, and the fifth to seventh for natatory functions (Fig. 457). In other species the peraeopods are short and fit within the sphere of the rolled up body. The species are in a family called Sphaeromatidae since they form a sphere. In still other species the peraeopods are fossorial or modified for digging in the substratum.

There are six segments plus a telson in the pleon of the primitive isopod, and in some modified parasitic species and some tube dwelling species, a true telson with six free pleonal segments are still found. However, in most species the telson is fused in some manner with one or more pleonal segments forming a pleotelson. Many times the pleotelson is broadened as in the cirolanids and with the broadened uropodal rami form a caudal fan used for swimming. The posterior segment fuses with the free pleonal segments forming a pleotelson which sometimes includes the whole pleon. In many instances only the first pleonal segment is free and there might or might not be indications of another or other segments. All segments of the pleon are fused and the pleon itself is fused with the peraeon in some species (e. g., *Haplomesus*).

The pleopods which are the five pairs of appendages of the anterior five pleonal segments are usually all free even when all of the segments are fused. The pleopods are also with few exceptions biramus. In two suborders, the Valvifera and the Asellota, the species have the pleopods enclosed in a branchial cavity. The number of pleopods is most always five pairs, but they are reduced in number and size in many of the parasitic bopyrids. In some species they are absent. The function of the pleopods (except for the sexually modified male pleopod 2) is sometimes natatory, but almost always they are modified for the exchange of respiratory gases or breathing. Species of the genus *Iais* utilize the pleopods of species of sphaeromatids for a home and are found almost exclusively among the pleopods of the host species.

The uropods are modified in many ways in addition to being valves or branchial cavity covers in the species of Valvifera. They can be either uniramus or biramus (Figs. 40, 41 and 42). They most

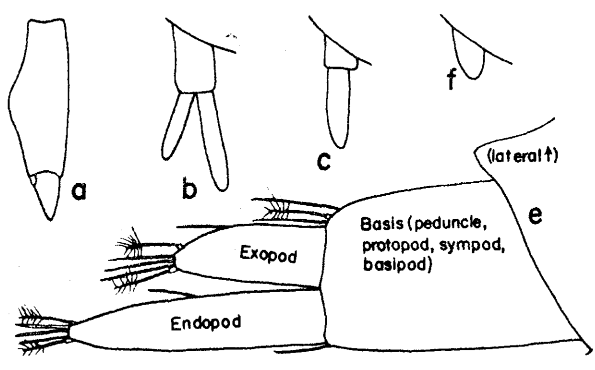


Figure 40. Uropod types. a. Valve or operculate branchial cavity cover (Valvifera). b. Simple biramus. c. Simple uniramus. d. Basis or peduncle only. e. Biramus uropod with setae.

probably are sensory structures, and are well developed and specialized in species that back into holes (anthurids). They are at times almost completely absent or absent in some species. Frequently they are broken off during the collection process so that their absence might be mistaken for normal absence. The margin of the telson, the last body segment, is generally fringed with sensory setae and the anus opens beneath it.

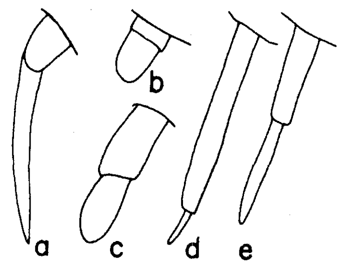


Figure 41. Uniramus uropod types. a. *Ischnomesus*. b. Haploniscid. c. *Ianirella*. d. Macrostylid. e. *Acanthocope*.

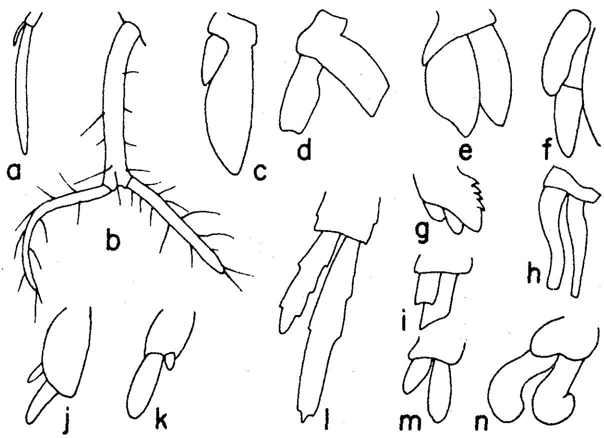


Figure 42. Biramus uropod types. a. Asellota. b. *Acanthomunna*. c. *Cassidinea*. d. Sphaeromatid (*Paracerceis*). e. Cirolanid. f. Anthurid. g. *Jaeropsis*. h. Gnathiidea. i. Munnid. j. Ilyarachnid. k. *Serolis*. l. *Stenetrium* m. *Eurycope*. n. Epicaridea.

KEY CHARACTERS AND OTHER CHARACTERS

It is important to know about key characters and other characters since all identifications in the book are based on the use of key characters in a key. Key characters are observed and then discriminate judgments are made that will lead to the identification of isopod specimens under study. Key characters should be easy to observe and consistently present (or absent) on almost every member of the taxon under study. Many times there are, in addition to key characters, other characters that are peculiar to the taxon or a species under study that are definitive, but the additional characters do not appear in a key to the species. There are illustrations of structures in this book (e. g., maxillipeds) that many times in themselves can be used to identify a particular isopod to a particular taxon, but they should not be used by themselves until more than just a general knowledge of isopod morphology is obtained.

A major difference between insects and crustaceans is the difference between the structure used by the animals in the respiratory exchange of gases with the environment; i. e., the breathing structures. Insects with very few exceptions have spiracles and a tracheal system that functions to exchange gases in an environment of gases, the atmosphere. The crustaceans which are usually found in an environment of water, have various structures on their bodies that function in respiratory gas exchange—the general thin body wall, thin membraneous appendages, gills or specialized pleonal appendages (the structures used by isopods). Crustaceans never have tracheae or any structure that are really like true tracheae of insects.

The structures used in respiratory exchange represent a fundamental difference between insects and crustaceans, but they are rarely used in a key made to discriminate between insects and crustaceans because they are not simple easy to observe structures that can be observed with simple equipment. Internal characters are not used for the same reason.

It is important to get to know the difference between what is a key character and what is a major difference between species, but not easy or useful to use in distinguishing animals. A key character is merely the most useful character from a set of characters to use when distinguishing animals from one another. This applies to any level of distinction from the phylum to the species, and is why a description of the different kinds of characters is included here. It is also important to know that an isopod crustacean is defined on much more than a single or a few characters. It is an animal that can be defined on a whole set of characters, but key characters are used to make distinctions between groups because the lists of differences between two widely divergent animals can be quite large. Many times several key characters can be used, but it is best to use a small number for ease in making the series of distinctions that finally lead to the correct name and identify the isopod specimen at hand. Additional characters can be used as a check on the main key characters, but the key (with the figures for assistance) are the best characters to use.

There are two types of keys recognized by taxonomists that are used to distinguish animals—a natural key and an artificial key. If evolution took place and all animals are related to each other as is represented by a phylogenetic tree, then the distinctions that are used to identify different taxa in a key are the same ones that are used to construct the phylogenetic tree itself. The branches of the tree are dichotomous just as the couplets in a key are dichotomous. In practice this is generally done as much as is possible, but still there are many perfectly valid characters that are obscure to immediate observation or are internal and only can be considered after dissection that are used in forming the phylogenetic tree pattern of animal evolution. Key, or artificial characters then, not natural characters are used to make the distinctions between taxa. The distinctions are then mostly artificial, because they are chosen without regard for the evolutionary importance for the animal keyed. Hence, any really useful key will be composed of natural and artificial characters, and there is really no practical reason to argue the merits of either one any further.

Completely artificial keys are sometimes constructed when the fauna from a particular geographic region are studied and identified. The animals are distinguished with little regard to their place in the phylogenetic tree of isopod evolution. The larger the geographic region studied, the more a key can be composed of natural or phylogenetic distinctions related to the evolution of the animals included. The key in this book represents a very large geographic region—the waters around the continent of North America—so the key at least in higher categories can be somewhat of a natural key. Many species that would fill in the branches of a phylogenetic tree are not represented in the geographic region included in the book so the key is not a true natural key. It is hoped that the key will serve to identify most of the isopods of the New World to genus. It will serve as a key to all of the suborders except the Oniscoidea, the terrestrial species, and the Phreatoicidea, a specialized group in Australia, New Zealand and South Africa. Any species except in those two suborders will key to suborder on a world wide basis and many will be identified to the family level. Only where there is overlap in distribution will Old World genera and species be included and there are many species that are common to the two regions, the New and the Old World.

Hessler claims fossil evidence dates Phreat. back to late Paleozoic!

HOW TO USE THE KEY AND NOMENCLATORIAL CONSIDERATIONS

The key used in the book is of the dichotomous type. Each couplet is composed of two lines, an *a* line and a *b* line. Each couplet describes a character or set of characters which are then compared to the same characters of the specimen under the microscope. The specimen is identified if it has or lacks the structures indicated in one couplet of the key. Reference to another couplet is then made, and further distinctions between two choices of characters are made. The first couplets are used to identify the specimen to suborder and the page number where the account of the suborder is found is given. Couplets leading to family identification (with page number given) are then encountered. The last set of couplets leads to genus and species, where there is a figure of the species given.

At the species level there will be found a reference to figure number, a species name, the author of the species (in parentheses even if he originally described the species in the same genus) and the length in millimeters of a large specimen of the species. The geographic range and usually the depth in meters where the species was taken follow. The depth is generally given as a range to include the various geographic sites and depths where it was found. A small paragraph of explanatory matter then may or may not follow. Species recorded for a particular depth at a particular geographic location will probably be reencountered at that place and depth, but one should not be surprised if a particular species is encountered at a different depth and a different geographic, but nearby, location because they were recorded only once or a very few times before.

Almost any marine isopod that the reader will casually encounter in the field will be contained in the book; it would be very rare indeed for an inexperienced person to find an isopod that would not fit or be keyed to suborder or family. A specimen that did not fit the species key, would be most probably encountered. However, the probability for any specimen that an amateur collector finds to not fit the key is slight. If the specimen seems not to fit the key, then the person using the key must reconsider all the choices that he has made. It has been the author's experience to discover that a specimen which a student was keying was not even an isopod, and of course the probability of its not even being an isopod must also be kept in mind by the beginner. If a student finds a new higher taxon, he has probably not used the key properly. Specimens taken from North American waters where few collections were made in the past, however, should be examined carefully because it is possible to find a new species of isopod.

The correct use of the key is based on a knowledge of the vocabulary and the figures. For most of the descriptive words used in the key, the illustrated glossary index has a definition or there is a reference to a page on which the definition is found in words or pictures. If the word definition is combined with an illustrated definition, then a clarification of the term and its meaning as applied to the specimen under the microscope should be apparent. The meaning of the words given in this book are definitions pertinent to the study of isopods, although the words might also be used in other fields of taxonomic carcinology.

Unfortunately, the terminology and the nomenclature of parts is not standard throughout the invertebrates, nor is it standard throughout the study of crustaceans for that matter. That is another useful function of this book—to standardize the nomenclature or at least provide a place where the common terms applicable to isopods are located and defined. The illustrations serve in part to help make the meaning of the words clear, and in some of them there are two or more names for some structures. The preferred term for the structure will be the one best defined in the illustrated glossary section; i. e., the one to which all alternate definitions are referred.

The term cephalon is used for the head, peraeon for the thorax and pleon for the abdomen. Antennae and mouth parts are names used for the appendages of the cephalon. Peraeopods are appendages of the peraeon whether they are locomotoral—ambulatory, natatory and prehensile—or secondary sexual in function. Pleopods and uropods are pleonal appendages. It is not necessary to elaborate, but the use of invertebrate terms for invertebrate structures is preferable to the use of invertebrate terms for invertebrate structures.

A WORD ABOUT THE ILLUSTRATIONS

The illustrations of species that are used in this book are not original except for a very few. They are for the most part line drawings taken from the originals, and are either enlargements or reductions of the original drawings of other authors or persons who revised the work of an original author of a species. Except where indicated, the scale on the lower left hand side of the main figure represents one millimeter of length of what is a large specimen of the species illustrated. That is to say, if a species were stated by its author to vary from 8 to 12 mm in length, then the scale at the side of the illustration represents one millimeter of the length of the isopod illustrated or 1/12 of its length. Where the line represents less than one millimeter, it is so stated below the scale. A generalization to keep in mind is that the longer the line representing 1 mm is in the illustration, the smaller the specimen is; and the reverse, the smaller the line, the larger the specimen. The cymothoid isopod illustrated on page 157, figure 236 is very large, indeed, 45 mm long. The munnid illustrated on page 293, figure 465 is only about 1 mm long since the line is about as long as the illustration of the specimen.

At times a whole figure of the animal has not been given. It is because it was not illustrated by the original author of the species, or it differs very little from other species in the genus. When accessory structures are illustrated in addition to the main figure, they are rarely on the same scale as the main figure generally being enlargements. Since isopods molt and grow all during their lives, it would be misleading to place a scale next to the illustration of an accessory structure. The structure might be of a larger or smaller size, but of the same configuration in another larger or smaller member of the same species. Size comparisons in invertebrate animals in general, and in crustaceans in particular, are very misleading since the animals do not reach a particular size and stop growing within a very narrow range that is characteristic of many common vertebrate organisms. The illustrations of accessory structures, unless otherwise indicated, are of mature individuals. At times the original author might not have known that his specimen was an immature individual, so there will probably be some errors made if all illustrations are thought to be of mature specimens. Where there are fundamental differences between the species illustrated here and that illustrated by the original author, then further work demonstrated that the original author was in error.

The illustrations can be used as a starting point for the identification of an isopod specimen. If a specimen under the microscope looks very much like an illustration in the book, then the key can be used in a backward direction to discover the identity of the specimen. The identity should be confirmed however by starting again at the beginning of the key so that all alternative considerations are eliminated.

KEY TO ISOPOD SUBORDERS FOUND IN NORTH AMERICAN WATERS

1a. Body symmetrical or at least with traces of bilateral symmetry; peraepods distinct (Fig. 7, except h and i) 2

1b. Body asymmetrical or not apparently based on bilateral symmetry; peraeopods not present or not easily seen (Fig. 7h and i); parasitic on Crustacea .... Epicaridea (in part) (p. 338)

2a. Uropods lateral, or lateral and operculate, or uropods absent (Fig. 43) 3

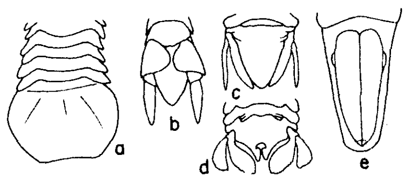


Figure 43. Lateral, absent (dorsal view) or ventral uropods. a. Absent (*Anuropus*). b. Anthurid. c. *Exosphaeroma*. d. *Paracerceis*. e. Valvifera (Uropods are valves or covers of branchial chamber).

2b. Uropods terminal (occasionally dorsal), or if present they would be terminal (Fig. 44) 5

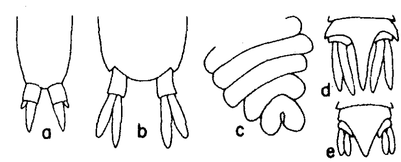


Figure 44. Terminal Uropods. a. Microcerberidea. b. Asellota. c. Epicaridea. d-e. Gnathiidea.

3a. Uropods folded under pleotelson, operculate to branchial cavity (Fig. 43e) .... Valvifera (p. 48)

3b. Uropods lateral or absent 4

7 pair pereopods

4a. Body elongate, length about 7 times width or more; pleotelson (or telson) elongate; uropods partially folded over or extending above pleotelson (Fig. 43b) .... Anthuridea (p. 85)

4b. Body never elongate, length much less than 7 times width; pleotelson moderately large to large; uropods with endopods and exopods flattened or pointed, never folded up over or above pleotelson .... Flabellifera (p. 109)

5 pr. pereopods

4c. Gnathiidae (p. 217)

5a. Blind; body length about 7 times width; length less than 2 mm (Fig. 343a) .... Microcerberidea (p. 214)

5b. Blind or with eyes; body length less than 7 times width; usually longer than 2 mm .... ~~8~~ 7

~~**6a.** Pleotelson "T"-shaped or triangulate; uropods with short base and long rami (Fig. 44d-e) .... Gnathiidea (p. 217)~~

~~**6b.** Not as above .... 7~~

7a. Body always symmetrical; pleon with at least posterior three segments and telson fused and with branchial cavity with pleopods and at least one pair of operculate pleopods (or fused pleopods forming operculum); antennae always distinct and generally long .... Asellota (p. 229)

7b. Body usually not symmetrical; pleon never with branchial cavity and with pleopods various; antennae always rudimentary or very small; parasitic on Crustacea .... Epicaridea (p. 309)

SUBORDER VALVIFERA

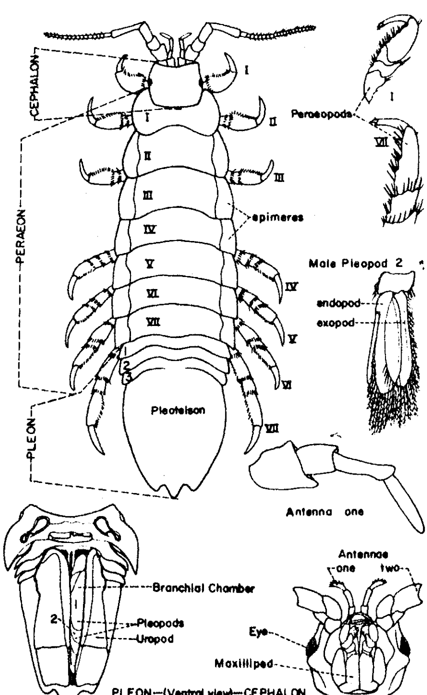


Figure 45. Valvifera (General nomenclature).

Three characters are always present in the Valvifera found in North American waters. The uropods form valves which fold over the branchial chamber as a cover. The flagellum of antenna one is always formed of a single fused segment and the mandible has no palp. The pleon always has several fused segments and the frontal margin of the cephalon rarely has a long rostrum. The North American species are divided into the two families—Arcturidae and Idotheidae. The arcturids are found in the deep sea, and indeed are filter feeders characteristic of that extensive habitat. They are found in deep water off Florida and in tropical regions, but in the northern part of their range they are found in shallow water. The idotheids are common in the near shore habitats along the margin of the continent and are especially abundant in the algae that is found there.

All species of Valvifera are highly calcified. Arcturids have a tendency to have very large spines on their bodies, and idotheids have smooth bodies but some species have spines. Spines are in part a character that shows the maturity of the specimen and in part a secondary sexual character generally being absent or smaller in females. There are other differences between the two families as will be seen. There are about ~~[illegible]~~ 80 recorded species in North American waters. They are divided in addition to the two families into 18 genera.

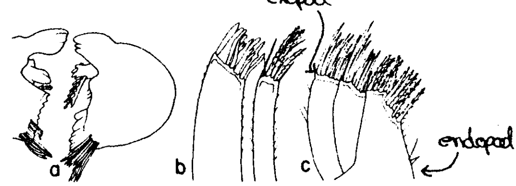


Figure 46. Mouth parts of Valviferan species. a. Mandibles. b. Maxilla one. c. Maxilla two.

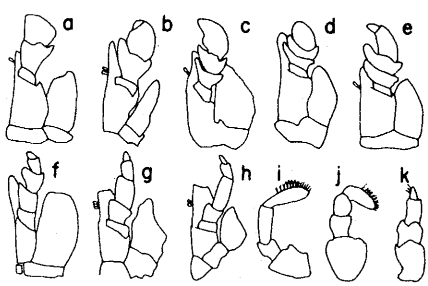


Figure 47. a-h. Maxillipeds of Valvifera. a. *Synidotea*. b. *Cleantis*. c. *Idotea*. d. *Idotea*. e. *Penidotea*. f. *Saduria*. g. *Pleuroprion*. h. *Arcturus*. i-k. Antennae one of Valviferan species. i. General. j. *Penidotea*. k. *Cleantis*.

KEY TO VALVIFERAN FAMILIES*

1a. Body not greatly dorsoventrally compressed; first four pairs of peraeopods different from last three pairs; first pair usually gnathal and small; second to fourth with long setae on inner margin, fifth to seventh ambulatory (some peraeopods can be naturally absent; i. e., never developed) .... Arcturidae (p. 50)

1b. Body more or less dorsoventrally compressed; all peraeopods ambulatory (anterior three generally different from posterior four) (Fig. 66) .... Idoteidae (p. 58)

note: There are 6 valviferan families, but Idoteidae & Arcturidae (= Astacillidae) occur in No. America (or Europe).

ARCTURIDAE

Specimens of arcturids are small to large in size. Small and medium size species are found in the near shore habitats and large species are found in the deep sea. The flagellum of antenna one in all of them is of a single article. Antenna two has the last two articles of the peduncle elongate and there is a short flagellum of few to many articles. Eyes are present and generally located laterally or dorsolaterally on the cephalon. The mouth parts are all well developed and frequently peraeopod I is modified as a small gnathal appendage located directly behind (or beneath) the maxillipeds. Generally peraeopods II to IV are modified by the presence of long setae and serve as food straining structures (Figs. 48 and 49). Peraeopods V to VII are ambulatory. The pleon usually has all segments fused, the anterior segments being only indicated in the lateral and sometimes dorsal surfaces (Fig. 50). Frequently the cephalon is fused to peraeonal segment I.

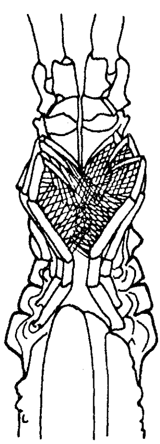


Figure 48. Ventral view of food straining first peraeopods of Arcturid (After Grunner).

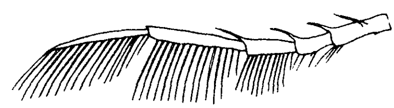


Figure 49. Peraeopod modified for food straining in *Arcturus*.

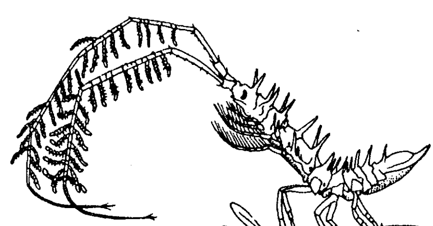


Figure 50. Arcturid with young (After Schmitt).

KEY TO GENERA AND SPECIES OF ARCTURIDAE

1a. Body geniculate; flagellum of antenna two more than three articles and usually longer than half length of last peduncular segment (Fig. 351) 62 5

1b. Body not geniculate; flagellum of antenna two of about three articles (apical article can be claw-like) (Fig. 56b) 2

2a. Body cylindrical and of nearly uniform diameter; fourth peraeonal segment greatly longer than others; pleon with one free segment; pleotelson with posterior margin conically produced .... *Astacilla*

Fig. 51. *Astacilla lauffi* Menzies and Frankenberg (5mm)

Range: Coast of Georgia (43 to 134 m)

Peraeonal segment IV of the male is about twice as wide as that of the female. Apparently this is characteristic of all species in the genus, but the females do not always have peraeonal segment IV as wide as it is in this species. One free pleonal segment is present.

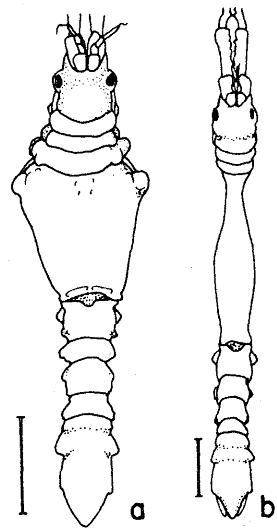


Figure 51. a. *Astacilla lauffi* (female). b. Male.

Fig. 52a,b. *Astacilla grandulata* (Sars) (16 mm)

Range: Newfoundland and Grand Banks (13 to 1170 m)

Fig. 52c. *Astacilla caeca* Benedict (9.5 mm)

Range: South of Martha's Vineyard (3337 m)

This species is blind and has a small rostrum on the frontal margin of the cephalon.

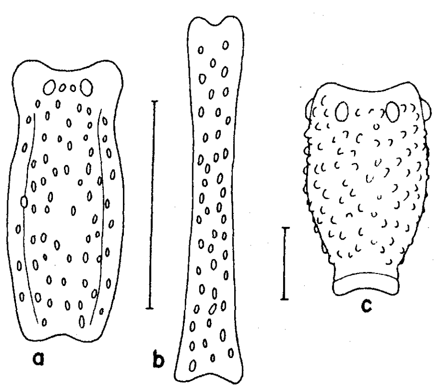


Figure 52. a-b. *Astacilla grandulata* (a. female, b. male). c. *A. caeca*.

2b. Body cylindrical; peraeonal segment IV longer (but not greatly longer) than other segments; segment IV also much wider than others; segment III also very wide 3

3a. With one free pleonal segment; peraeonal segment I not fused to cephalon; epimeres obscure in dorsal view .... ***Pleuroprion***

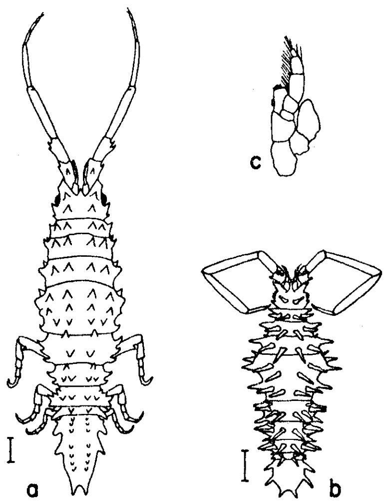


Figure 53. *Pleuroprion. a. P. murdochi. b. P. intermedium.* c. Maxilliped, *P. intermedium.*

Fig. 53a. *Pleuroprion murdochi* (Benedict) (12 mm)

Range: Off Pt. Frankland, Alaska

The pleotelson of this species is longer than wide and there are short spines on it.

Fig. 53b. *Pleuroprion intermedium* (Richardson) (7 mm)

Range: Kyska Harbor, Aleutian Islands (30 m)

The pleotelson of this species is about as wide as long and it has long spines on it.

3b. With no free pleonal segments; peraeonal segment I fused to cephalon; epimeres visible in dorsal view **4**

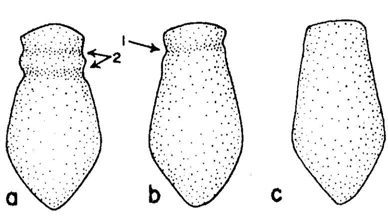


Figure 54. Pleonal sutures or indications of pleonal segments in pleotelson of Valvifera. a. Two. b. One. c. None.

4a. With two pleonal segments indicated in dorsal view of pleon (Fig. 54a); lateral lappet of peraeonal segment I not expanded beyond margin of body .... ***Neastacilla***

Fig. 55. *Neastacilla californica* (Boone 1918) (6.1 mm)

Range: Southern California, Pt. Conception to Pt. Loma (Shallow water to 99m)

The species lives in sea weed. There are two pleonal segments indicated along with the conically produced pleotelson. This is the only species of the genus collected in North American waters.

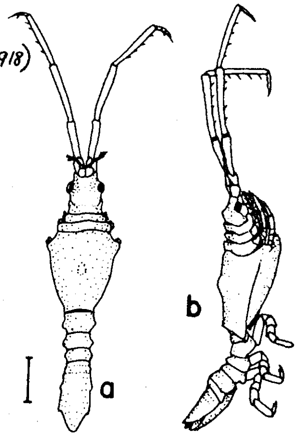


Figure 55. *Neastacilla californica*. a. Dorsal view. b. Lateral view.

4b. With no pleonal segments indicated (Fig. 54c); lateral lappet of first peraeonal segment expanded and visible in dorsal view .... *Idarcturus*

Fig. 56. *Idarcturus allelomorphus* Menzies and Barnard (5.2 mm)
1959

Range: Pt. Conception to Laguna Beach and Cortes Bank, southern California (13 to 91 m)

The species was collected in medium coarse gray sand on the shelf off southern California.

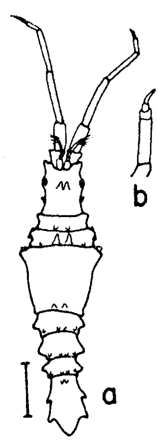


Figure 56. a. *Idarcturus allelomorphus*. b. Detail antenna two.

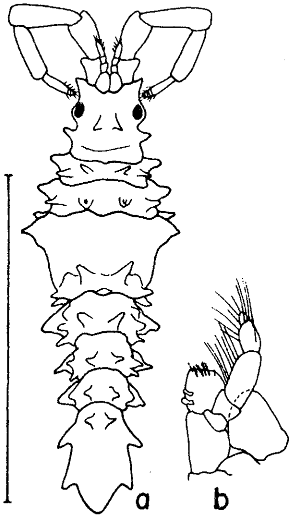


Figure 57. a. *Idarcturus hedgpethi*. b. Maxilliped.

Fig. 57. *Idarcturus hedgpethi* (Menzies 1951) (1.4 mm)

Range: Tomales Bay, California (Intertidal)

This species differs from *I. allelomorphus* in that it is shorter and wider than *I. allelomorphus*. It was found on a hydroid.

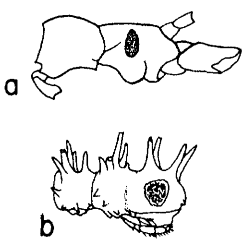


Figure 58. Lateral furrows between cephalon and peraeon. a. Absent. b. Present.

5a. Furrow between cephalon and peraeonal segment I (sometimes sutures laterally distinct) (Fig. 58b) 6

5b. Shallow groove only between cephalon and first peraeonal segment (never laterally sutured) (Fig. 58a) .....*Antarcturus*

Fig. 59. *Antarcturus floridanus* (Richardson)

Range: Fernandina, Florida (494 to 499 m)

The species was originally described as a member of the genus *Arcturus*, but then *Antarcturus* was defined and the species was placed in that genus. The species differs from *A. annaoides* in that it has long spines on its body.

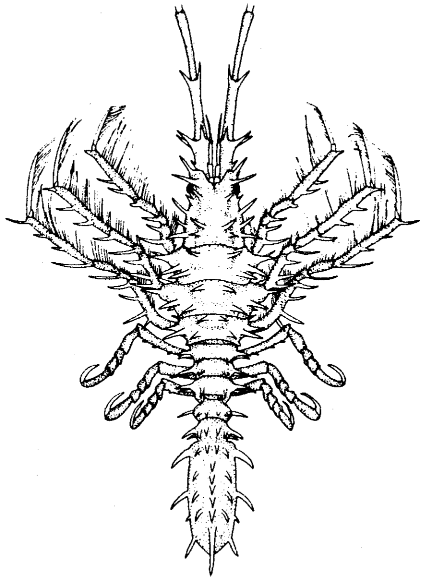


Figure 59. *Antarcturus floridanus.*

Fig. 60. *Antarcturus annaoides* (Menzies) (13 mm)

Range: Caribbean Sea, south of Jamaica (1244 m)

Antennae two are about 25 mm long or about twice the length of the body. The body is smooth; i. e., without large spines that are found in *A. floridanus.*

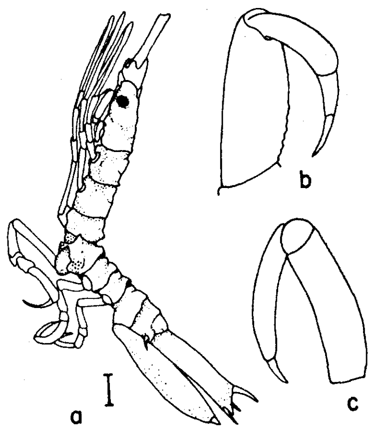


Figure 60. *Antarcturus annaoides.*

6a. Antennae two shorter than body; flagellum short with two to four articles; pleon never longer than last four peraeonal segments .... *Microarcturus*

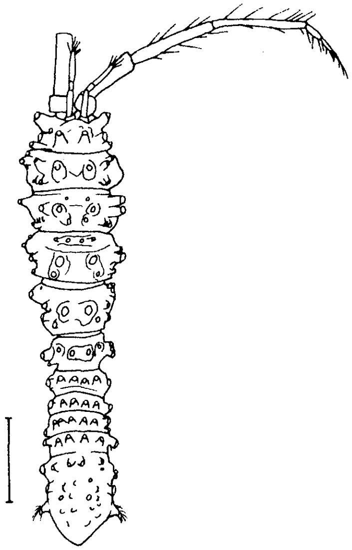


Figure 61. *Microarcturus tannerensis.*

Fig. 61. *Microarcturus tannerensis* Schultz, 1966 (5.5 mm)

Range: Tanner Canyon, southern California coastal shelf (1298 m)

This is the first species of this deep sea genus to be taken in North American waters. It is very much like an *Arcturus* species, but the species are blind and with short antennae two.

6b. Antennae two longer than body; flagellum with more than four articles; pleon sometimes longer than last four peraeonal segments .... *Arcturus*

GENUS ARCTURUS

The arcturids *Arcturus* and related genera, are among the most characteristic isopod of the deep sea. They are taken in abundance from the edge of the continental shelf to the deepest parts of the ocean. Food is probably obtained by filtering mud from the bottom where the isopod lives. The food particles are caught in the filter mechanism that is formed by folding the front legs together (Fig. 48).

The species live in cold and cool water. It is interesting to note that species caught off Florida are taken from the cold water at great depths; whereas, those sometimes of the same species taken off Greenland are taken from relatively shallow, but cold water. There are many species in the genus *Arcturus* and representatives are found in every ocean of the world. The genus *Antarcturus* was recently split from the parent genus *Arcturus,* and it is necessary to examine both old and newly described species in order to make sure that they are placed in the correct genus.

KEY TO SPECIES OF ARCTURUS

7a. Posterior margin of pleotelson notched (dorsal view) 8

7b. Posterior margin of pleotelson conically produced and without notch (dorsal view) 9

8a. Body without spines .... ***A. beringanus***
Fig. 62d. *Arcturus beringanus* (Benedict) (11 mm)
Range: Bering Sea, Alaska (51 to 133 m)

8b. Body with spines .... ***A. longispinus***
Fig. 62c. *Arcturus longispinus* (Benedict) (35 mm)
Range: Aleutian Islands (101 m)

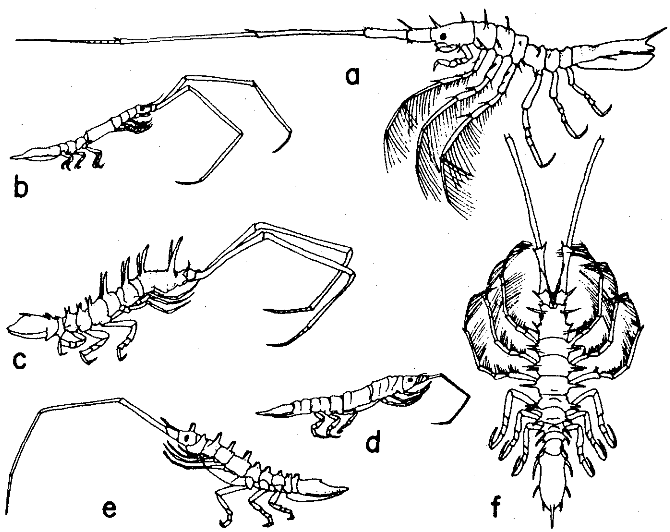


Figure 62. *Arcturus*. a. *A. purpureus*. b. *A. glaber*. c. *A. longispinus*. d. *A. beringanus*. e. *A. baffini*. f. *A. caribbaeus*.

9a. Body with spines 10

9b. Body without spines .... ***A. glaber***
Fig. 626. *Arcturus glaber* (Benedict) (31 mm)
Range: Bering Sea, Alaska (101 m)

10a. Pleotelson with long medial terminal spine projecting beyond posterior margin 11

10b. Pleotelson with short dorsal spine or tubercle not projecting beyond posterior margin .... *A. baffini*

Fig. 62c. *Arcturus baffini* (Sabine) (40 mm)
Range: Greenland and northeastern Canada (9 to 274 m)

A subspecies without the large spines on the body has been called *A. baffini tuberosus* because it has tubercles instead of spines on the body.

11a. Large spines present on pleonal segment 2 .... *A. caribbaeus*
Fig. 62f. *Arcturus caribbaeus* (Richardson)
Range: Near Aves Island, Caribbean Sea (1249 m)

11b. Large spines not present on pleonal segment 2 .. *A. purpureus*
Fig. 62a. *Arcturus purpureus* (Beddard) (18 mm)
Range: Sombrero Island, West Indies (813 m)

A character of the suborder!

IDOTEIDAE

Species of idoteids rarely have spines or especially long peraeopods. The flagellum of antenna one is of a single article. Antenna two has a very short or rudimentary flagellum or a long one of many articles. The mouth parts of the cephalon are always well developed and they are chewing and biting types. The peraeonal segments frequently have distinct coxal plates visible although different species have different numbers of them visible and some species have none visible. Peraeopods I to III are frequently different from peraeopods IV to VII and they never are specifically modified for food gathering or straining although they can be subchelate. There is generally one free pleonal segment and sometimes two or three. Frequently lateral indications of other segments are present, and the pleotelson is well defined. Antenna 2 with peduncle of 5 distinct articles.

KEY TO GENERA AND SPECIES OF IDOTEIDAE

1a. Eyes dorsally located; cephalon with notched anterolateral lobes; first three peraeopods subchelate; last four ambulatory 2

1b. Eyes laterally or sometimes dorsolaterally located; cephalon without anterolateral lobes; front of cephalon usually emarginate 8

2a. Palp of maxilliped with five articles; uropod with inner branch (endopod) minute .... *Saduria*

(= Mesidotea)

Fig. 63a-c. *Saduria entomon* (Linaeus) (30 mm)

Range: Circumpolar, south on west coast to mid-California (On beach—north—to 813 m—south)

This species grows to about 30 mm or more and is a characteristic resident of the continental shelf in the Arctic regions. It is also taken from the mud and sand of the bottom in small bays and inlets in brackish and occasionally freshwater. Occasionally it is found on the beach buried in the sand or under rocks. This species is generally taken on sand and gravel bottoms and beaches. The specimens from mid-California were taken in the cool deep water, and it is limited in depth probably more by temperature than pressure. The genus has been called *Mesidotea*.

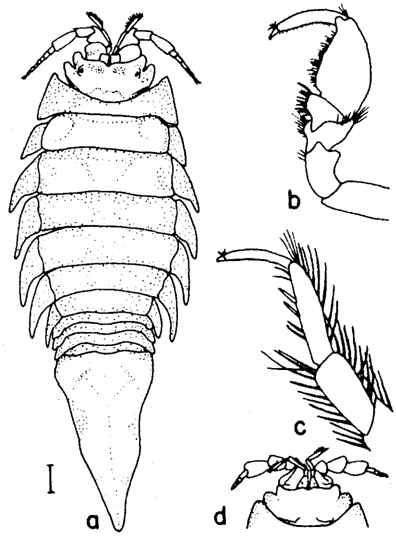


Figure 63. *Saduria*. a. *S. entomon*. b. Peraeopod I. c. Peraeopod VI. d. *S. sabini*.

Fig. 63d. *Saduria sabini* (Kroyer) (20 mm) → has Ant. 2 peduncular articles greatly dilated.

Range: Circumpolar (On beach to 139 m)

This species is blind and found on muddy bottoms and in the mud of beaches. It is possible that the species has lost its eyes because of lack of light in its muddy habitat. Its eyed elative *S. entomon* lives in a sand and gravel habitat. This species has been divided into a number of subspecies, but they are disregarded here because many of them are found outside of the range represented in this book.

for Saduria see Menzies & Mohr, 1962

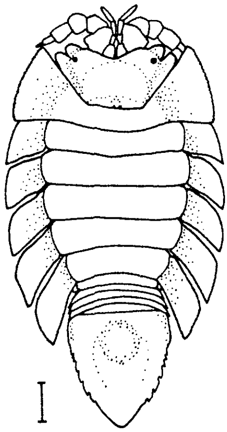


Figure 64. *Saduria sibirica.*

Fig. 64. *Saduria sibirica* (Birula) (8.8 mm)

Range: Siberia to northeastern Alaska near Canada (7 to 50 m)

2b. Palp of maxilliped with three articles; uropod with inner branch half as long as outer branch .... *Chiridotea*

GENUS CHIRIDOTEA

The species of the genus are common on the sandy bottoms off the Atlantic coast of North America. They are occasionally found several centimeters below the sand on intertidal beaches. The palp of the maxilliped has three articles and the mandible lacks a molar process. The type-species of the genus of six species is *C. coeca.*

Burrow along just under the surface, leaving a trail of raised sediment.

KEY TO SPECIES OF CHIRIDOTEA

3a. Prominent anterolateral groove, indentation or cut on cephalon **4**

3b. No prominent anterolateral groove, indentation or cut on cephalon .... *C. stenops*

Fig. 65a-c. *Chiridotea stenops* (Menzies and Frankenberg) (2.3 mm)

Range: Off Georgia coast (104 m)

This species was shown by Watling & Maurer (1975) to be a jr. synonym of C. arenicola (a juvenile stage).

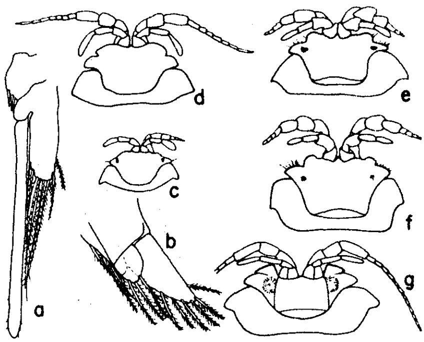


Figure 65. a-c. *Chiridotea stenops*. a. Pleopod 2, male stylet. b. Apex of uropod (endopod and exopod). c. Cephalon. d. *C. almyra*. e. *C. nigrescens*. f. *C. arenicola*. g. *C. tuftsi*.

4a. Antennae two with flagella long, much longer than all of antennae one 5

4b. Antennae two with flagella short, only slightly longer than antennae one 6

5a. Eyes prominent; antennae one extend only to end of peduncle of antennae two .... *C. tuftsi*

Fig. 65g. *Chiridotea tuftsi* (Stimpson) (6.5 mm)

Range: Gulf of St. Lawrence to Long Island Sound (Low tide to 55 m)

5b. Eyes small; antenna one extends beyond (but only just beyond) end of peduncle of antenna two .... *C. almyra*

Fig. 65d. *Chiridotea almyra* (Bowman) (5.8 mm)

Range: Cape Cod to Georgia (Shallow water)

This species has eyes, but they are difficult to see in preserved specimens. The species is exclusively found in brackish water.

6a. Clavate flagellum of antenna one about 3 times as long as wide 7

6b. Clavate flagellum of antenna one much more than 3 times as long as wide .... *C. coeca*

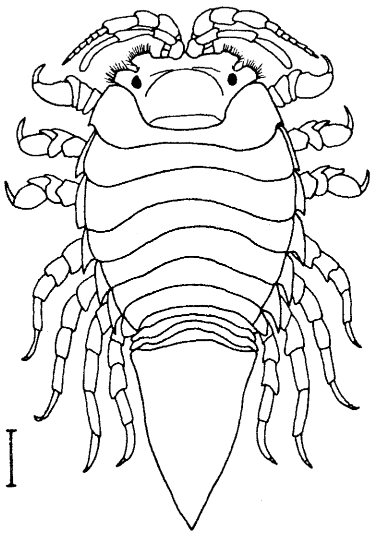


Figure 66. *Chiridotea coeca.*

Fig. 66. *Chiridotea coeca* (Say) (13 mm)

Range: Nova Scotia to Florida (Surface to 31 m)

7a. **Antenna one extended slightly beyond end of peduncle of antenna two; one or more setae on anterior lobe of frontal margin of cephalon** .... *C. nigrescens*

Fig. 65e. *Chiridotea nigrescens* (Wigley) (10.5 mm)

Range: Southern and western shores of Cape Cod (Near surface to 1.5 m)

7b. **Antenna one not quite reaching to end of peduncle of antenna two; no setae on anterior lobe of cephalon** .... *C. arenicola*

Fig. 65f. *Chiridotea arenicola* (Wigley) (7.5 mm)

Range: Georges Bank (27 to 66 m)

8a. **Flagellum of antenna two long and well developed (Fig. 67)** **9**

8b. **Flagellum of antenna two rudimentary to 3 articles (Fig. 102c)** .... **41 (p. 80)**

9a. **Palp of maxilliped with four or five articles; various number of coxal plates visible in dorsal view** **26**

9b. **Palp of maxilliped with three articles; no coxal plates visible in dorsal view** .... *Synidotea*

GENUS SYNIDOTEA Harger 1878

This genus contains many species all of which are superficially alike and can be told apart, if at all, by making observations of minute or qualitative characters. The species are mostly found on the west coast of North America south to southern California, but they are circumpolar in distribution and are found on the east coast south to Cape Cod. See Menzies & Miller (1972) for a key to the California Synidotea, & a review of world species.

KEY TO SPECIES OF SYNIDOTEA

10a. **Pleotelson with posterior margin notched** **11**

10b. **Pleotelson with posterior margin rounded or pointed** .... **21 (p. 68)**

11a. **Two small spines or two spines with ridge base mediolaterally placed on frontal margin of cephalon** **12**

11b. **Cephalon without spines on frontal margin** **18**

12a. **Spines on frontal margin of cephalon on ridges** **13**

12b. **Spines on frontal margin of cephalon not on ridges** **14**

13a. **Pleon about as wide as long; cephalon about 2/3 as wide as body** .... ***S. bicuspida***

Fig. 67. *Synidotea bicuspida* (Owen 1839) (25 mm)

Range: West Coast of Alaska and Bering Sea (6 to 148 m). Originally described as Idotea bicuspida. Synonomized by Harger in 1879. Circumpolar; S. to Bodega Bay.

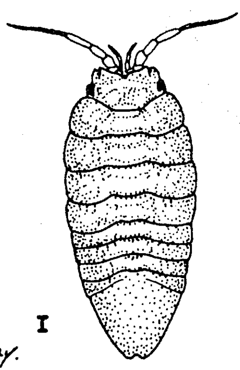


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Figure 67. Synidotea bicuspida.

13b. **Pleon shorter than long; cephalon less than 2/3 width of body** .... ***S. marmorata***

Synidotea media Iverson, 1972. California

Synidotea spinosa anadyrensis Gurjanova 1955. Bering Sea.

Synidotea berolzheimeri Menzies & Miller 1972. Morro Bay to Sonoma Co.

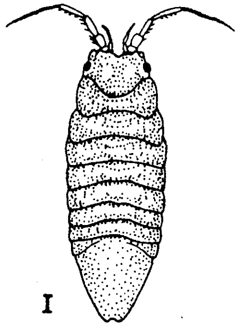

Figure 68. *Synidotea marmorata.*

Fig. 68. *Synidotea marmorata* (Packard) (19 mm)

Range: Laborador and Grand Banks (22 to 236 m)

This species and the smaller *S. nodulosa* are the only two species of *Synidotea* on the east coast of North America.

14a. Anterolateral corners of cephalon horn-like; peraeonal segment I abruptly wider than cephalon; pleon shorter than wide .... *S. ritteri*

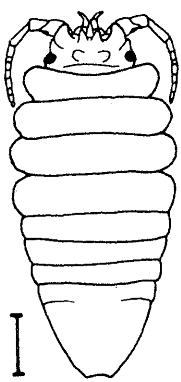

Figure 69. *Synidotea ritteri.*

Fig. 69. *Synidotea ritteri* Richardson 1904 (6 mm)
Range: San Francisco, California (Shallow water) to Vancouver Is.

14b. Anterolateral corners of cephalon not horn-like; peraeonal segment I not abruptly wider than cephalon; pleon about as wide or longer than wide **15**

15a. With conspicuous tubercles or small spines on dorsum of peraeon **16**

15b. With no conspicuous tubercles or small spines on dorsum of peraeon **17**

16a. **With medial dorsal tubercles on dorsum of pleon; lateral edges of peraeonal segments pointed** .... *S. pettiboneae*

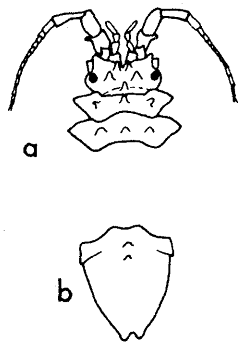

Figure 70. a. *Synidotea pettiboneae*, anterior part. b. Posterior part.

Fig. 70. *Synidotea pettiboneae* Hatch 1947 (10.5 mm)

Range: Puget Sound, Washington (27 to 55 m), to San Mateo Co. (Calif.)

16b. **With no medial dorsal tubercles on dorsum of pleon; lateral edges of peraeonal segments broadly rounded** .... *S. pallida*

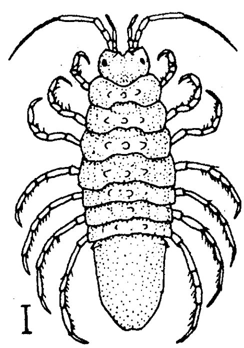

Figure 71. *Synidotea pallida*.

Fig. 71. *Synidotea pallida* Benedict 1897 (12 mm)

Range: Chirikof Island, Alaska (1271 m)
Arctic; Bering Sea

17a. **With lateral edges of peraeonal segments pointed; eyes laterally placed on cephalon** .... *S. consolidata*

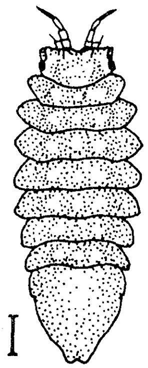

Figure 72. Synidotea consolidata.

= S. pettiboneae
(see Menzies & Miller, 1972: 25)

Fig. 72. *Synidotea consolidata* (Stimpson) (8 mm)

Range: Pacific Grove, California (Shallow water)

17b. With lateral edges of peraeonal segments broadly rounded; eyes dorsally placed on cephalon .... *S. erosa*

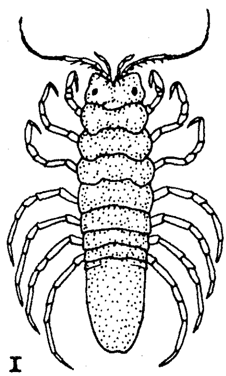

Figure 73. Synidotea erosa.

Fig. 73. *Synidotea erosa* Benedict 1897 (21 mm)

Range: Sannakh Island, Alaska ~~(11 to 59 m)~~ (869 m) & Bering Sea

18a. Peraeonal segment IV widest part of body **19**

18b. Peraeon with segments of about same width, or with segment II widest and gradually tapering to narrow pleotelson **20**

19a. Pleon longer than wide; posterior margin rounded with shallow groove; cephalon with deep medial frontal groove .... *S. nebulosa*

Fig. 74. *Synidotea nebulosa* Benedict 1897 (12 mm)

Range: Aleutian Islands, Alaska (11 to 59 m)

Bering Sea to Washington State

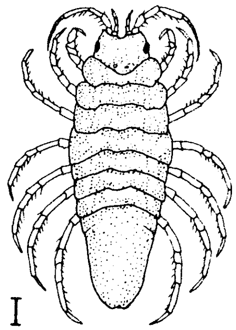

Figure 74. *Synidotea nebulosa.*

19b. Pleon about as wide as long; posterior margin broad with deep medial groove; cephalon with shallow medial groove on frontal margin .... *S. laticauda*

Fig. 75. *Synidotea laticauda* Benedict 1897 (17.5 mm)

Range: San Francisco Bay, California (Shallow water) Presently restricted to San Francisco Bay, although claims to have collected it in Japan. Probably synonomous with S. harfordi.

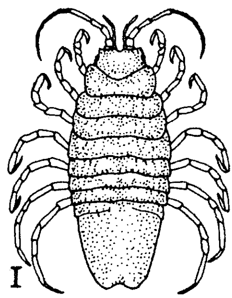

Figure 75. *Synidotea laticauda.*

20a. Cephalon with shallow medial frontal groove; body with continuous lateral margins tapering towards pleon .... *S. hartfordi*

Fig. 76. *Synidotea har~~t~~fordi* Benedict 1897 (16 mm)

Range: ~~Southern California to northern Baja California~~ Morro Bay to Gulf of California

- Iverson has collections from Japan
- Menzies & Miller report it from Japan
- We have collections from Pt. Chivato & Guaymas.

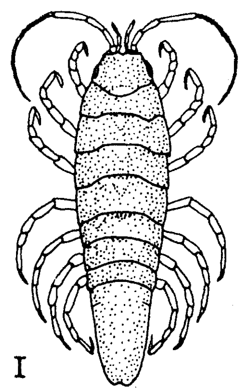

Figure 76. *Synidotea harfordi.*

20b. **Cephalon with deep medial frontal groove; peraeonal segments with obtusely pointed lateral edges** .... *S. angulata*

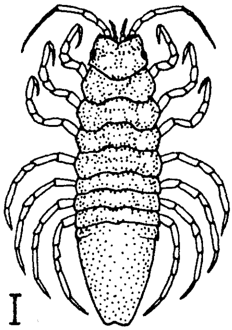

Figure 77. *Synidotea angulata.*

Fig. 77. *Synidotea angulata* Benedict 1897 (12 mm)

Range: Washington State (57 to 69 m)

21a. **Pleotelson with posterior margin rounded** 22

21b. **Pleotelson with posterior margin pointed** 23

22a. **Body margins almost parallel; peraeonal segments all of almost same length and width** .... *S. calcarea*

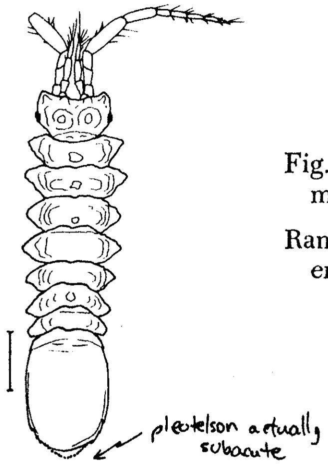

Figure 78. *Synidotea calcarea.*

Fig. 78. *Synidotea calcarea* Schultz 1966 (6 mm)

Range: Tanner Canyon on shelf off southern California (813 m)

Santa Rosa Cyn. (?) 54 m

22b. **Body margin widest at peraeonal segment III; peraeonal segment III both longer and wider than peraeonal segment VII** .... *S. magnifica*

Fig. 79. *Synidotea magnifica* Menzies and Barnard (6 mm)

Range: ~~Pt. Conception~~ to Oceanside, California (55 to 91 m)

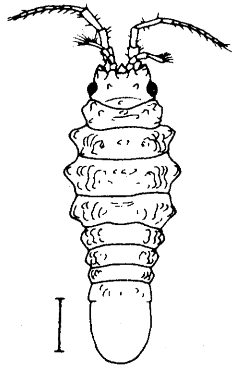

Figure 79. *Synidotea magnifica.*

23a. **Body with short spines or large tubercles** 24

~~23b. Body with no short spines or large tubercles .... 25~~

24a. **Front of cephalon deeply incised; eyes take up less than one half lateral margin of cephalon** .... *S. muricata*

Fig. 80. *Synidotea muricata* (Harford) (22 mm)

Range: Icy Cape, Greenland (46 m)

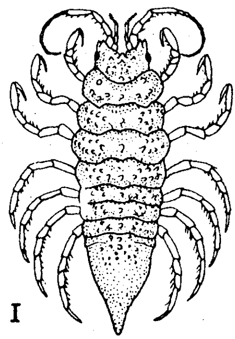

Figure 80. *Synidotea muricata.*

24b. **Front of cephalon not deeply incised; eye takes up more than half of lateral margin of cephalon** .... *S. nodulosa*

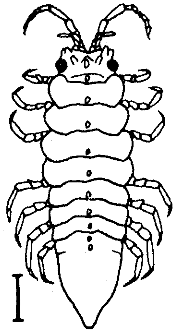

Figure 81. *Synidotea nodulosa.*

Fig. 81. *Synidotea nodulosa* (Krøyer, 1848) (7.5 mm)

Range: Circumpolar, south to Georges Bank and British Columbia (11 to 203 m)

Sometimes the parasitic isopod *Clyptoniscus meinerti* (p. 339) is found in the marsupium of the female.

25a. Body narrows from peraeonal segment IV to strongly produced posterior margin of pleotelson .... *S. laevis*

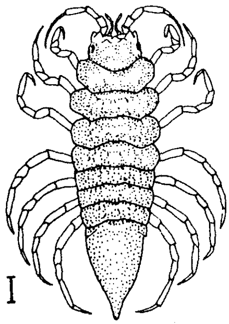

Figure 82. *Synidotea laevis.*

Fig. 82. *Synidotea laevis* Benedict, 1897 (13 mm)

Range: Bering Sea near Pribilof Islands (54 to 66 m)

25b. Body narrows convexly to pointed (only slightly produced) posterior margin of pleotelson .... *S. picta*

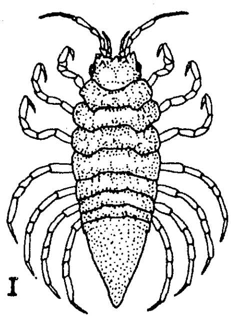

Figure 83. *Synidotea picta.*

Fig. 83. *Synidotea picta* Benedict, 1897 (16 mm)

Range: Alaska and Bering Sea (9 to 37 m)

I doubt these 3 species are all valid - they may all be synonyms!

Key to the Species of Idoteidae Knov

1. Pleon composed of more than one dis
– Pleon composed of

KEY TO BOREAL SPECIES
PLEOTELSON M

Note: these 4 species are all
ymous, at least picta, noc

1. Anterior part of pleon wi
tubercles or spines on pe
margin of cephalon with d
of Ant. 2 with more than

– Anterior part of pleon wi
tubercles or spines on pe
very low and weak; fronta
to modest incision or not
than 11 articles ....

2. Median tubercles of pereo
region of cephalon with t
2 flagellum with more tha

– Median tubercles of perec
posterior region of cepha
antenna 2 flagellum with

3. Median tubercles of perec
about 3 times width; fror
incision or notch; antenr
and extended to middle o

– Median tubercles of pere
body length equal tao ab
of cephalon without a di
may be concave; antenna
extended to middle of pe

on drifting seaweeds throughout the Atlant
occurrance in the northeast Pacific is not t

Fig. 81. *Synidotea nodulosa* (Krøyer 1848) (7.5 mm)

I doubt -
e all valid-
he synonym

Key to the Species of Idoteidae Known from the Gulf of California

1. Pleon composed of more than one distinct segment 2
– Pleon composed of one segment 7
2. Pleon composed of 4 segments, plus 1 pair of partial suture lines; flagellum of antenna 2 uniarticulate .... *Cleantioides occidentalis*
– Pleon composed of 3 segments, plus 1 pair of partial suture lines; flagellum of antenna 2 multiarticulate 3
3. Maxillipedal palp of 4 articles .... *Idotea (Idotea) urotoma*
– Maxillipedal palp of 5 articles 4
4. Eyes transversely (dorsoventrally) elongate and narrow; maxilliped with 1, 2, or 3 coupling hooks .... *Idotea (Pentidotea) stenops*
– Eyes not transversely elongate and narrow; maxilliped with 1 coupling hook 5
5. Posterior border of pleotelson strongly concave; frontal process extended beyond frontal lamina 1 ...... *Idotea (Pentidotea) resecata*
– Posterior border of pleotelson convex, with small median lobe; frontal process not extended beyond margin of frontal lamina 1 .. 6
6. Length less than 3.7 times width; eyes reniform; males with distinct tufts of setae on pereopods .... *Idotea (Pentidotea) wosnesenskii*
– Length more than 3.7 times width; eyes circular; males without tufts of setae on pereopods .... *Idotea (Pentidotea) aculeata*
7. Flagellum of antenna 2 of a single article 8
– Flagellum of antenna 2 multiarticulate 10
8. Lateral margins of pleon expanded posteriorly; pleon without suture lines .... *Erichsonella cortezi*
– Lateral margins of pleon smooth and gently convex; pleon with one pair of partial anterolateral suture lines 9
9. Maxillipedal palp of 4 articles; cephalon with a mediodorsal hump; coxal plates of pereonite 6 distinct in dorsal view .... *Eusymmerus antennatus*
– Maxillipedal palp of 3 articles; cephalon without mediodorsal hump; coxal plates of pereonite 6 NOT distinct in dorsal view ... . *Parasymmerus annamaryae*, n. sp.
10. Maxillipedal palp of 4 articles; posterior margin of pleotelson acuminate .... *Colidotea findleyi*
– Maxillipedal palp of 3 articles; posterior margin of pleotelson concave .... *Synidotea harfordi*

Note: The Atlantic species *Idotea metallica* has not previously been reported from the northeastern Pacific; we have, however, a record of a single specimen from the Gulf of California and a second individual, collected by M. Ninos, from Catalina Island, California. This species is commonly found on drifting seaweeds throughout the Atlantic Ocean and elsewhere, and its occurrance in the northeast Pacific is not totally unexpected.

their respective pereonites by most workers (see, for example, Sheppard's [1957] clarification of the genus *Edotea* in this regard). Hence, it is apparent from the literature that various workers have interpreted the concept of a "coxal plate" in a variety of ways, some considering a slightly swollen coxa as representing a coxal plate, others assuming lack of an obvious suture line meant the plate had fused with its respective pereonite (when in fact the

Mackey for the collection of important materials used in this paper, and other studies; Melinda Thun, for illustrating the dorsal views of *S. harfordi, P. annandaryae,* and *C. occidentalis*; Bob Setzer and Dr. David Young, for algal identifications; S. Luke, for assistance in obtaining loan materials from Scripps Institution; and Ruth Toyama, for typing the manuscript.

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Literature Cited

Benedict, J. E. 1897. A revision of the genus *Synidotea*.—Proc. Acad. Nat. Sci. Phil. 49:389–404.

Briggs, J. C. 1974. Marine zoogeography.—McGraw-Hill, New York. 475 pp.

Brusca, R. C. 1977. Range extensions and new host records of cymothoid isopods (Isopoda: Cymothoidae) in the eastern Pacific.—Bull. So. Calif. Acad. Sci. 76(2):128–131.

———. 1978a. Studies on the cymothoid fish symbionts of the eastern Pacific (Isopoda, Cymothoidae). I. Biology of *Nerocila californica*.—Crustaceana 34(2):141–154.

———. 1978b. Studies on the cymothoid fish symbionts of the easter Pacific (Crustacea: Isopoda: Cymothoidae). II. Biology of *Lironeca vulgaris*.—Occ. Pap. Allan Hancock Found. (n. ser.) 2:1–19.

Brusca, R. C., E. Iverson, B. Wallerstein, and B. Winn. (in preparation).—The marine isopods of California.

Brusca, R. C. and B. R. Wallerstein. 1977. The marine isopod Crustacea of the Gulf of California. I. Family Idoteidae.—Amer. Mus. Novitates 2634:1–17.

Brusca, R. C. and B. R. Wallerstein. 1979. Preliminary comments on zoogeographic patterns of idoteid isopods in the northeast Pacific, with a review of shallow water zoogeography for the region.—Bull. Biol. Soc. Wash. [in press].

Croizat, L., G. Nélson, and D. E. Rosen. 1974. Centers of origin and related concepts.—Syst. Zool. 23(2):265–287.

Gurjanova, E. F. 1936. Ravnonogie dalnevostochnykh morei (Isopoda of far east seas).—Fauna SSSR, Rakoobraznye 7(3):1–279.

Harford, W. G. W. 1877. Description of a new genus and three new species of sessile-eyed Crustacea.—Proc. Calif. Acad. Sci. 7(1):53–55.

Iverson, E. 1978. The status of *Exosphaeroma inornata* Dow and *Exmedia* George and Stromberg (Isopoda: Sphaeromatidae) with ecological notes.—Jour. Fish. Res. Bd. Canada 35(10):1381–1384.

Johnson, M. E. and H. J. Snook. 1955. Seashore animals of the Pacific coast.—(Reprinted by Dover Publ., New York, 1967) 659 pp.

Kensley, B. and H. W. Kaufman. 1978. *Cleantioides*, a new isopod genus from Baja California and Panama.—Proc. Biol. Soc. Wash. 91(3):658–665.

Menzies, R. J. 1950. The taxonomy, ecology and distribution of northern California isopods of the genus *Idotea* with the description of a new species.—Wasmann Jour. Biol. 8:155–195.

———. 1962. The zoogeography, ecology and systematics of the Chilean marine isopods.—Repts. Lund Årsskrift, N.F. 57(2):1–162.

Menzies, R. J. and R. J. Waidzunas. 1948. Postembryonic growth changes in the isopod

VI to VII in Colidotea

26a. Coxal plates visible in dorsal view on peraeonal segments II to VII or on only IV to VII; maxillipedal palp of four articles 32

26b. Coxal plates visible in dorsal view on peraeonal segments II to VII; maxillipedal palp of five articles .... *Pentidotea*

GENUS PENTIDOTEA

The medium to large species of this genus are fairly common and are frequently found between the tides on rocks and in seaweed, kelp, eelgrass and other marine vegetation. Apparently their color is changeable and varies according to the background on which they are located. The species of the genus have been considered as a subgenus (*Pentidotea*) of *Idotea*, but since there is a consistent difference in maxillipedal palp article number between species of *Pentidotea* and those of *Idotea*, it is here considered a full genus.

KEY TO SPECIES OF PENTIDOTEA

27a. Posterior margin of pleotelson with single medial protuberance 28

27b. Two posterolateral protuberances from posterior margin of pleotelson present .... *P. resecta*

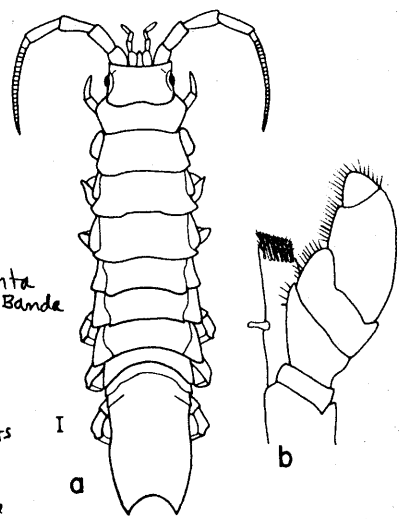


Figure 84. a. *Pentidotea resecta.* b. Maxilliped.

Fig. 84. *Pentidotea resecta* (Stimpson) (36 mm)

Range: Southeastern Alaska to ~~southern California~~ Punta Banda (Surface to 18 m)

– Records so. of Pt. Banda are uncommon but it apparently drifts on seaweed a lot & has been collected from La Paz & the mouth of the Gulf, as well as some of Mexico's offshore islands.

28a. Cephalon not deeply set into peraeonal segment I; eyes dorsolaterally placed on cephalon, not laterally placed .... *P. schmittii*

flagellar articles poorly defined.

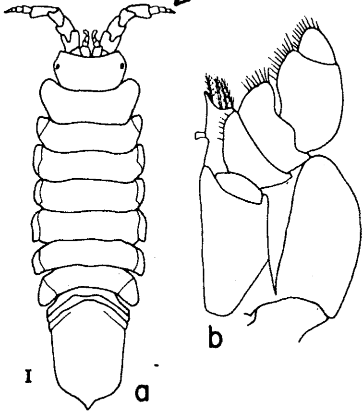


Fig. 85. *Pentidotea schmittii* (Menzies) (30 mm)

Range: Dillon Beach, California (Intertidal) to Punta Banda

– we also have a record from Washington State

Figure 85. a. *Pentidotea schmittii*. b. Maxilliped.

28b. Cephalon moderately to deeply set into peraeonal segment I; eyes laterally placed on cephalon 29

29a. Body margins subparallel and with peraeonal segment I only slightly wider than cephalon; no spaces between ends of peraeonal segments; posterior margin of pleon moderately to lightly produced .... *P. montereyensis*

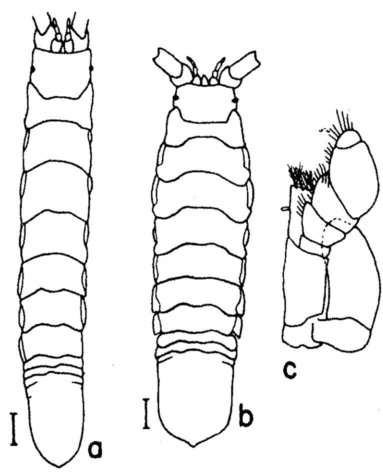


Fig. 86. *Pentidotea montereyensis* (Maloney) (14.3 mm)

Range: Washington to ~~Monterey Bay,~~ N. Baja California (Intertidal)

Figure 86. a. *Pentidotea montereyensis* (male). b. Female. c. Maxilliped.

29b. Body margins somewhat convex and pleon noticeably narrower than widest body part; lateral ends of peraeonal segments slightly to moderately separated at ends; posterior margin of pleotelson moderately to strongly produced 30

30a. Pleon as narrow or narrower than cephalon with posterior margin strongly produced .... *P. aculeata*

Fig. 87. *Pentidotea aculeata* (Stafford) (23 mm)
Range: ~~Central to southern~~ No. Calif. to lower Gulf of California (Tide pools)

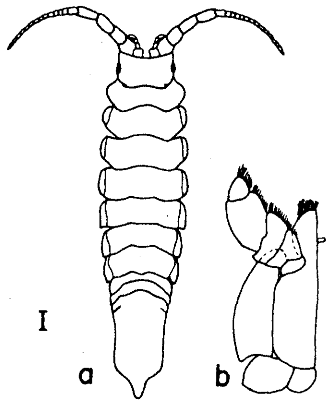


Figure 87. a. *Pentidotea aculeata*. b. Maxilliped.

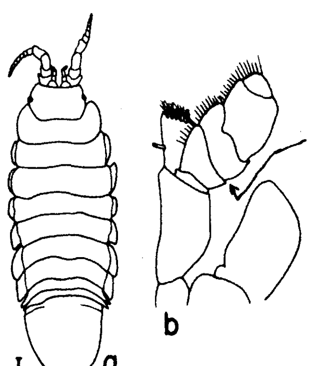
30b. Pleon wider than cephalon with posterior margin moderately produced 31

31a. Lateral edges of free pleonal segments separated and moderately pointed; posterolateral margin of pleon rounded .... *P. wosnesenskii*

Fig. 88. *Pentidotea wosensenskii* (Brandt) (32 mm)

Range: Western Aleutians to San Francisco Bay (Surface to 16 m)

La Paz (USNM #69575)
Gulf of Alaska (rocky littoral) - common



this suture between 2 & 3 is often indistinct.

Figure 88. a. *Pentidotea wosnesenskii*. b. Maxilliped.

Pentidotea kirchanskii Miller & Lee, 1970
Central Calif. (N. of San Francisco)
Resembles P. aculeata

31b. **Lateral edges of pleonal segments more or less continuous with lateral body margin; posterolateral margin somewhat quadrate** .... *P. stenops*

Upper coupling hook often missing, especially in pre- or mid-molt individuals.

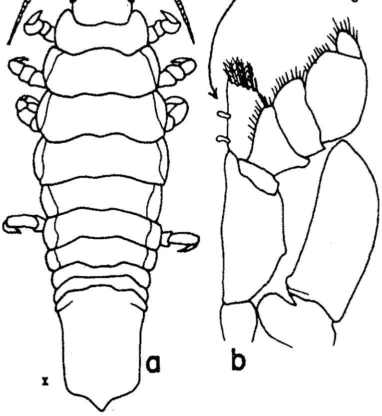


Figure 89. a. *Pentidotea stenops*. b. Maxilliped.

Fig. 89. *Pentidotea stenops* (Benedict) (42 mm)

Range: ~~Monterey Bay, California~~ (Shallow water) Washington state to La Paz

32a. **Coxal plates visible only on peraeonal segments V to VII** .... *Colidotea*

{ Dorsal coxal plates exist on II–VII, but anterior ones are small and situated ventrally, visible in lateral view; V–VII or VI–VII only visible in dorsal view. }

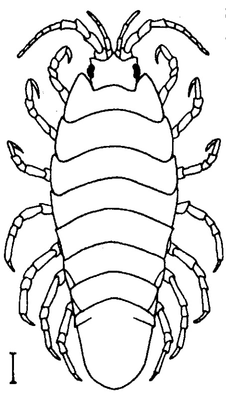


Figure 90. *Colidotea rostrata*.

Fig. 90. *Colidotea rostrata* (Benedict) (12 mm)

Range: San Pedro, California (Shallow water) to Punta Eugenio.

This species is the type and only one in the genus. No ?

C. edmondsoni Miller 1940 (Hawaii)

C. findleyi Brusca & Wallerstein 1977 (west Mexico)

commensal on Strongylocentrotus

C. wallersteini Brusca 1983 (NW Mexico)

32b. **Coxal plates visible on peraeonal segments II to VII** .... *Idotea*

GENUS IDOTEA

The species of this genus are among the most common isopods found in the algae in near shore habitats. Many of them are very widely distributed since they are easily transported by ships. The species are of economic importance because they are frequently encountered in the stomachs of commercial fish.

KEY TO SPECIES OF IDOTEA

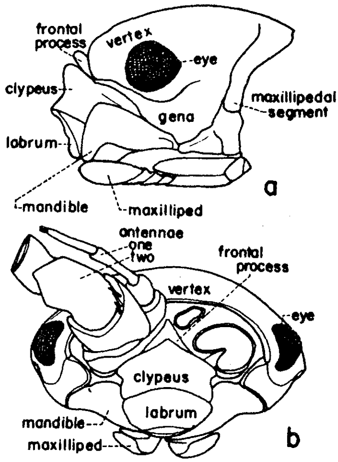


Figure 91. Nomenclature of cephalon of Valvifera. a. Lateral view. b. Frontal view.

33a. Posterior margin of pleotelson with large medial protuberance 34

33b. Posterior margin of pleotelson without or with very small medial protuberance if at all 37

34a. Lateral margins of body continuous without noticeable breaks between peraeonal segments 35

34b. Lateral margins of body broken by laterally produced epimeres, especially on peraeonal segments V, VI and VII .... *I. phosphorea*

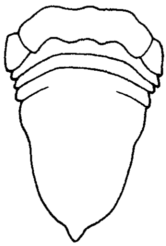
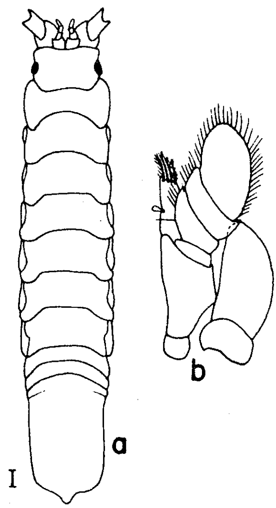


Fig. 92. *Idotea phosporea* (Harger) (21 mm)

Range: Gulf of St. Lawrence south to Cape Cod (Surface to 33 m)

Figure 92. *Idotea phosphorea.*

35a. Long narrow body with nearly parallel lateral margins; epimeres not prominent in dorsal view .... *I. fewkesi.*



(Idotea)

Fig. 93. *Idotea fewkesi* Richardson (42 mm)

Range: Alaska to southern California (Shallow water)

This species is very common and has frequently been described as a new species.

Figure 93. a. *Idotea fewkesi.* b. Maxilliped.

35b. Body not especially long with body margins somewhat convex; epimeres easily distinguished in dorsal view **36**

36a. Epimeral sutures cut completely acrossed lateral edges of peraeonal segments II, III and IV; lateral margins of pleotelson convergent along entire length .... *I. balthica*

Fig. 94. *Idotea balthica* (Pallas) (20 mm)

Range: Atlantic coast of North America from Gulf of St. Lawrence to Rio de Janeiro (Surface to 218 m)

This species is common in floating or attached seaweed, in eelgrass and in sand and gravel in the bays and inlets along the entire coast of North America (and Europe). It is sometimes taken in quantity from the stomachs of fish, especially smelt, so it is apparently of some economic importance and also imporant in the ecosystem. The species comes in many color forms sometimes being quite brightly colored.

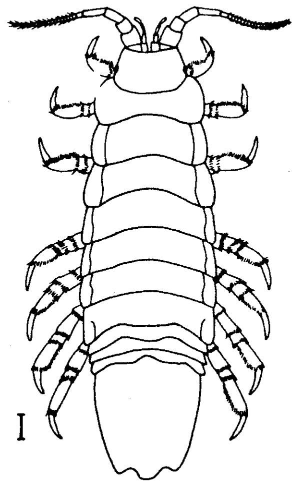


Figure 94. *Idotea balthica.*

36b. Epimeral sutures obliquely cut acrossed anterolateral margins of peraeonal segments II, III and IV; lateral margins of pleotelson concave .... *I. ochotensis*

Fig. 95. *Idotea* (Idotea) *ochotensis* Brandt (42 mm)

Range: Northwestern North America to San Francisco Bay (Surface to 33 m)

This species is perhaps a synonym of *I. fewkesi.*

I. ochotensis alvetica Gurjanova

I. ochotensis ochotensis Brandt (includes I. (I.) derjugini)

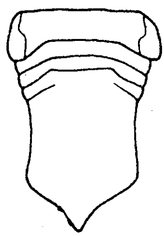


Figure 95. *Idotea ochotensis.*

37a. Posterior margin of pleotelson truncate or ending in small posterior protuberance or obtuse angle **38**

37b. Posterior margin of pleotelson straight with two posterolateral protuberances .... *I. rufescens*

I. obscura Rafi, 1972 Queen Charlotte Is. N. to Prince

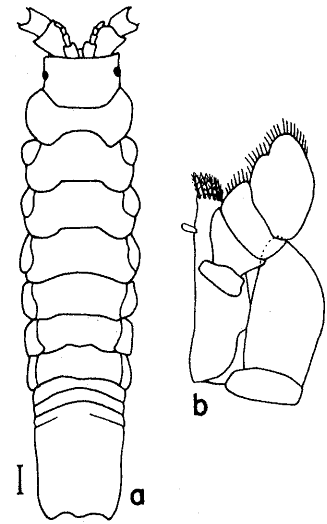


Figure 96. a. *Idotea rufescens.* b. Maxilliped.

Fig. 96. *Idotea* (Pentidotea) *rufescens* (Fee) (15 mm)

Range: British Columbia to central California (Intertidal to 82 m) (So. of Carmel, Monterey Co.)

= I. resecata by Menzies & Waidzunas (1948), but not by Menzies (1950).

38a. Posterior margin of pleotelson ending in small medial protuberance or obtuse angle 39

38b. Posterior margin of pleotelson truncate .... *I. metallica*

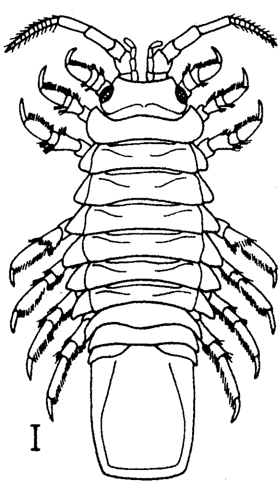


Figure 97. *Idotea metalica.*

Fig. 97. *Idotea metallica* (Bosc) (18 mm)

Range: Greenland, Nova Scotia to Straits of Magellan (South America) (Surface to 166 m)

This species is common and widespread and is frequently found on floating seaweed and is also taken from attached seaweeds along the east coast of North America and Europe.

USNM has a specimen (1) from the Gulf of California, & we have 1 from Catalina Island !!

39a. Posterior margin of pleotelson ending in obtuse angle .... *I. rectilinea*

Fig. 98. *Idotea rectilinea* (Lockington) (17 mm)

Range: Mid-California to northern Baja California (55 to 73 m)

This species has been taken on sandy and muddy bottoms.

= I. urotoma (see Menziés, 1950: 166)

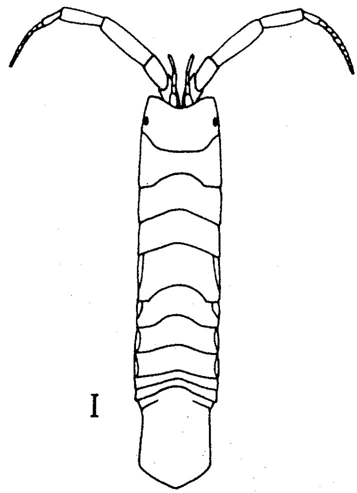


Figure 98. *Idotea rectilinea.*

39b. Posterior margin of pleotelson ending in small protuberance 40

40a. Pleonal margins converging along entire length; body width about one-fourth length .... *I. urotoma*

Fig. 99. *Idotea urotoma* Stimpson (17.5 mm)

Range: Puget Sound, Washington to ~~southern California~~ La Paz. (Intertidal)

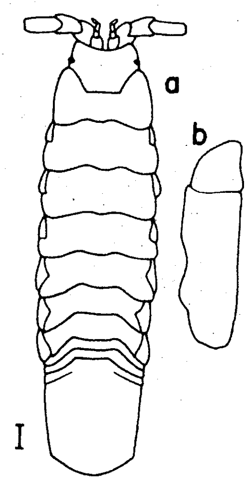


Figure 99. a. *Idotea urotoma.* b. Uropod or valve.

40b. Pleotelson margins concave; body width about one-fifth length .... *I. gracillima*

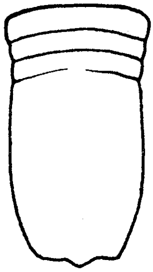


Figure 100. *Idotea gracillima.*

Fig. 100. *Idotea gracillima* (Dana) (11 mm)

Range: Coast of California

= I. montereyensis (see Menzies, 1950: 185)

of 1 large article & 1-2

Antenna two with

41a. ~~Antenna two shorter than antenna one~~; flagellum rudimentary; palp of maxilliped with three articles .... *Edotea*

articles

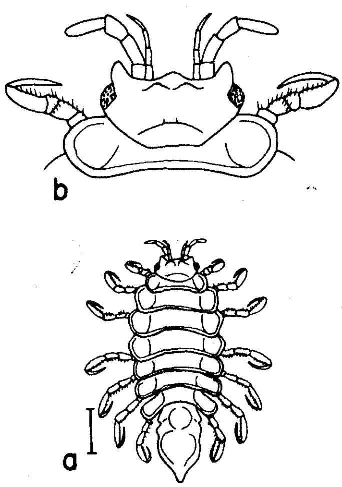


Figure 101. a. *Edotea montosa.* b. Detail anterior part.

Fig. 101. *Edotea montosa* (Stimpson) (9 mm)

Range: Long Island to Nova Scotia (15 to 46 m)

The posterior margin of the pleotelson is produced in this species.

= E. triloba

Wallace (1919) synonymized E. montosa & E. acuta with E. triloba

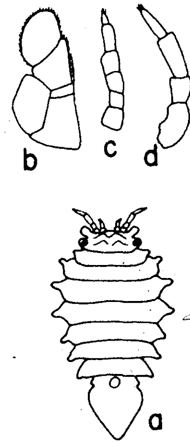


Figure 102. a. *Edotea acuta.* b. Maxilliped. c. Antenna two. d. Antenna one.

Fig. 102. *Edotea acuta* (Richardson)

Range: Off New England coast (188 m)

This species was taken from the stomach of a cod. It has knob-like anterolateral corners on the cephalon.

= E. triloba

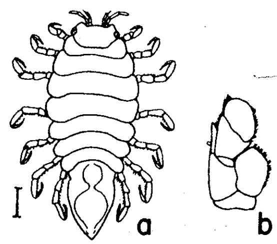


Figure 103. a. *Edotea triloba.* b. Maxilliped.

Fig. 103. *Edotea triloba* (Say) (7 mm)

Range: Maine to ~~New Jersey~~ S.C. (Surface to 1 m)

This species was found in muddy water and eelgrass. There are no indications of a second pleonal segment in the species.

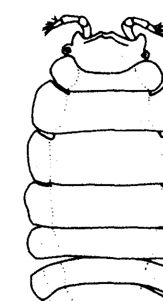


Figure 104. *Edotea sublittoralis.*

Fig. 104. *Edotea sublittoralis* (Menzies and Barnard) (4 mm)

Range: ~~Pt. Conception~~ San Francisco, California to northern Baja (14 to 64 m)

This species has two small tubercles on the frontal margin of the cephalon.

Barry & Ernie collected E. sublittoralis at Campo PeeWee - summer, 1979 (4 specimens)

41b. ~~Antenna two longer than antenna one,~~ flagellum of one to three articles; palp of maxilliped with four articles 42

42a. Pleon with 2 to 3 free segments with indications of the presence of 3 or 4; flagellum of two or three articles .... *Cleantis*

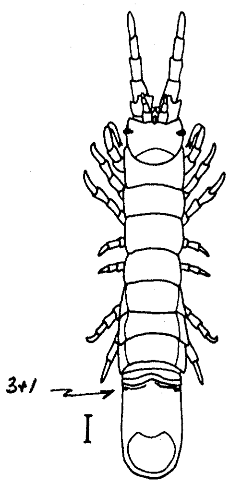


Figure 105. *Cleantis planicaudata.*

Fig. 105. *Cleantis planicauda* (Benedict) (15 mm)

Range: Georgia to Florida also Pureto Rico (Beach to 44 m) & tropical E. Pacific (see Brusca & Wallerstein, 1979) & Japan (see Nunomura, 1975)

This species has been collected on a sandy bottom on the Georgia coast. It has a broadly rounded posterior margin on the pleotelson.

The genus Cleantis has:
① mdb lacks palp
② uropod of 1 or 2 articles
③ mxp. palp of ~~4~~ 5 articles

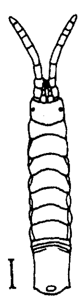


Figure 106. *Cleantis heathii.*

Fig. 106. *Cleantis heathii* (Richardson) (8 mm)

Range: Monterey Bay, California (Shallow water)

There are posterolateral corners on the pleotelson of this species.

= Idotea urotoma (see Menzies 1950:166)

Fig. 107. *Cleantis occidentalis* Richardson (7.5 mm)

Range: Magdalena Bay, Baja California (22 m)

The posterior borders of the pleotelson are rounded in this species.

= Cleantioides occidentalis (Rich. 1899a) by Kensley & Kaufman, 1978

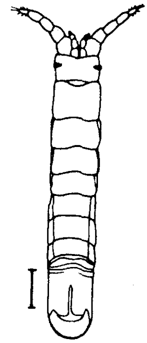


Figure 107. *Cleantis occidentalis.*

42b. Pleotelson with or without indications of one pleonal segment; one flagellar article on antenna two 43

43a. Pleotelson smooth and rounded; indications of one pleonal segment .... *Eusymmerus*

Fig. 108. *Eusymmerus antennatus* (Richardson) (8 mm)

Range: ~~Abreojos~~, Baja California to So. Mexico (10 m)

This is the type and only species in the genus.

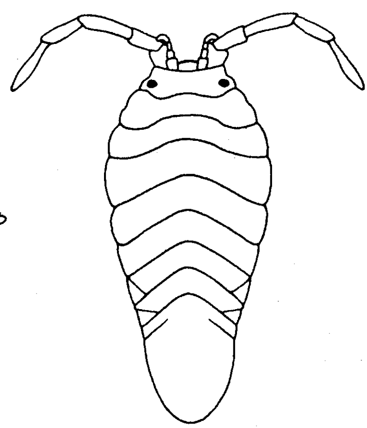


Figure 108. *Eusymmerus antennatus.*

43b. Pleotelson with sides subparallel with lateral bulges or projections and pointed posterior border; with or without indications of pleonal segment .... *Erichsonella*

Parasymmerus annamarae

The correct authorship is: Erichsonella Richardson, 1900

Her file for co ects.

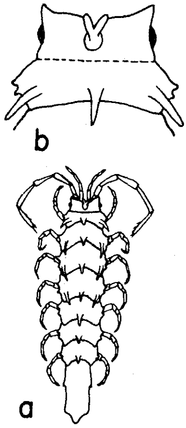


Figure 109. a. *Erichsonella floridana*. b. Detail anterior part.

Fig. 109. *Erichsonella floridana* (Richardson)

Range: Florida (Below low tide)

~~This is the only species of the genus with spines on the dorsum.~~

E. filiformis tropicalis: Puerto Rico to Brazil
E. filiformis isabellensis: Gulf of Mexico
E. filiformis filiformis: Mass. to Florida

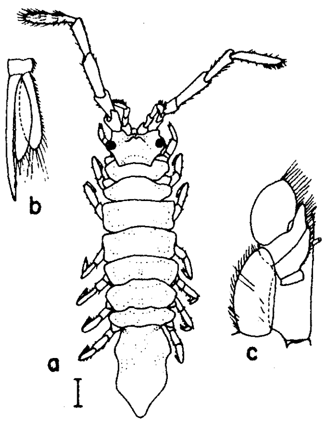


Figure 110. a. *Erichsonella filiformis*. b. Male pleopod 2. c. Maxilliped.

Fig. 110. *Erichsonella filiformis* (Say) (8 mm)

Range: Massachusetts to Florida to Texas including Bahama Islands (8 to 33m)

The species is common in the eelgrass beds of the shallow bays and estuaries within its range. ~~Two~~ Three subspecies, *E. filiformis filiformis* (Menzies) and *E. f. isabelensis* (Menzies), have been described. *E. f. isabelensis* is much narrower and found further west than *E. f. filiformis*.

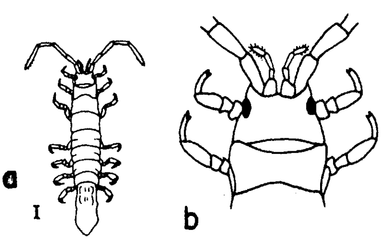


Figure 111. a. *Erichsonella attenuata*. b. Detail anterior part.

Fig. 111. *Erichsonella attenuata* (Harger) (12 mm)

Range: Connecticut to North Carolina (Below low tide)

The species is taken in eelgrass (*Zostera*) and in coral. ~~Its body is much broader in proportion than that of *E. filiformis*.~~

AHF has a specimen from Corpus Christi (Texas), collected by M.K. Wicksten; from Thallassia.

= crenulata: Holotype (♂), no spines on pereon.
Allotype (♀), weak spines on pereon. small spines on cephalic hump.
Paratype (♂), no spines on pereon. no spines on cephalic hump.

Erichsonella cortezi Brusca & Wallerstein. 1977

Fig. 112. *Erichsonella crenulata* (Menzies) (23 mm)

Range: Newport Bay, California (Shallow water)

The species was taken from eelgrass (*Zostera*). We have a specimen from Bahía San Quintín with small lobes on the legs as in E. pseudoculata. All 3 species appear very similar (= siblings).

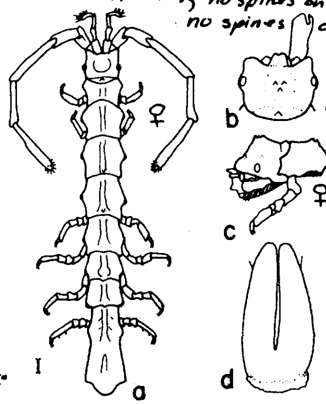


Figure 112. a. *Erichsonella crenulata*. b. Detail, cephalon. c. Lateral view cephalon. d. Penis.

Fig. 113. *Erichsonella pseudoculata* (Boone) (9 mm)

Range: Pt. Conception to La Jolla, California (Surface to 18 m)

The species was first taken from eelgrass at San Pedro, California. Once it was the only species in the genus *Ronalea*, although it was originally described in Erichsonella. (Ronalea was synonymized with Erichsonella; it was originally estab. on the basis of the partial suture on the pleon of E. pseudoculata, a character since shown to be variable in the genus!

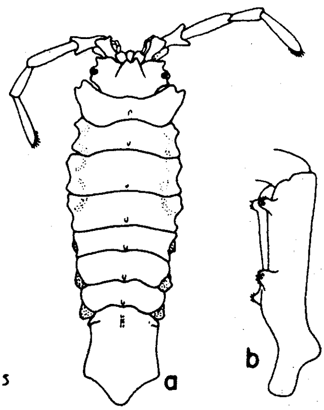


Figure 113. a. *Erichsonella pseudoculata*. b. Basis of peraeopod VII.

SUBORDER ANTHURIDEA
ANTHURIDAE

Species of anthurids are placed in only one family, the Anthuridae. The isopods are medium to small in size. Some species common in the near shore habitats can reach to about 25 mm long for mature individuals, but most specimens average about half that size. Species found in the deep sea can be quite small. Anthurids live on the bottom where they are generally found in tubular burrows. Mostly the burrows are of their own construction although they are at times found in the tubes of other animals, especially those of marine worms. They are also frequently collected from encrusting animals and algae on piles or rock jetties, but they are usually found only on the side where the water is relatively calm. There are some species that have been taken exclusively in near shore caves, and they are blind like their deep sea relatives.

At times the two sexes have been described as different species. The anthurid species are different from other isopods in that they have extremely elongate bodies and a peculiar kind of caudal fan, both of which are adaptations for living in holes in the mud or sand

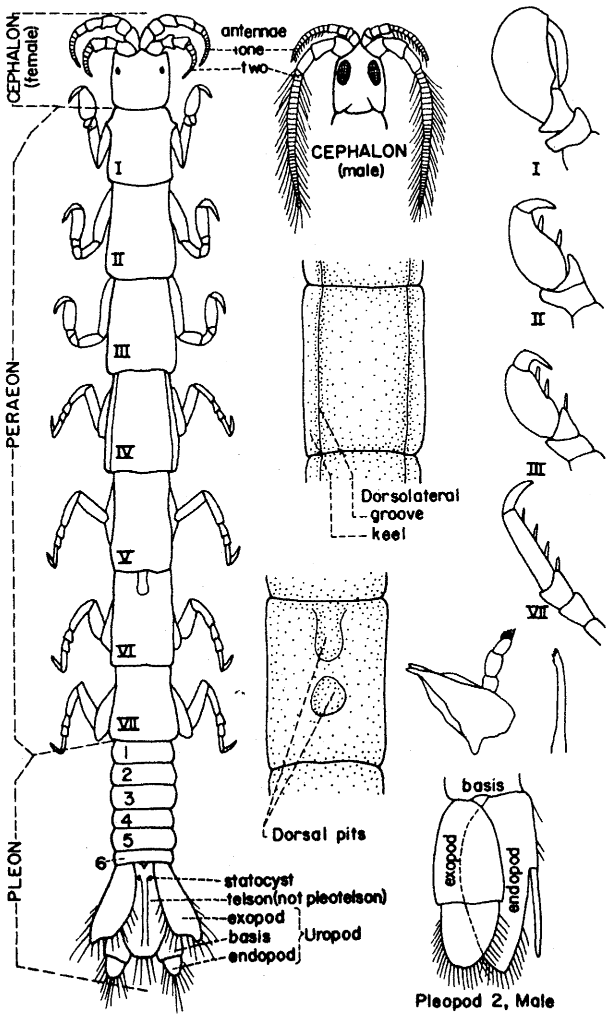


Figure 114. Anthuridea (General nomenclature).

of the bottom. Specimens of anthurids are most frequently females, males being relatively rare. Apparently all animals are female at first (protogynous) then some change to males. The male can be identified by the very long, sometimes quite bushy antennae, and by the presence of much larger eyes than those of the female. Some males have more than one set of eyes also.

The number of articles in the flagellum of the antennae can vary from few to many according to species as well as sex. The mandible and mandibular palp are generally normal although there is a loss of mandibular palp articles or complete loss of the structure in some species. The structure of the maxilliped is almost specific to genus (Fig. 115), but there are several genera that cannot be distinguished by the maxillipedal configuration alone. The number of palp articles varies from none to five. Species with piercing

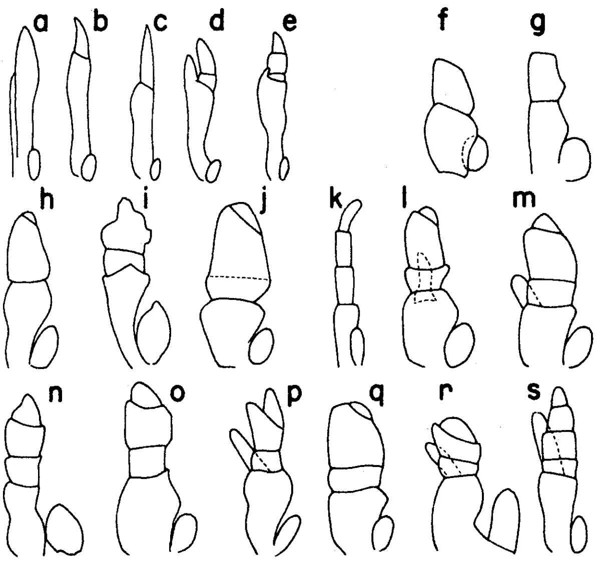


Figure 115. Maxillipeds of Anthuridea. a-e. Piercing and sucking. a. *Neoanthura*. b. *Leptanthura*. c. *Paranthura*. d. *Calathura*. e. *Accalathura*. f-s. Biting. f. *Anthura*. g. *Ptilanthura*. h. *Cyathura*. i. *Xenanthlura*. j. *Haliophasma*. k. *Eisthistos*. l. *Anathura*. m. *Apanthura*. n. *Holoanthura*. o. *Mesanthura*. p. *Hyssura*. q. *Skuphonura*. r. *Bathura*. s. *Panthura*.

and sucking mouth parts have pointed maxillipeds without or with only a few articles. Those with normal or biting mouth parts generally have one to five palp articles, the usual number being less than five.

The shape of the peraeonal segments is in keeping with the general body configuration and it is long and thin in most instances, although at times peraeonal segment VII is quadrate or shorter than wide or does not show at all in the dorsal view. The peraeopod number is usually seven when there are seven peraeonal segments, and the anterior peraeopods are subchelate. In many instances peraeopod I is strongly subchelate and all other peraeopods, especially I to III, are less so until peraeopod VII which is more or less ambulatory. Occasionally in some species the male will have a very large subchelate peraeopod I and the female will have peraeopod I only slightly modified. On the peraeonal segments there are sometimes very strongly developed lateral ridges or grooves. At times they are called keels or lateral leels and sometimes they are called dorsolateral grooves. In many species they are reduced in size or absent. There are dorsal pits on the dorsum of the peraeonal segments of some species and they can be either located medially (generally anterior on the segment) or paired (generally posterior on the segment). The peraeonal segments are never fused to the cephalon, the pleon or to each other. Oostegites are present on the female on either segments II to V or III to V.

The pleonal structure varies both according to species and according to sex. In some species all segments including the sixth are distinct; in others there are only marginal sutures and in others there are no external indications of segments. The pleopods also vary there being two general types. In the first type the anterior or first set of pleopods is indurate and operculate to the others. In the second all pleopods are about the same there never being an operculate set of pleopods. The second male pleopod is sexually modified and is a good guide to species although it unfortunately has not been well described for most species. Pleonal segment six in all instances has two large generally oval and sometimes spoon-shaped rami, the uropods. The telson itself is generally elongate or oval, and, indeed, the posterior margin and the cross sectional view of the telson has many different shapes including one with a medio-dorsal ridge. Generally long non-plumose marginal setae are present on the exopod, endopod and telson, and they apparently serve to anchor the specimens in the tubes in which they dwell. There are special organs called statocysts and found only in anthurids present on the anterior half of the telson in many species. They are places where muscles are attached and perhaps have some sensory function in regard to body position. A pair of them is most often present, but in some instances they apparently fuse on the midline to form a single statocyst.

The anthurids are one of the most economically important isopod groups and the species serve a function in their environment not unlike that of the earthworm in its terrestrial habitat. At times

For key to California anthurids see Schultz (1977). keys to world genera see Poore (1980, 1981).

they are found in great abundance and frequently many square miles of bottom will be covered by their burrows. Man is only beginning to understand the near-shore ecological habitats of which the anthurids are an important part. They deserve much more study. There are about 20 genera and 37 species in North American waters. Some are not too well defined. They can be easily confused with species of the order Tanaidacea from which they differ in the type of peraeopod I (in tanaids they are truly chelate, not subchelate—Fig. 6) and in the configuration of the pleotelson.

KEY TO GENERA AND SPECIES OF ANTHURIDAE

1a. Six large peraeonal segments visible in dorsal view of mature specimen (+ minute 7th segment, w/o legs) 2

1b. Seven large peraeonal segments visible in dorsal view of mature specimen 3

2a. Eyes present; five anterior peraeonal segments of about equal length .... *Colanthura*

GENUS COLANTHURA

The species of this genus and the single species of the genus *Neoanthura* differ from other anthurids in that there are six rather than seven elongate, distinct peraeonal segments visible in the dorsal view. Peraeonal segment VII is minute and located between the pleon and peraeonal segment VI. The mouth parts of the species of both genera are modified for piercing and sucking.

Schultz (1977) synonomized this with Paranthura infundibulata from Bermuda.

Fig. 116. *Colanthura tenuis* (Richardson) (4 mm)

Range: Bermuda (Shallow water)

This species is the type species of the genus. It is very much like the Pacific coast species of the genus from which it differs only in the shape of the peraeonal segments.

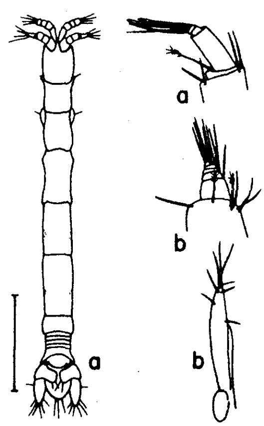


Figure 116. a. *Colanthura tenuis*. b. Antenna one. c. Antenna two. d. Maxilliped.

note: Schultz (1977) supressed the name Colanthura, replacing it with Califanthura. This was in error and was repaired by Poore (1980). But, [illegible] press) is now resurrecting Califanthura [illegible]

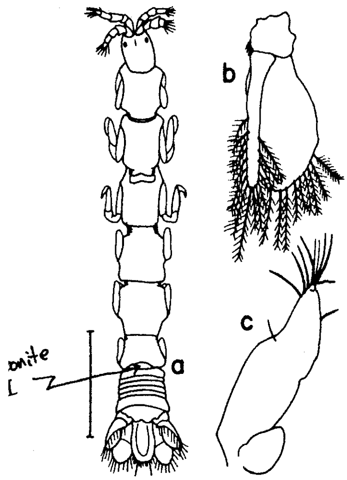


Figure 117. a. *Colanthura squamosissma*. b. Male pleopod 2. c. Maxilliped.

Fig. 117. *Colanthura squamosissima* Menzies (4.4 mm)

Range: Coastal shelf, Pt. Conception to Mexican border (18 to 91 m)

Also in Gulf of California.

2b. Blind; peraeonal segment V longest of peraeonal segments .... *Neoanthura*

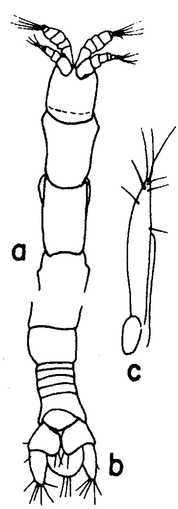


Figure 118. a. *Neoanthura coeca*, anterior part. b. Posterior part. c. Maxilliped.

Fig. 118. *Neoanthura coeca* (Menzies) (3.8 mm)

Range: Caribbean Sea south of Jamaica (1244 m)

The species is the type and only one in the genus. The species is blind and pigmentless and all pleonal segments are distinct. The maxilliped consists of the endite only.

3a. Cephalon with anterior width more than twice posterior width (Fig. 119) .... *Skuphonura*

Colanthura tenuis (Caribbean species) occurs in

... (in letter 24-Nov-1981)

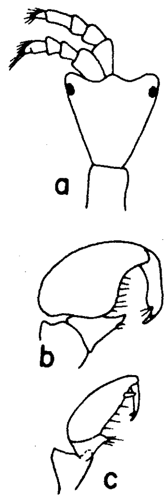


Figure 119. a. *Skuphonura laticeps*, dorsal view of cephalon. b. Peraeopod I. c. Peraeopod II.

Fig. 119. *Skuphonura laticeps* (Barnard) (7 mm)

Range: Lesser Antillies (7 to 37 m)

The broad cephalon sets the species apart from other species of anthurids. The species is the type and only one in the genus. Dorsolateral keels and dorsal pits are absent. The segments of the pleon are fused and without lateral sutures. The telson is shorter than the pleon, thin, dorsally flattened and with small paired statocysts (Fig. 120a). Pleopod one is operculiform. The maxillipedal palp has three articles (Fig. 115g).

3b. Not as above 4

4a. All, or mostly all, segments of pleon distinct and completely separated from one another (Fig. 120a) 5

4b. All segments of pleon not distinct or indicated only by lateral sutures or dorsal indentations (Fig. 120b or c) 15

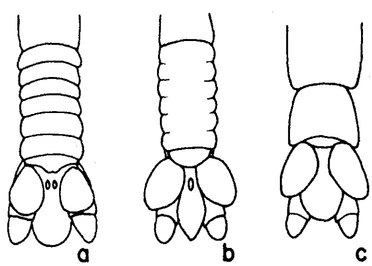


Figure 120. Pleon and statocyst types. a. Segments distinct and paired statocysts. b. Marginal sutures only present and statocyst single. c. No segments or statocysts distinct.

5a. Pleopod 1 operculate (Fig. 121a); telson with round or obtusely pointed posterior margin (Fig. 127) 8

5b. **Pleopod 1 not operculate (Fig. 121b); telson acutely pointed and long or concave and shorter than exopod and endopod 6**

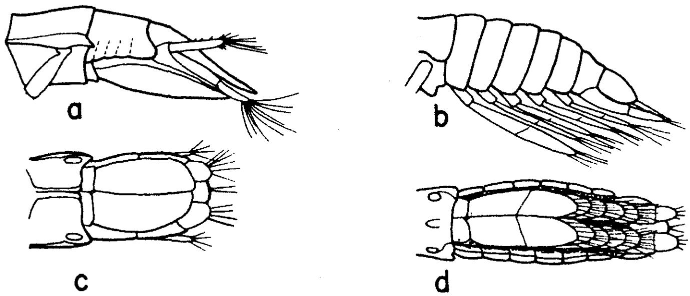


Figure 121. Pleopod I types. a. Operculate. b. Not operculate. c-d. Ventral views.

6a. **Blind; maxillipedal palp of three articles; mandibular palp of three articles; telson long and pointed (Fig. 127) 7**

6b. **Eyes present; maxillipedal palp of two articles; mandibular palp represented by single seta only; telson short with concave posterior border (Fig. 127a) ....*Xenanthura***

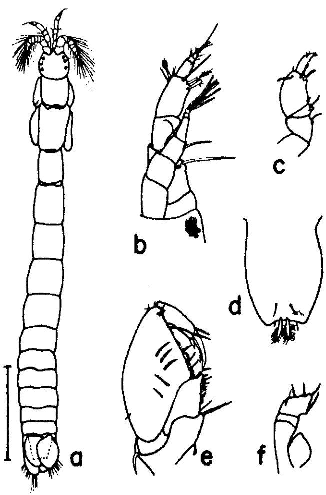


Figure 122. a. *Xenanthura brevitelson* (male). b. Antenna one and two, female. c. Peraeopod VI, male. d. Telson. e. Peraeopod I, male. f. Maxilliped.

Fig. 122. *Xenanthura brevitelson* (Barnard) (4.5 mm)

Range: Off Georgia Coast and West Indies (18 to 133 m)

The species is remarkable in that each body segment is distinct and there is no marked difference between the peraeon and the pleon except in the length of the segments. The species is the type and only species of the genus. The female has shorter antennae than the male and only one pair of eyes.

7a. **Exopods of uropods with spines on inner margins (Fig. 123) ....*Horoloanthura***

Fig. 123. *Horoloanthura irpex* (Menzies and Frankenberg) (3.7 mm)

Range: Off Georgia coast (48 to 77 m)

This blind, pigmentless species is the type and only species in the genus. It has biting mouth parts.

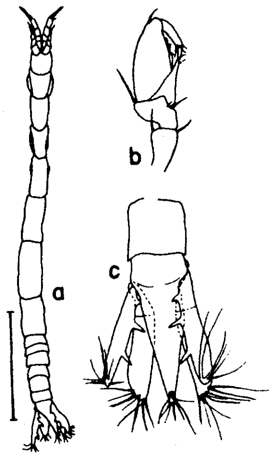


Figure 123. a. *Horolcanthura irpex* (female). b. Peraeopod I. c. Detail posterior part.

7b. Exopods of uropods with no spines on inner margins .... *Hyssura*

GENUS HYSSURA

The species of this genus are blind with very pointed, indurate telsons. No dorsolateral keels or dorsal pits are present. The maxillipedal palp has three articles, and pleopod 1 is never operculate.

Fig. 124a. *Hyssura producta* (Norman and Stebbing) (6.5 mm)

Range: North Atlantic–56° N X 37° W (2642 m)

This species has the posterior border of the telson much rounder in cross section than that of *H. profunda.*

Fig. 124b. *Hyssura profunda* (Barnard) (10 mm)

Range: North Atlantic (No specific place or depth given)

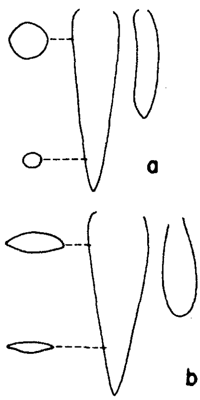


Figure 124. a. *Hyssura producta,* telson and endopod. b. *H. profunda,* telson and endopod.

8a. **Mouth parts modified for piercing and sucking; maxillipedal palp with one or two articles; dorsal pits never present** **9**

8b. **Biting mouth parts; maxillipedal palp of three articles; dorsal pits absent or present** **11**

9a. **Maxillipedal palp of one article; no statocysts present; eyes present** .... ***Paranthura***

GENUS PARANTHURA

The genus contains a heterogeneous assemblage of species that are best separated here on the basis of shape of the telson.

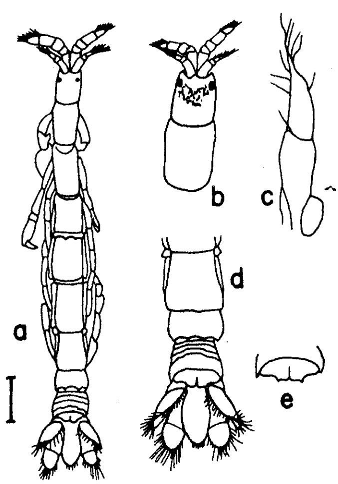


Figure 125. a. *Paranthura elegana.* b. Detail anterior part. c. Maxilliped. d. Detail posterior part. e. Pleonal segment 6.

Fig. 125. *Paranthura elegans* Menzies 1951 (8.6 mm)

Range: Mid-California to northern Baja California (18 to 55 m)

The telson is (lanceolate)? in this species.

Also in Gulf of California

Paranthura longitelson Wägele, 1983
Sea of Cortez (midriff area)

Fig. 126. *Paranthura infundibulata* (Richardson) (7 mm)

Range: Bermuda and West Indies (Shallow water)

As the illustrations show, the male has a concave posterior border on the telson which has subparallel borders; the female has a straight posterior border on the telson. The male and female were originally described as separate species. A third species *P. antillensis* Barnard (5.5 mm long, from St. Johns and St. James Islands in the West Indies at 29 m) has been included in the genus. It has never been adequately illustrated, but is said to differ from the above species in that the telson is ovate (Fig. 127c).

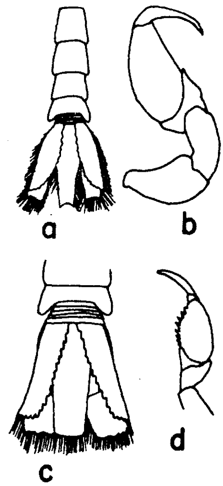


Figure 126. a. *Paranthura infundibulata* (male). b. Peraeopod I, male. c. Posterior part female. d. Peraeopod II, male.

This is a senior synonym of Colanthura tenuis by Schultz (1977), but not according to Kensley & Poore (see letter from Kensley 7/20/78).

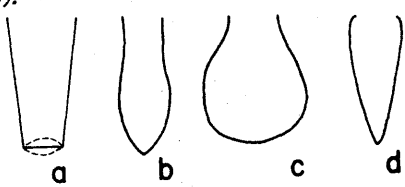


Figure 127. Telson types. a. With subparallel margins, posterior border (convex or concave). b. Lancelolate. c. Ovate. d. Pointed.

9b. Maxillipedal palp of two articles; single or fused statocysts present; eyes absent or present 10

10a. Eyes usually present; peraeonal segment VII shorter than broad; pleon short but with distinct segments ..... *Accalathura*

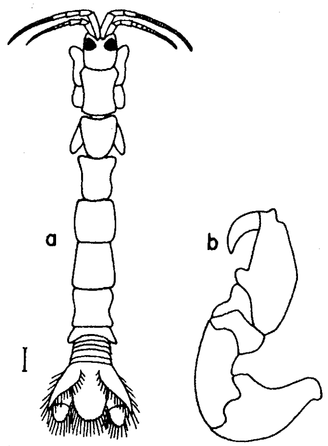


Figure 128. *Accalathura crenulata* (male). b. Peraeopod I, male.

Fig. 128. *Accalathura crenulata* (Richardson) (18 mm)

Range: Bahamas, West Indies and Yucatan (38 m)

This species has been found in relatively shallow water and also in gulfweed—sargassum.

Accalathura crassa (Barnard) (8 mm) from St. Johns, West Indies, has also been described, but never well illustrated. It differs from other species in the genus in being blind and lacking a produced posterolateral corner on peraeonal segment VII. It needs to be redescribed to be properly placed in the anthurids.

10b. Blind; peraeonal segment VII only slightly shorter than other six peraeonal segments; pleon much longer than broad with segments distinct .... *Leptanthura*

GENUS LEPTANTHURA

The species of the genus have a single fused statocyst (Fig. 120b). About 10 species are included in the genus, but only two are from North American waters.

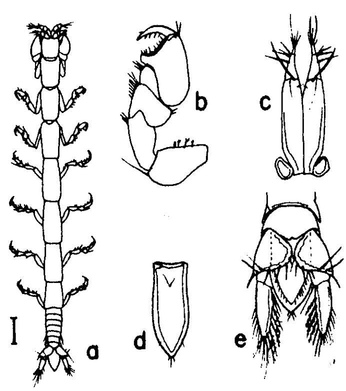


Figure 129. a. *Leptanthura tenuis*. b. Peraeopod I. c. Maxillipeds. d. Telson. e. Detail posterior part.

Fig. 129. *Leptanthura tenuis* (Sars) (14 mm)

Range: North Atlantic (near Portugal) (274 to 1313 m)

The specimen was taken just outside of the range of most species included in this book, but it is illustrated because *L. thori* Barnard (7 mm) from the North Atlantic (957 m) found within the North American waters has never been illustrated. *L. thori* resembles *L. tenuis,* but the telson is widest at the base narrowing very slightly to a rounded apex which bears a tuft of setae not set into a notch. The endopods of the uropods are also more pointed in *L. thori*.

11a. **Eyes present or absent; operculate pleopods 1 (Fig. 121a, c) never fused** **12**

11b. **Eyes present; operculate pleopods 1 fused** .... *Eisothistos*

Fig. 130. *Eisothistos atlanticus* (Vanhoeffen) (5 mm)

Range: Cape Verde Islands and St. Thomas, West Indies (9 m)

Since the specimens that represent the species are from two widespread localities, they could represent two species. They must be examined more closely.

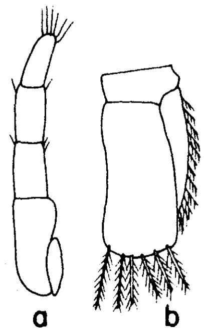


Figure 130. a. *Eisothistos atlanticus*, maxilliped. b. Pleopod 2, female.

12a. **Eyes present; maxillipedal palp of four or five articles; dorsal pits absent, but dorsolateral keels present** .... *Pananthura*

Fig. 131. *Pananthura formosa* (Menzies and Frankenberg) (4.5 mm)

Range: Off Georgia coast (77 to 90 m)

This eyed, small species has fairly long antennae and is the first species of the genus to be recorded from North American waters.

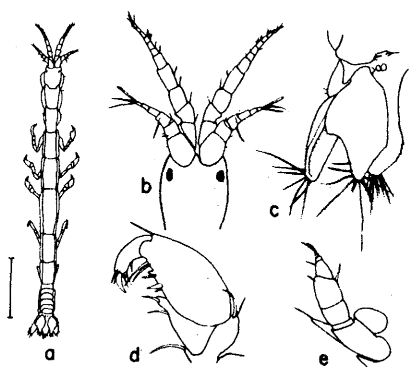


Figure 131. a. *Pananthura formosa*. b. Detail, cephalon. c. Detail, pleon. d. Peraeopod I, female. e. Maxilliped.

12b. **Eyes absent or present; maxillipedal palp of three articles; dorsal pits and dorsolateral keels absent or present** **13**

13a. **Blind; dorsal pits and dorsolateral keels present and conspicuous; telson slightly longer than pleon with paired statocysts, dorsomedial groove and truncate posterior margin fringed with setae** .... *Bathura*

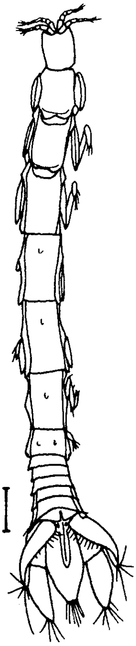


Figure 132.
Bathura luna.

Cortezura penascoensis Schultz 1977

Fig. 132. *Bathura luna* Schultz 1966 (21 mm)

Range: Tanner Canyon on the shelf off southern California (783 to 812 m)

The species was taken from the green mud on the bottom of the canyon. The species is the type and only one in the genus. AHF has only the Holotype; No subsequent records are known, not even from the BLM study. Kensley ('78) removed this species to *Anthelura* Norman & Stebbing, thus leaving the genus *Bathura* a nomen nudum.

13b. Blind or with eyes; dorsal pits or dorsolateral keels absent or present; telson various 14

14a. Eyes usually present; dorsal pits absent; telson lanceolate with truncate or obtusely pointed posterior border, never rounded; carpus of peraeopod VI underriding propodus (Fig. 133a) .... *Apanthura*

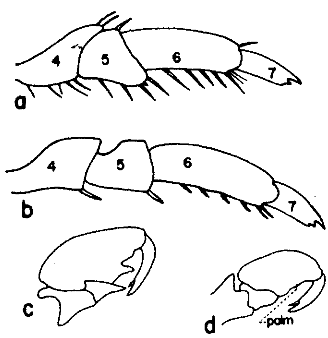


Figure 133. Peraeopod VI and palm types. a. Carpus underriding propodus. b. Carpus not underriding propodus. (4-merus; 5-carpus; 6-propodus; 7-dactylus) c. Palm notched. d. Palm not notched.

GENUS APANTHURA

Only two species of this very large genus are recorded from North American waters.

For a key to the world species see Kruczynski & Myers (1976). For a generic description see Miller & Menzies (1952).

Fig. 134. *Apanthura magnifica* Menzies and Frankenberg 1966 (8.5 mm)

Range: Off Georgia coast (17 to 137 m). Also Florida.

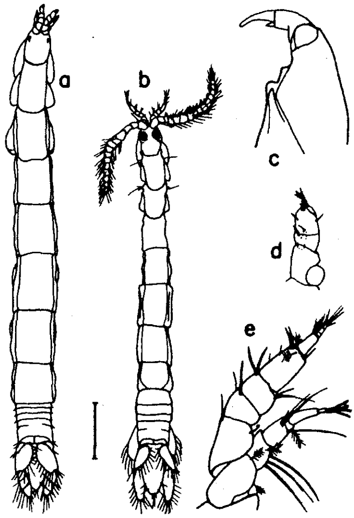


Figure 134. a. *Apanthura magnifica.* (female). b. Male c. Peraeopod I, female. d. Maxilliped. e. Antennae two and one.

Fig. 135. *Apanthura californiensis* Schultz 1964 (11 mm)

Range: Off Santa Monica, California (80 m)

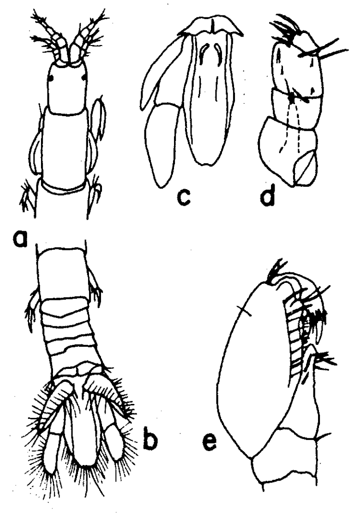


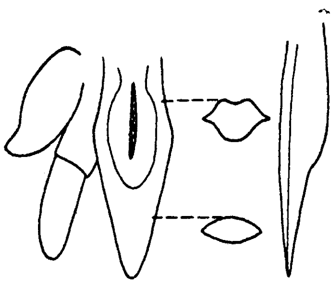
Figure 135. a. *Apanthura californiensis* anterior part. b. Posterior part. c. Telson and uropod. e. Peraeopod I, female. d. Mxp.

14b. **Usually blind; dorsal pits absent or present; telson various; carpus of peraeopod VI not underriding propodus (Fig. 133b) 15**

15a. **Telson pointed or rounded; dorsal pits absent or present; dorsolateral keels not present (some species have eyes) .... *Ananthura***

GENUS ANANTHURA

This genus contains a heterogeneous group of species which are not well enough described to be placed in any other genus with confidence. The palp of the maxilliped has three articles, and pleopod 1 is operculate.



a b

Figure 136. a. *Ananthura sulcaticauda*, telson and uropod. b. Lateral view of indurate telson.

Fig. 136. *Ananthura sulcaticauda* (Barnard) (6.5 mm)

Range: Davis Strait

This is the type-species of the genus.

Fig. 137. *Ananthura affinis* (Richardson)

Range: Bermuda (Shallow water)

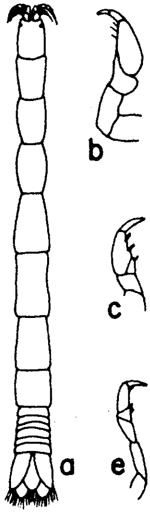


Figure 137. a. *Ananthura affinis*. b. Peraeopod I. c. Peraeopod II. d. Peraeopod VI.

Fig. 138. *Ananthura abyssorum* (Norman and Stebbing) (9 mm)

Range: Davis Strait (3200 m)

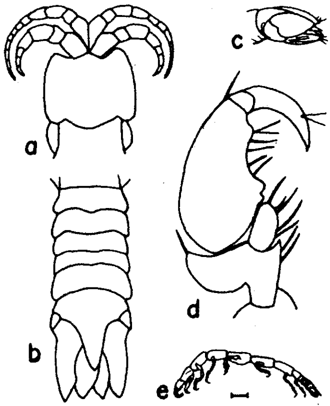


Figure 138. a. *Ananthura abyssorum* anterior part. b. Posterior part. c. Laterial view, posterior part. d. Peraeopod I. e. Lateral view, whole animal.

15b. **Blind; telson broadly ovate widest at basal third; dorsal pits absent** .... *Anthelura*

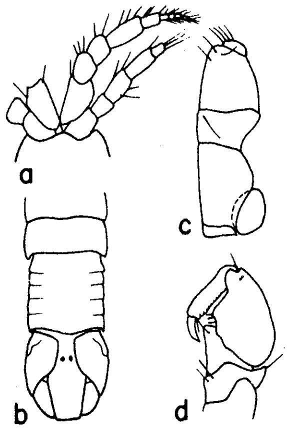


Figure 139. a. *Anthelura truncata* anterior part. b. Posterior part. c. Maxillipeds. d. Peraeopod I.

Fig. 139. *Anthelura truncata* (Hansen) (10 mm)

Range: Davis Strait (2193 to 2624 m)

There is still question as to the correct genus for this species—is it an *Anthelura* or a *Cyathura*?

16a. Blind; mouth parts for piercing and sucking (Fig. 140c); dorsal pits present; maxillipedal palp of three articles; posterior margin of telson produced .... *Calathura*

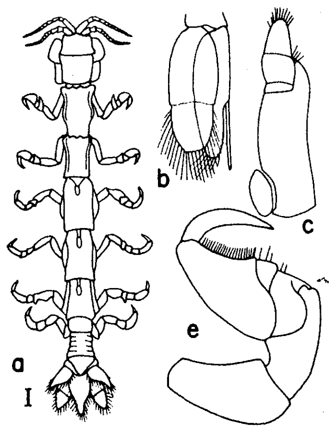


Figure 140. a. *Calathura branchiata*. b. Pleopod 2, male. c. Maxilliped. d. Peraeopod I, male.

Fig. 140. *Calathura branchiata* (Stimpson) (26 mm)

Range: North Atlantic (37 to 831 m)

This type and only species is common being found burrowed in mud, clay and in rocky sandy bottoms from the Gulf of Maine northward. The species is the largest recorded anthurid from North American waters, but the length is approached by species of *Cyathura*.

16b. Mostly with eyes; mouth parts normal; i. e., for biting; dorsal pits absent or present; maxillipedal palp of one to three articles; posterior margin of telson not produced **17**

17a. **Maxillipedal palp of two articles; dorsal pits present; dorsolateral keels feebly or strongly indicated 18**

17b. **Maxillipedal palp of one or three articles; dorsal pits or dorsolateral keels absent or present 25**

18a. **Cephalon with distinct posterolateral lobes (Fig. 141a); palm of peraeopod I without notch (Fig. 133d) ....** ***Haliophasma***

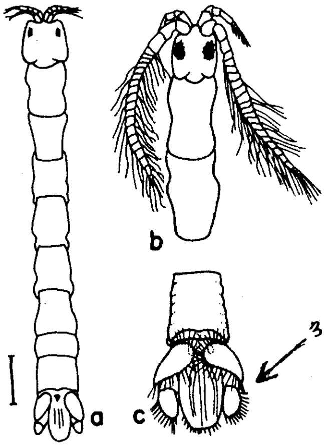
Fig. 141. Silophasma ~~*Haliophasma*~~ *geminata* (Menzies and Barnard 1959)

Range: Monterey ~~Pt. Conception~~ to San Quintin Bay, Baja California (Shallow water to ~~18~~ 65 m)

The species is very abundant on the continental shelf off southern California and northern Mexico. It is apparently associated with *Gnathia crenulatifrons*, another abundant benthic isopod (p. 224). The species has chewing mouth parts.

— 9.2 to 512 m, on shelf & slope.

— See Schultz (1977) for generic synonymy.



3 longitudinal carinae on telson is key character

Figure 141. a. *Haliophasma geminata* (female). b. Anterior part, male. c. Posterior part, male.

— Kensley & Poore claim H. geminata fits Poore's generic description perfectly and should remain in Haliophasma. (see letter); Silophasma should be suppressed!

18b. **Cephalon without distinct posterolateral lobes; palm of peraeopod I with notch (Fig. 133c) ....** ***Cyathura***

GENUS CYATHURA

This genus contains the largest number of species of any anthurid genus from North American waters. The species *C. polita* has been studied more than any other anthurid, and probably as much is known of its ecology as of any other isopod species. The species listed elsewhere in this book (p. 102) called *Anthelura truncata* perhaps is more properly placed in this genus. It needs to be examined more closely.

KEY TO SPECIES OF CYATHURA

19a. Eyes present 21

19b. Blind 20

20a. Male pleopod 2 with stylet longer than exopod .... *C. curassavica*

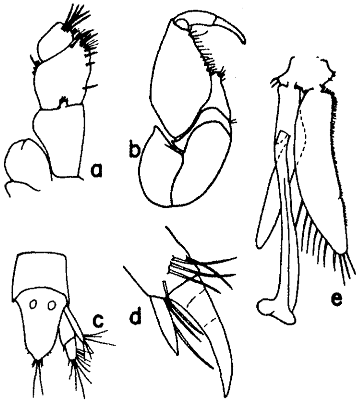


Fig. 142. *Cyathura curassavica* (Stock) (7 mm)

Range: Freshwater caves on Curaçao, Dutch West Indies

Figure 142. a. *Cyathura curassavica*, maxilliped. b. Peraeopod I, male. c. Detail, pleon and uropod. d. Detail, dactylus peraeopod V. e. Pleopod 2, male.

20b. Male pleopod 2 with stylet shorter than exopod ....*C. specus*

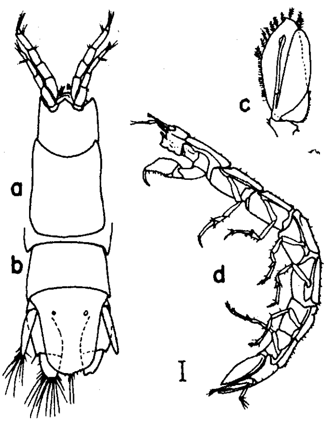


Fig. 143. *Cyathura specus* (Bowman) (20 mm)

Range: Freshwater caves of northern Cuba

Figure 143. a. *Cyathura specus* anterior part, female. b. Posterior part. c. Pleopod 2, male. d. Lateral view, female.

21a. Pleon about as long as wide with strong dorsal indications of segment 1; dorsolateral keels absent .... *C. munda*

Fig. 144. *Cyathura munda* Menzies 1951

Range: ~~Mid-California~~ Marin Co. to Mexican border (18 to 55 m) ♂ in Gulf of California.

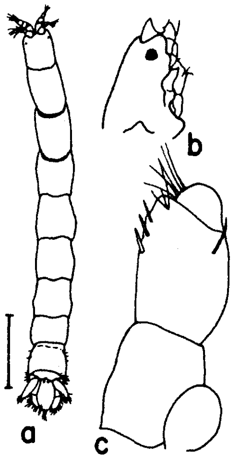


Figure 144. a. *Cyathura munda* (female). b. Lateral view, cephalon. c. Maxilliped.

21b. Pleon shorter than width; only very feeble dorsal indications of pleonal segment 1 22

22a. Dorsolateral keels absent .... *C. crucis*

Fig. 145. *Cyathura crucis* (Barnard) (7 mm)

Range: St. Croix, West Indies (7 m)

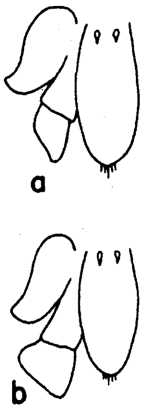


Figure 145. a. *Cyathura cruis*, telson and uropod, male. b. Telson and uropod, female.

22b. Dorsolateral keels feebly or strongly indicated **23**

23a. Sixth pleonal segment fused to telson .... *C. polita*

Fig. 146. *Cyathura polita* (Stimpson) (25 mm)

Range: Maine to Louisiana (Tidal marshes and shallow water)

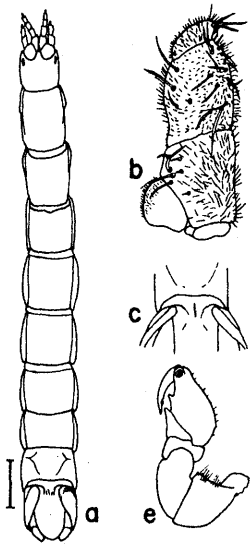


Figure 146. a. *Cyathura polita* (male). b. Maxilliped. c. Detail, posterior part of pleon. e. Peraeopod I, male.

The species lives in mud and muddy sand in unlined burrows of its own construction, usually in places where there is a continual movement of water and an inflow of freshwater from a stream or spring. The isopods have a high tolerance for the changes in the physical factors and salinity changes that take place in their shallow water habitats. At times they are found in enormous numbers.

The species form a very important part of the ecosystem of the bays and marshes that border the sea where they eat and are eaten by other animals in the ecological food web. They thus have an important role to play in the flow of energy through the near shore ecosystem. Their role on the bottom of the shallow water is somewhat like that of earthworms on land. The composition of the mud in which they live is constantly changed through the chemical and physical actions of their living processes. A detailed study of the life processes of the isopod is rewarding because the environment in which they live is one of the richest in terms of biological productivity of any environment on land or in the deep sea.

23b. Sixth pleonal segment separated from telson **24**

24a. Medial cephalic projection rounded or obtusely pointed, as long as or slightly shorter than anterolateral cephalic projections .... *C. burbanki*

Fig. 147. *Cyathura burbanki* Frankenberg (12 mm)

Range: Coast of Georgia (16 to 77 m)

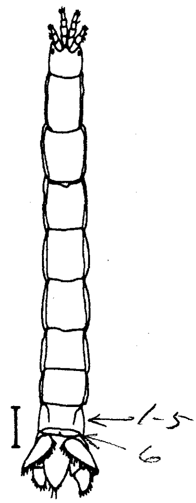


Figure 147. *Cyathura burbancki.*

24b. Medial cephalic projection pointed and as long as or slightly longer than anterolateral projections ....*C. carinata*

Fig. 148. *Cyathura carinata* (Kroyer) (15 mm)

Range: Northwestern North America and Greenland (Surface to 19.5 m)

It is possible that this species is really only found in Europe, and its inclusion in North American records is in error. If it is present, it is found only in northern waters because the more southern locations where it has been reported to occur are inhabited only by *C. polita.* The species is the type-species of the genus. All animals of the species begin life as females, become sexually mature, and then some change to become males; i. e., they are protogynous.

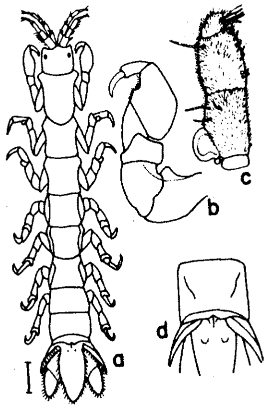


Figure 148. a. *Cyathura carinata.* b. Peraeopod. c. Maxilliped. d. Detail, posterior part of pleon.

25a. Maxillipedal palp of one article; mandibular palp of only one article .... *Ptilanthura*

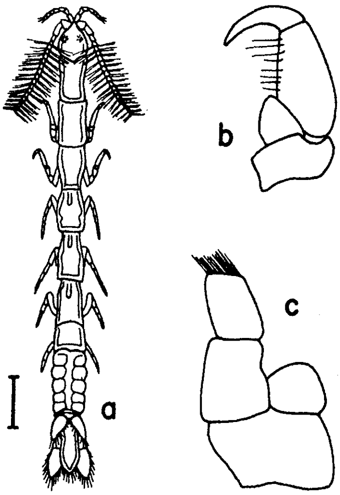


Figure 149. a. *Ptilanthura tenuis* (male). b. Peraeopod I, male. c. Maxilliped.

Fig. 149. *Ptilanthura tenuis* (Harger) (8.5 mm)

Range: Bay of Fundy to Long Island Sound (Surface to 35 m)

This species is the type-species of the genus. It was taken on muddy bottoms in deep water and on stony bottoms in shallow water.

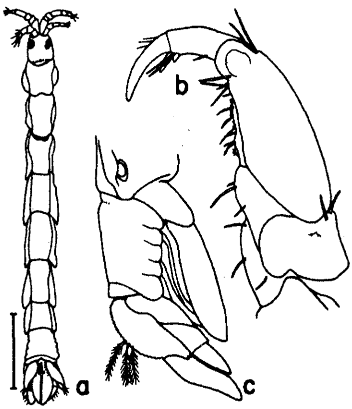


Figure 150. a. *Ptilanthura tricarina* (female). b. Peraeopod I, female. c. Lateral view, pleon.

Fig. 150. *Ptilanthura tricarina* (Menzies and Frankenberg) (5.8 mm)

Range: Off Georgia (25 to 141 m)

There is no dorsal indication of segmentation in the pleon of the species as there is in *P. tenuis*.

25b. Maxillipedal palp of three articles; mandibular palp of three articles .... *Mesanthura*

Fig. 151. *Mesanthura pulchra* (Barnard) (7 mm)

Range: St. Thomas and St. Johns, West Indies (18 to 40 m)

Only a single crude figure of this species is available, but the dorsal pigment pattern is characteristic of the species.

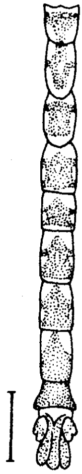


Figure 151. *Mesanthura pulchra.*

Mesanthura nubifera Wägele, 1983
Sea of Cortez; intertidal
(midriff region)

Fig. 152. *Mesanthura occidentalis* Menzies and Barnard, 1959

Range: Pt. Conception to San Quintin Bay, Baja California (Shallow water to 18 m)

This species has a characteristic body pigmentation. It is found in live and dead algae on the bottom in shallow water. And in Gulf of California.

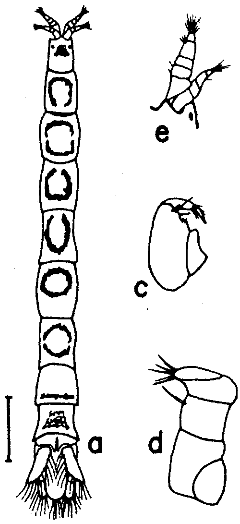


Figure 152. a. *Mesanthura occidentalis* (female). b. Antennae one and two. c. Peraeopod I, female. d. Maxilliped.

SUBORDER FLABELLIFERA

The suborder Flabellifera contains the largest number of species that any amature collector will probably encounter of any isopod suborder. It includes most of the common near shore species and also many economically important species. Generally the species are medium to large in size, but the largest as well as some of the smallest isopods are included within the suborder. The species are abundant in most near-shore habitats and are also common as fish parasites. They are rarely encountered in the deep sea. For most species the mouth parts are biting and strongly developed, but the parasitic species have mouth parts that are modified for their peculiar parasitic type of feeding. Most species have eyes although cave forms have lost their eyes, and certain of the more parasitic species have rudimentary eyes or no eyes at all. The antennae are generally well developed, but parasitic forms for the most part have small antennae.

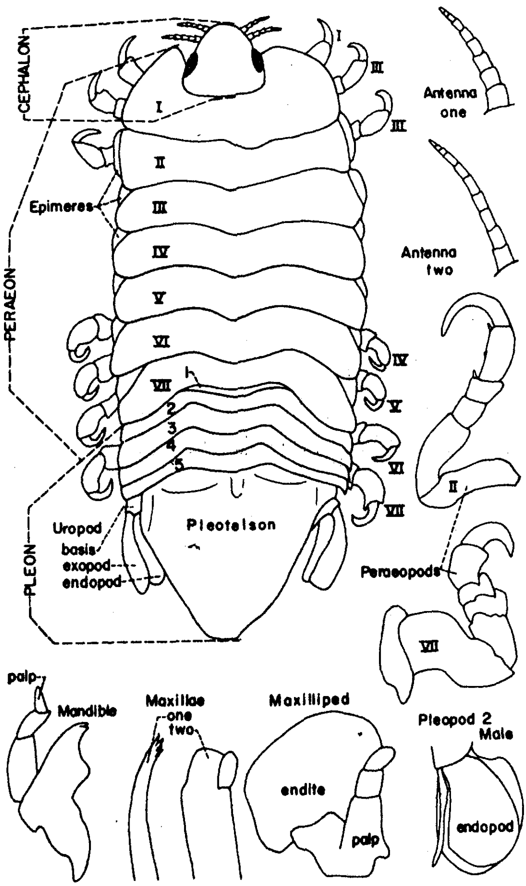


Figure 153. Flabellifera (General nomenclature).

The peraeopods are ambulatory and prehensile and frequently a combination of the two types are found on one animal. The pleonal segments are generally well defined although they are sometimes not all distinct in the dorsal view. Lateral indications are generally present when pleonal segments are fused. Pleopods are always present, and they are never found within a branchial chamber. In some species they are well developed and are said to be natatory. The uropods generally have a flattened exopod and endopod and together with the pleotelson serve as part of the caudal fan which is used in swimming. Since there are many well defined families in the suborder, further discussion of the flabelliferan species will be found there. There are many subtile differences between groups and many exceptions to general rules of structure among the species. Species of ten families are known from North American waters.

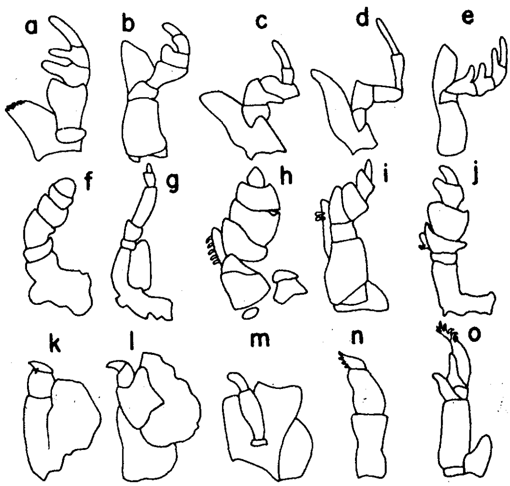


Figure 154. Maxillipeds of Flabellifera (for Cirolanides, see Fig. 274). a. *Tecticeps*. b. *Cassidinidea*. c. *Sphaeroma quadridentatum*. d. *Sphaeroma destructor*. e. *Exosphaeroma* (*E. rhomburum*). f. *Alcirona*. g. *Excorallana*. h. *Bathynomus*. i. *Excirolana*. j. *Cirolanides*. k. *Anilocra*. l. *Meinertia*. m. *Serolis*. n. *Nerocila*. o. *Aega*.

KEY TO FAMILIES OF FLABELLIFERA

1a. Pleon with at least ~~one~~ two free pleonal segment 2

1b. Pleon with only one pleonal segment indicated mediodorsally .... Cirolanidae (genus *Colopisthus* only—p. 168)

2a. Pleon composed of four or five free segments plus pleotelson (a pleonal segment sometimes is hidden under peraeonal segment VII) 4

2b. Pleon composed of three or less visible free segments plus pleotelson 3

3a. Pleon composed of only ~~one~~ 1-2 free segments plus pleotelson; uropod with one ramus fused to basis; generally able to roll into ball .... Sphaeromatidae (p. 114)

3b. Pleon of three free segments plus pleotelson; uropods with both rami movable; body greatly compressed dorsoventrally, never able to roll into ball .... Serolidae (p. 136)

4a. Uropods present 5

4b. Uropods absent .... Anuropidae (p. 137)

5a. Uropods with both exopod and endopod flattened 6

5b. Uropods with one or both with hook-like rami .... Limnoridae (p. 138)

6a. All peraeopods prehensile (modified for clinging) or all peraeopods ambulatory, never mixed; Mdb. w/ or w/o lacinia mobilis .... ~~8~~ 7

6b. Peraeopods both prehensile and ambulatory (or modified natatory—Fig. 31b) on same individual; Mdb. w/o lacinia mobilis or molar process or with reduced l.m. + m.p. .... ~~9~~ 8

7a. All peraeopods prehensile; maxillipedal palp of two articles, distal article with hook-like setae .... Cymothoidae (p. 145)

7b. All peraeopods ambulatory; mandibles with lacinia mobilis and well developed peculiar tooth-bearing molar process (Fig. 37f) .... Cirolanidae (p. 168)

8a. Maxillipedal palp of two or five articles, distal article with stout hook-like setae .... Aegidae (p. 188)

8b. Maxillipedal palp usually of five articles, distal article with no hooks only fringing setae .... ~~10~~ 9

9a. Antepenultimate article (palp article three) of maxillipedal palp longer than broad (Fig. 155a) .... Excorallanidae (p. 205)

9b. Antepenultimate article of maxillipedal palp as broad as long (Fig. 155b) .... Corallanidae (p. 212)

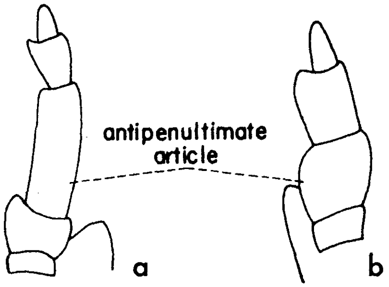


Figure 155. Antipenultimate maxillipedal palp articles compared. a. *Excorallana*. b. *Corallana*.

SPHAEROMATIDAE

The species in the family sphaeromatid are not only among the most common groups of isopods, but they are in one of the most taxonomically confused groups as well. Species of many genera are found in the near shore environments. Some species are sexually dimorphic; others are not. They are generally small to medium in size and are very good swimmers, but there are no special flattened natatory peraeopods on the specimens. Instead, peraeopods with very long natatory setae are found (Fig. 31b). The species are frequently taken from under rocks and debris found on the beaches of the world. They are abundant in tidal pools and are frequently taken in and among encrusting animals and plants on wharves, piles and rocks. Many times they are found in burrows of other animals including the boring species of *Limnoria*. There are some species that will bite if they are caught in the bare hand. Their bites are harmless, however. One species of the family is known to destroy wooden pilings by boring into them just as the species of *Limnoria* do. They then are of considerable economic importance to man.

There are several different ways that the sphaeromatid are classified. One of them, used mainly for the European species, is based on the structure of the pleopods. Some pleopods, usually the last two or three, are "fleshy" or membraneous and others are more or less translucent. Sometimes all pleopods are translucent. There are either one or two segments in the rami of the pleopods (Fig. 180), and fringing setae (usually plumose setae) are absent or present. Since the particular pattern of the characters of the pleopods are

... Key to sphaeromatidae is all screwed up. There is no key to get to couplet #15 -- Discerceis, Cymodoce, Sphaeroma, etc.

not known for all North American genera, it will be used here only in part.

Some member of the sphaeromatids are sexually dimorphic, the male being much different than the female. The female is usually "plain" or generalized and does not differ much from other females either of the same or of different genera. The species generally can only be firmly defined and differentiated on the differences found in the males. Species of Paracerceis are good examples of sexually dimorphic species (p. 120).

Many sphaeromatid species are able to roll into a tight ball like their terrestrial cousins the pill bugs (Oniscoidea). Indeed, that is where the name sphaeromatid comes from since the isopod roll into spheres. Sometimes there are dorsal projections or the uropods are modified so that they form very spiny balls when rolled up. The five pleonal segments are fused so that there are only lateral indications of the segments. The pleotelson forms a caudal fan with the uropods and it serves as a swimming structure. The basis of the uropod and the endopod are fused and the exopod is freely articulate and lateral to the fused basis and endopod. The epimeral plates are fused to the lateral margins of the peraeonal segments in such a manner as to appear continuous with them, except of course those of peraeonal segment I.

KEY TO GENERA AND SPECIES OF SPHAEROMATIDAE

1a. Uropods uniramus, only long endopod present ....*Ancinus*

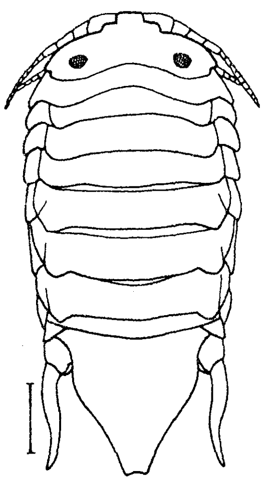


Figure 156. *Ancinus depressus.*

Fig. 156. *Ancinus depressus* (Say) (6.3 mm)

Range: Massachusetts to Texas (Surface to 3 m)

The species is rarely found in water over 3 meters deep. Occasionally in North Carolina the species is taken in wave washed beach sand. The species of the genus are common, but rarely are found in large numbers.

...ianella elegans (n. gen., n. sp.) Boone, 1923 — from So. California

Bathycopea daltonae (M & B, 1959) (= Ancinus daltonae Menzies & Barnard 1959)

Fig. 157. *Ancinus granulatus* ~~granulosus~~ (Holmes and Gay) (8 mm)

Range: Southern California (6 to 10 m)

The species was found in two places in southern California. At Pt. Conception it was found in medium-coarse, gray sand. It differs from the east coast species of the genus in that the pleotelson is more pointed and other characters. (see Schultz, 1973)

Ancinus seticomvus Trask is a jr. synonym of A. granulatus

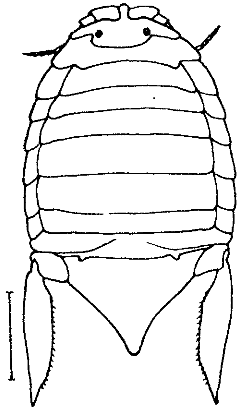


Figure 157. Ancinus daltonae ~~granulosus~~.

1b. Uropods biramus (remember the endopod and basis are fused) 2

2a. Uropod with exopod very short and set within margin of long endopod .... *Cassidinidea*

Fig. 158. *Cassidinidea lunifrons* (Richardson) (4 mm) Charleston (Stono River)

Range: Great Egg Harbor, New Jersey to Georgia (Surface to 1 m)

The species is found in the mud and dead leaves in the shallow water of estuaries and inland embayments and brackish marshes. The coxal extensions are indicated by a groove; they are not actually separated from the peraeonal segments as in species of *Ancinus*.

Also: Cassidinidea tuberculata Rich 1912 from Madre, Mexico. (pleotelson rounded; pleon tuberculate).

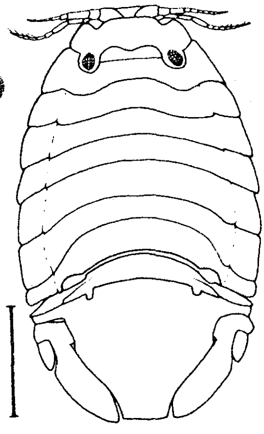


Figure 158. Cassidinidea lunifrons.

Fig. 159. *Cassidinidea ovalis* (Say) (3.8 mm)

Range: South Carolina to Florida (Very shallow water)

It is still an open question if this species is the same as *C. lunifrons*. The two species overlap in range, but there still are differences in the uropodal structure so that they

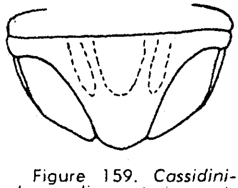


Figure 159. Cassidinidea ovalis, posterior part.

note: M.E. Hendrickx has sent me specimens of a Cassidinea from Mazatlan!

must be considered separate species until more specimens from southern locations are obtained.

2b. Uropod with endopod and exopod of about equal lengths or with exopod much longer than endopod 3

3a. First and second pair of peraeopods subchelate in male, only first pair subchelate in female; maxillipedal palp with articles 2, 3 and 4 medially produced into lobes .... ***Tecticeps***

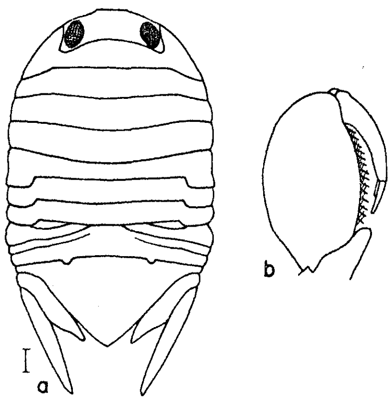


Figure 160. a. *Tecticeps alascensis.* b. Peraeopod I.

Fig. 160. *Tecticeps alascensis* (Richardson) (16 mm)

Range: Bering Sea and Aleutian Islands (16 to 194 m)

The posterior margin of the pleotelson is pointed in this species.

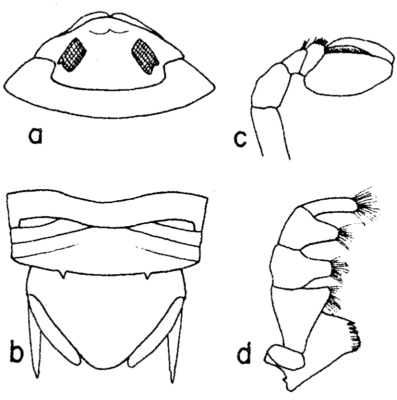


Figure 161. a. *Tecticeps convexus,* anterior part. b. Posterior part. c. Peraeopod I. d. Maxilliped.

Fig. 161. *Tecticeps convexus* (Richardson) (11.5 mm)

Range: ~~Monterey Bay, California (9 m)~~ Pt. Conception to Crescent City.

This species is known to roll into a ball and the exopod of the uropod forms a protective spine. There is a rounded posterior margin on the pleotelson in the species.

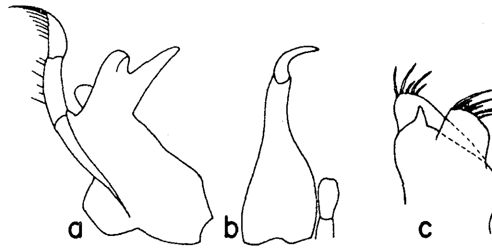


Figure 162. Mouth parts of *Tecticeps convexus*. a. Mandible. b. Maxilla one. c. Maxilla two.

Figs. 162 and 163. *Tecticeps pugettensis* (Hatch) (10.1 mm)

Range: Whidbey Island, Washington (13 m)

The configuration of the posterior margin of the pleotelson and the position of the eyes distinguish this species from other North American members of the genus.

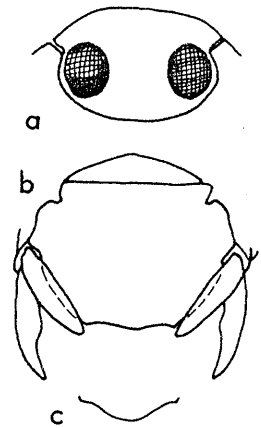


Figure 163. a. *Tecticeps pugettensis*, cephalon. b. Pleotelson. c. Posterior margin of 'pleotelson.

3b. **All peraeopods ambulatory; maxillipedal palp structure various** **4**

4a. **Posterior medial border of pleotelson deeply cleft or with moderately deep medial groove** .... **5** go to 17

4b. **Posterior medial border of pleotelson** smoother **not deeply cleft or with moderately deep medial groove (deep mediolateral clefts can be present causing the medial portion of the posterior border of the pleotelson to be produced into a point–Fig. 309)** .... ~~10~~ 9

go to 9, then try 15.

5a. **Exopod and endopod about same length with exopod capable of folding under endopod; medial cleft in posterior border of pleotelson flanked by two produced sections of posterior border which can be closely adherent at tips causing triangulate hollow in pleotelson (Fig. 173)** .... ~~6~~ 7

5b. Exopod and endopod about same length only in female; male with exopod elongate and not capable of folding under endopod; male with very deep medial cleft or with shallow cleft without produced borders (sometimes it is only seen as a groove on the ventral posterior part of the pleotelson, the posterior border being rounded); tubercles usually present 6

6a. Cephalon produced into three anterior lobes; uropods with tips of exopods turned outward (in males); no teeth within shallow notch on posterior border of pleotelson ..*Dynameniscus*

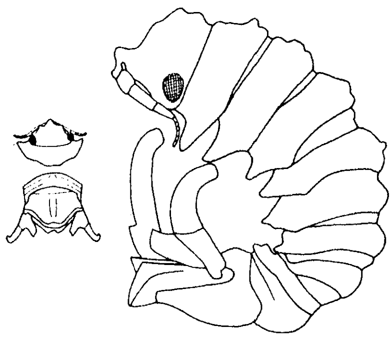


Figure 164. a. *Dynameniscus carinatus*, dorsal view. b. Lateral view.

Fig. 164. *Dynameniscus carinatus* (Richardson)

Range: Coast of Georgia (805 m)

One small male specimen is all that represents the type-species of the genus.

6b. Cephalon not produced into three lobes; uropods with tips of exopods turned inward (in males); teeth within notch on posterior border of pleotelson ....*Paracerceis*

GENUS PARACERCEIS

This genus with a complicated taxonomic history is further made more difficult to study because the males are quite different from the females. Males are usually greatly ornamented with long caudal process extending from the pleotelson or it might be said a deep indentation usually with internal teeth in the medial border of the pleotelson. There are five species in the genus in North American waters, but it is quite possible that some of them are the same species or synonymous. It is also just as possible that there have been several species described under one species name.

Since the male and females are so different some have been described as being in different genera. More attention must be paid to the variation in the females when collected with known males. Females are not well described and are frequently confused, not only with females of the same genus, but with females of other genera as well. They are probably subject to some individual and regional variation, but with more complete and accurate descriptions of their morphology their true identity can be made known. Males are also subjected to age and regional variations which have never been recorded. The species of the genus are frequently found on sandy bottoms and are also taken in corals and sponges. No key is included here since males and females are not known in all species.

Fig. 165. *Paracerceis caudata* (Say) (9 mm)

Range: New Jersey, Bermuda and West Indies (Surface to 46 m)

The species is found among algae and grass and in coral reefs. It is probably composed of a complex of species and subspecies and deserves more study.

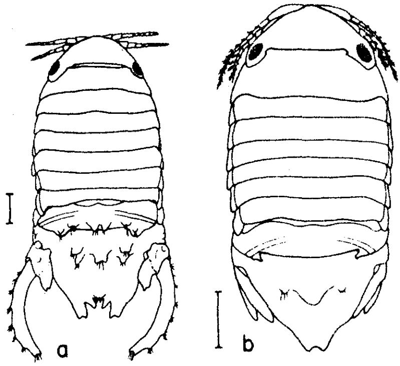


Figure 165. a. *Paracerceis caudata* (male). b. Female.

Fig. 166. *Paracerceis tomentosa* (Schultz and McCloskey) (6.2 mm)

Range: Cape Lookout, North Carolina (5 m)

The species was found in a coral head on Cape Lookout jetty. The male is unknown.

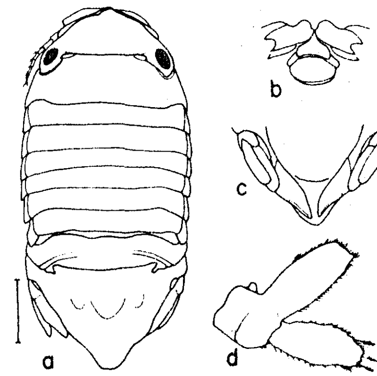


Figure 166. a. *Paracerceis tomentosa* (female). b. Frontal lamina. c. Pleon, ventral aspect. d. Uropods.

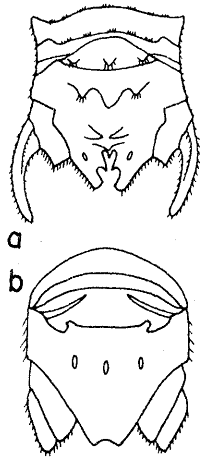


Figure 167. a. *Paracerceis sculpta* (male). b. Female.

Fig. 167. *Paracerceis sculpta* (Holmes)

Range: San Clemente Island and San Diego, California (Shallow water)

The species was found in pieces of sponges.

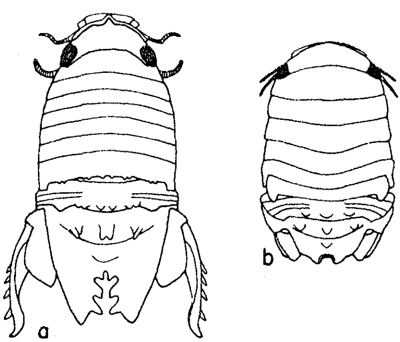


Figure 168. a. *Paracerceis cordata* (male). b. Female.

Fig. 168. *Paracerceis cordata* (Richardson) (7.1 mm)

Range: Aleutian Islands to southern California (37 to 55 m)

The species is found in corals as well as on sandy bottoms.

ie has descriptions & figs. of two new species of Paracerceis.

Fig. 169. *Paracerceis gilliana* (Richardson) (4.8 mm)

Range: Southern California (55 to 73 m)

This species differs from *P. cordata* only in minor features.

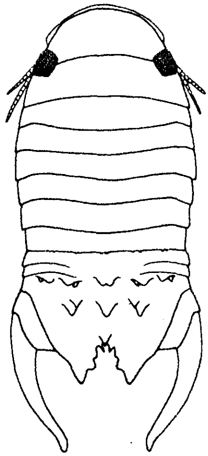


Figure 169. *Paracerceis gilliana* (male).

7a. **Maxillipedal palp with medial edges of articles two, three and sometimes four produced into lobes 8**

7b. **Maxillipedal palp with medial edges or articles two, three and four never produced into lobes ....** *Paradynamene*

Fig. 170. *Paradynamene benjamensis* (Richardson) (10 mm)

Range: Atlantic coast and in Gulf Stream

The species was found in floating algae in the Gulf Stream.

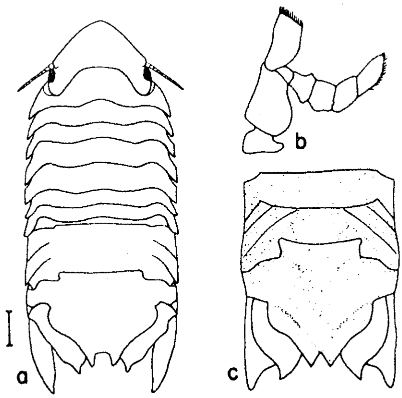


Figure 170. a. *Paradynamene benjamensis* (female). Maxilliped. c. Male.

8a. **Antenna one with two basal segments of peduncle flattened and enlarged, generally visible in dorsal view in front of cephalon ....** ***Dynamene dilatata***

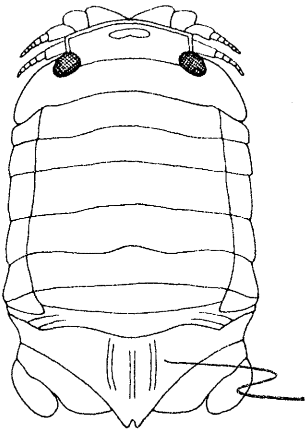


Figure 171. *Dynamene dilatata.*

Fig. 171. *Dynamene dilatata* (Richardson) (3 mm)

Range: Monterey Bay, California

The true generic status of this species is still undetermined. Only one specimen has ever been collected.

flattened, w. shovel-like epistome

8b. Antenna two without expanded peduncular segments .... *Dynamenella* and *Dynamenopsis*

GENERA DYNAMENELLA AND DYNAMENOPSIS

Reasonable morphological criteria for distinguishing species of the two genera are not found among the North American members. Also immature males look like adult females and can only be distinguished by the differences found in pleopods 2. The two genera are defined on the character of the pleopods and it is not known what those structures are like in North American species.

9a. Tubercles on dorsum of pleotelson in trapezoidal or square pattern **10**

9b. No tubercles on dorsum of pleotelson .... *D. glabra*

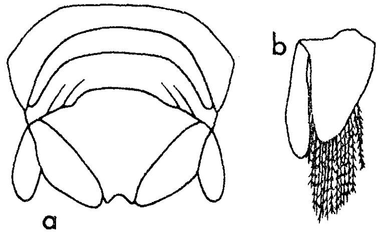


Fig. 172. *Dynamenella glabra* (Richardson) (3 mm)

Range: Monterey Bay, California (Surface)

Figure 172. a. *Dynamenella glabra,* posterior part. b. Pleopod 2, male.

10a. **Tubercles on dorsum of pleotelson in trapozoidal pattern** .... *D. dianae*

now in Dynamenella

Fig. 173. *Dynamenopsis dianae* (Menzies) (4 mm)

Range: Northern Baja California (Shallow water)

This species closely resembles *Dynamenella perforata* from Puerto Rico. It is found in large numbers in San Quintin Bay, Baja California. Also reported from Puerto Rico & Eniwetok Atoll. & No. Carolina

Figure 173. *Dynamenopsis dianae.*

10b. **Tubercles on dorsum of pleotelson in square pattern** **11**

11a. **Posterolateral margins of pleotelson concave along entire margin** .... *D. sheareri*

Fig. 174. *Dynamenella sheareri* (Hatch) 1947 (3.3 m)(formerly Dynamene)

Range: Coos Bay, Oregon (Shallow water)

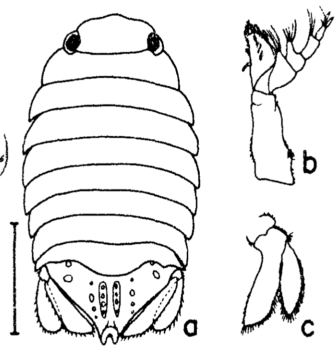


Figure 174. a. *Dynamenella sheareri.* b. Maxilliped. c. Uropod.

11b. **Posterolateral margins of pleotelson convex along entire margin** **12**

12a. Posterior margin of pleotelson broadly rounded except for shallow medial cleft; four very small tubercles on dorsum of pleotelson .... *D. perforata* (immature—see below)

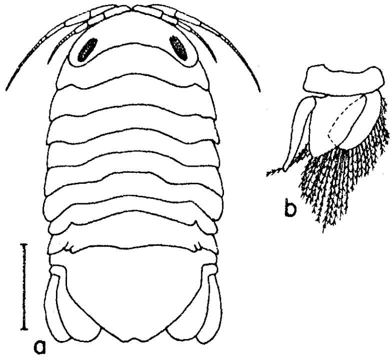


Figure 175. a. *Dynamenella perforata*, immature male. b. Pleopod 2, male.

Fig. 175. *Dynamenella perforata* (immature male)

Range: Bermuda to Puerto Rico (Intertidal)

The species has been recorded to be present clinging to the bottoms of chitons. Chitons are common mollusks of the tropical intertidal zone (see Fig. 176).

12b. Posterior margin of pleotelson with deep cleft; dorsum variously decorated 13

13a. Deep cleft of pleotelson opening into large cavity .... *D. perforata*

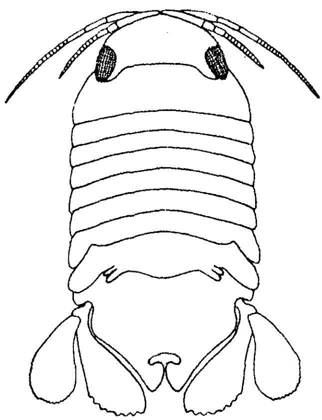


Figure 176. *Dynamenella perforata.*

Fig. 176. *Dynamenella perforata* (Moore) (4 mm)

Range: Puerto Rico, Culebra Island and Bermuda (Intertidal)

The species is found on the roots of mangroves and is the same species as *D. moorei* which was the name given to immature males and females of the species (see also Fig. 175).

13b. Deep cleft of pleotelson not opening into large cavity 14

14a. Posterior margin of uropodal rami produced and acutely pointed .... *D. angulata*

Dynamenella conica Boone, 1923 - from Central California

Fig. 177. *Dynamenella angulata* (Richardson)

Range: No Name Key, Florida

No males were ever described and the species might turn out to be the female of another related species.

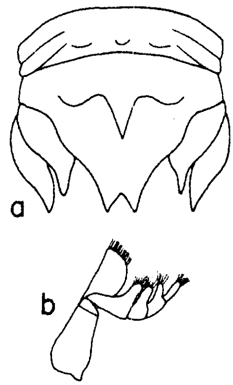


Figure 177. a. *Dynamenella angulata*, posterior part. b. Maxilliped.

14b. Posterior margin of uropodal rami rounded ....*D. benedict*

Fig. 178. *Dynamenella benedicti* (Richardson) (3 mm)

Range: Monterey Bay, California (Shallow water)

Both males and females are known for this species.

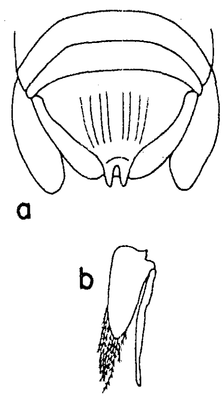


Figure 178. a. *Dynamenella benedicti*, posterior part. b. Pleopod 2, male.

15a. Surface of body densely granulated 16

15b. Surface of body not densely granulated 17

16a. Male with deep mediolateral clefts and endopod much shorter than exopod; pleotelson separated from pleonal segments (which are feebly indicated) by straight line .... *Discerceis*

GENUS DISCERCEIS

Only two species are now contained in this formerly large genus. Other species have been removed and put into separate genera all of which are included here.

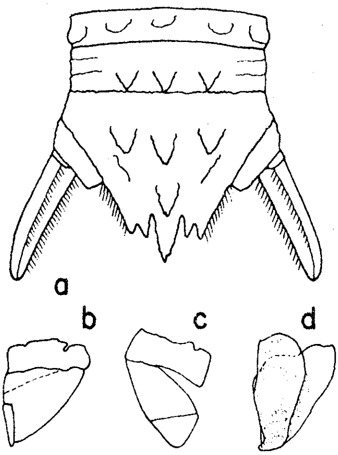


Figure 179. a. *Discerceis grandulosa*, posterior part. b. Pleopod 2, male. b. Pleopod 3. d. Pleopod 4.

Fig. 179. *Discerceis granulosa* (Richardson) (9 mm)

Range: Cerros Island, Baja California (37 m)

This species is the type-species of the genus. It is not well described and *D. linguicauda* is also not well described.

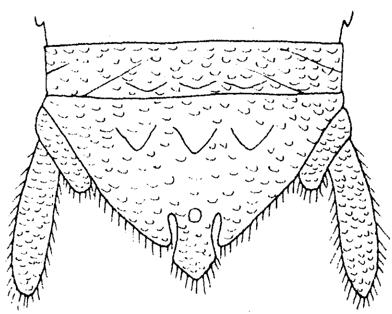


Figure 180. a. *Discerceis linguicauda.*

Fig. 180. *Discerceis linguicauda* (Richardson)

Range: Cape Catoche, Yucatan, Mexico (44 to 46 m)

16b. Male and female with exopod and endopod well developed; pleotelson separated from remaining part of pleon, not by straight line (sutures of pleonal segments strongly indicated at least laterally) .... *Cymodoce*

Fig. 181. *Cymodoce japonica* (Richardson) (17.5 mm)

Range: Japan, but introduced to west coast (Surface to 1547 m)

The species was introduced to North America most probably on oysters. It thus has economic importance.

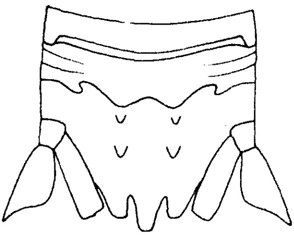


Figure 181. *Cymodoce japonica.*

Fig. 182. *Cymodoce faxoni* (Richardson (5.5 mm)

Range: Florida to Texas

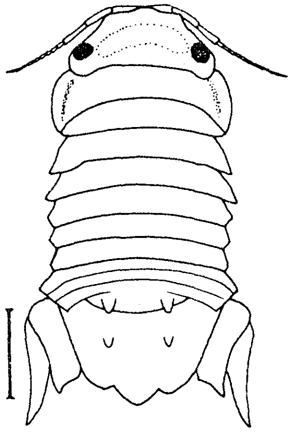


Figure 182. *Cymodoce faxoni.*

17a. Maxillipedal palp with inner margin of articles two, three and four produced into lobes 18

17b. Maxillipedal palp with inner margin of articles two, three and four not produced into lobes .... *Sphaeroma*

GENUS SPHAEROMA

Four species of this genus are common and widespread on the east coast of North America, but there is only one species on the west coast. The species are remarkably well pigmented, and there is much variation of color in the different populations and different regions. The species are frequently taken from the burrows of *Limnoria* species, the wood-boring isopod, and they apparently form an association with them. One species, S. *destructor*, has been recorded to be itself a borer of wooden pilings in southern and southeastern United States.

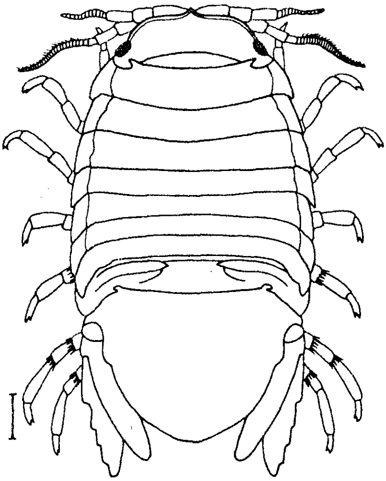


Figure 183. *Sphaeroma quadridentatum.*

Fig. 183. *Sphaeroma quadridentatum* (Say) (10 mm)

Range: Massachusetts to Key West, Florida (Surface to 1 m)

This species is very common on the east coast of North America where it is found on algae, marine pilings and occasionally on rocky, shelly bottoms. The dorsum of the pleotelson of this species is relatively smooth when compared to that of S. *destructor.*

This sp. was made a jr. synonym of S. terebrans Bate, 1866 long ago. see Stebbing (1904), Pillai (1955), Richardson (1905), etc.

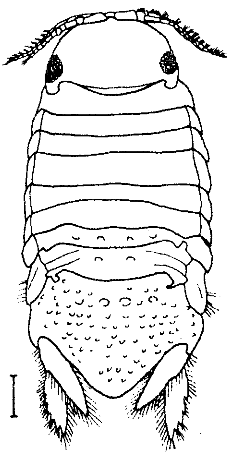


Figure 184. *Sphaeroma destructor* (for mouth parts see Fig. 38).

Fig. 184. *Sphaeroma destructor* (Richardson) (10 mm)

Range: Georgia and Florida to Louisiana (Intertidal and shallow water) Circumtropical !

This species destroys wooden marine structures and is of considerable economic importance. It has tubercles over its entire dorsum, but they are especially noticeable on the pleotelson. Bores into prop roots of R. mangle (see Simberloff, et al., 1978).

Sphaeroma walkeri Stebbing 1905

Fig. 185. *Sphaeroma ~~pentodon~~* (Richardson), 1904 (8 mm) = *S. quoyana*

Range: Sausalito, San Francisco Bay, California and southward (Mud flats and in soft rock)

This species has large teeth on the outer margin of the exopod of the uropod and two rows of tubercles medially placed on the dorsum of the pleotelson. The species is unique among North American isopods in that it burrows into soft rock just as *S. destructor* burrows into wood. The pleopods of the species serve as the home of the species *Iais californica* (p. 269), a small asellote. Also reported from Australia, New Zealand & Tasmania. with long setae on Pl-7.

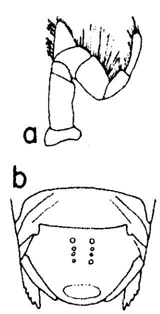


Figure 185. a. *Sphaeroma pentadon*, maxilliped. b. Posterior part.

Fig. 186. *Sphaeroma barrerae* (Boone) (13.5 mm)

Range: Cabanas, Cuba

This species has a "dome-like" pleotelson.

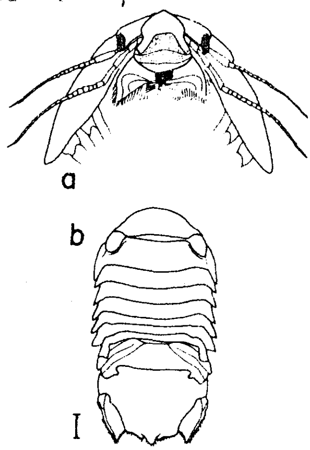


Figure 186. a. *Sphaeroma barrerae*, anterior part, ventral aspect. b. Dorsal view.

18a. Lateral edges of two or three pleonal segments extend to border of pleon; no "fleshy," folded pleopods .... *Gnorimosphaeroma*

Fig. 187(a). *Gnorimosphaeroma oregonensis* (Dana) (12 mm)

Range: Mid-California to Alaska (Intertidal to 22 m)

The species is common on the west coast in tidal pools and sometimes in brackish water. The edges of three pleonal segments reach the edge of the pleonal margin.

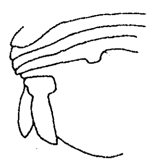


Figure 187(a). *Gnorimosphaeroma oregonensis*, details of pleonal edges.

Gnorimosphaeroma rayi (introduced; Tomales Bay only in Calif.) Hoestlandt, 1969

Figure 187(b). a. *Gnorimosphaeroma lutea*, details of pleonal edges. b. Dorsal-oblique view.

Figs. 187(b). *Gnorimosphaeroma lutea* Menzies, '54 (8.5 mm)

Range: ~~Mid California~~ San Luis Obispo to Alaska (Fresh and brackish water)

The species had been considered as a subspecies of *G. oregonensis,* until it was demonstrated that there were consistent physiological and ecological differences. The lateral edges of only two pleonal segments reach the edge of the margin of the pleon.

[this is the jr syn of G. insulare. see Hoestlandt, 1977]

for info on Gnorimosphaeroma see papers by Hoestlandt, 1977 & 1969 and also Menzies, 1954

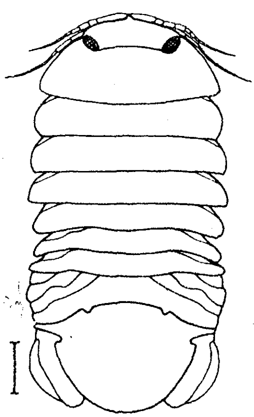


Figure 188. *Gnorimosphaeroma insularis.*

Fig. 188. *Gnorimosphaeroma insulare* (Van Name, 1940) (8 mm)

Range: San Nicolos Island off southern California (Freshwater)

The species differs from *G. oreogonensis* and *G. lutea* in angulation, length and relationship of the pleonal sutures.

freshwater - estuarine; Calif to Alaska.

(= G. lutea)

Fig. 189. *Gnorimosphaeroma* ~~*nobeli*~~ *noblei* Menzies, (2.9 mm)
Range: Tomales Bay, California (Intertidal) to Los Angeles.

~~This species can be told from other species in the genus by the configuration of the pleotelson and by the smooth dorsum.~~ *G. rayi* Hoestlandt has also been described from Tomales Bay, but it only differs in color from other species in the genus. It may only be a subspecies of one of the species in the genus. Also reported from Kurile Is., Sea of Okhotok.

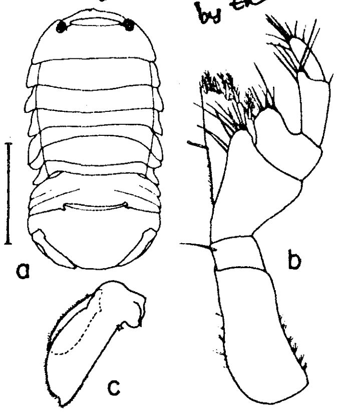


Figure 189. a. *Gnorimosphaeroma nobeli*. b. Maxilliped. c. Uropod.

18b. Lateral edges of only one pleonal segment extend to border of pleon; endopods of pleopods 4 and 5 "fleshy" and folded .... *Exosphaeroma*

GENUS EXOSPHAEROMA

This genus contains a large and heterogeneous assemblage of species. When they are more thoroughly examined they will undoubtedly be divided into several genera.

KEY TO SPECIES OF EXOSPHAEROMA

19a. Uropodal rami very large and broad; posterior margin of pleotelson pointed .... *E. amplicauda*

Fig. 190. *Exosphaeroma amplicauda* (Stimpson) (8 mm)

Range: Aleutian Islands, Alaska to So. ~~mid~~ California (Wet shore to low water)

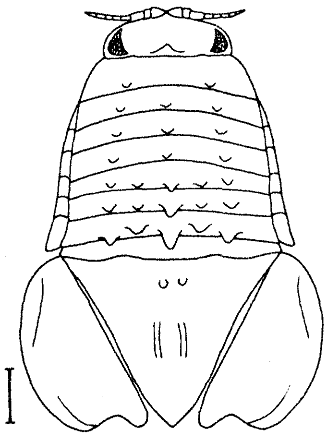


Figure 190. *Exosphaeroma amplicauda*.

19b. Uropodal rami narrow or normal; posterior margin of pleotelson truncate, rounded or obtusely pointed 20

20a. Body covered with papillae or short setae .... *E. papillae*

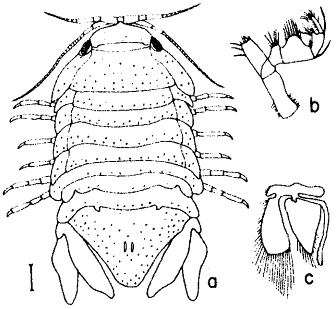


Figure 191. a. *Exosphaeroma papillae*. b. Maxilliped. c. Pleopod 2, male.

Fig. 191. *Exosphaeroma papillae* (Bayliff) (9 mm)

Range: North shore Long Island, New York (Brackish water)

20b. Body without noticeable papillae or short setae 21

21a. Cephalon not deeply or moderately set into peraeonal segment I, but extending acrossed entire width of body 22

21b. Cephalon deeply or moderately set into peraeonal segment I 24

22a. Uropods set outside of general body margin 23

22b. Uropods set within general body margin .... *E. crenulatum*

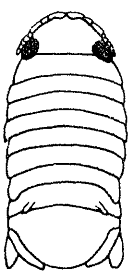


Figure 192. *Exosphaeroma crenulatum*.

Fig. 192. *Exosphaeroma crenulatum* (Richardson)

Range: Bermuda

This species according to the original author is morphologically placed between a *Sphaeroma* and an *Exosphaeroma* species.

23a. Body margins strongly convex; pleonal segment 3 completely separated from others .... *E. inornata*

Fig. 193. *Exosphaeroma inornata* Dow 1958

Range: Palos Verdes to Humboldt Bay, California

The isopod was found under the holdfasts of kelp.

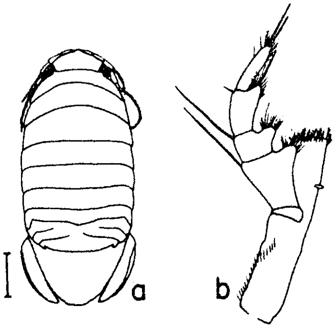


Figure 193. a. *Exosphaeroma inornata*. b. Maxilliped.

23b. Body margins only slightly convex; pleonal segment 3 completely separated from others .... *E. media*

Fig. 194. *Exosphaeroma media* George and Stromberg 1968

Range: Puget Sound, Washington (Intertidal)

The species is found in the sand in the upper part of the intertidal zone.

This will be reduced to a jr. synonym of E. inornata by G. Iverson.

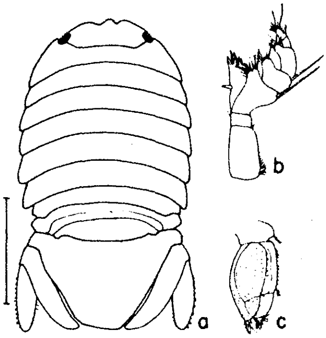


Figure 194. a. *Exosphaeroma media*. b. Maxilliped. c. Pleopod 4, male.

24a. Pleotelson longer than wide; uropodal rami elongate .... *E. dugesi*

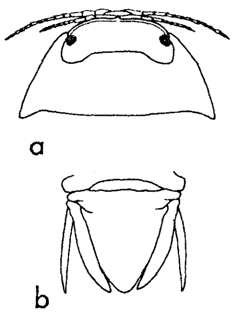


Figure 195. a. *Exosphaeroma dugesi*, anterior part. b. Posterior part.

Fig. 195. *Exosphaeroma dugesi* (Dollfus) (12 mm)

Range: Aquascalientes State, Mexico (Springs)

The species is found in regular freshwater springs and in hot springs abundant near Aquascalientes, Mexico. All peraeopods are ambulatory on the species.

24b. Pleotelson shorter than wide or as long as wide; uropodal rami not especially elongate 25

25a. Eyes large; posterior border of pleotelson strongly truncate; two tubercles on dorsum of pleotelson .... *E. antillense*

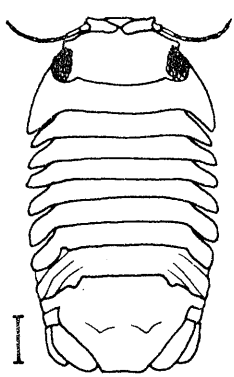


Figure 196. *Exosphaeroma antillense.*

Fig. 196. *Exosphaeroma antillense* (Richardson) (7.2 mm)

Range: Montego Bay, Jamaica (Shallow water)

25b. Eyes of only moderate size; posterior border of pleotelson various; dorsum of pleotelson variously decorated or not decorated 26

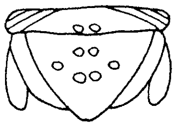
26a. Dorsum of pleotelson with ornamentation 27

26b. Dorsum of pleotelson without ornamentation 28

Exosphaeroma aphrodita Boone, 1923 - from So. Calif.

27a. **Posterolateral margin of pleotelson regularly convex .... *E. octoncum***

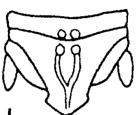
27b. **Posterolateral margin of pleotelson with lateral margins with deep identations for uropods .... *E. rhomburum***



a

Fig. 197a. *Exosphaeroma octoncum* (Richardson)

Range: Monterey Bay, California, to Tomales Head (Marin Co.)



b

Fig. 197b. *Exosphaeroma rhomburum* (Richardson) (3.1 mm)

Range: Monterey Bay, California

Figure 197. a. *Exosphaeroma octoncum*. b. *E. rhomburum*.

28a. **Cephalon deeply set into peraeonal segment I; posterior margin of peraeopodal segment I sinuate .... *E. thermophilum***

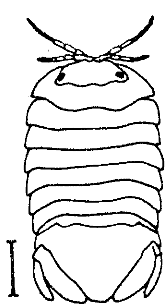


Fig. 198. *Exosphaeroma thermophilum* (Richardson) (4.6 mm)

Range: Near Socorro, New Mexico (Warm Springs)

Another species of the genus *E. dugesi* has also been found in warm springs. How the species reached the warm springs from the marine environment is a mystery.

Figure 198. *Exosphaeroma thermophilum*.

28b. **Cephalon only moderately set within peraeonal segment I; posterior margin of peraeonal segment I straight .... *E. diminutum***

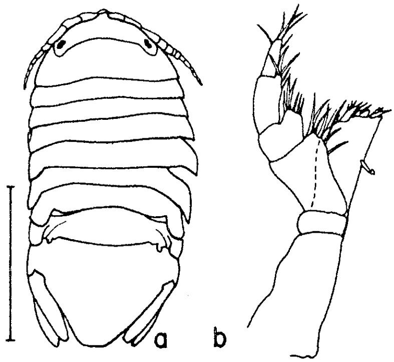


Figure 199. a. *Exosphaeroma diminutum*. b. Maxilliped.

Fig. 199. *Exosphaeroma diminutum* (Menzies and Frankenberg) (2.2 mm)

Range: North Carolina to Georgia (Intertidal and in beach sand)

SEROLIDAE

The family is composed of large dorsoventrally flattened animals that are widely distributed on the bottom of the deep sea. In the Antarctic region the species are especially abundant and are found in shallow water and tidal pools as well as in the deep sea. The specimens of *Serolis* species are large enough to appear in photographs taken by camera lowered to near the bottom in water 2 miles deep. The species apparently live partially immersed in the loose bottom mud and are most probably filter feeders. There are several genera in the family, but the nominal genus *Serolis* is well known and the only one that is represented in North American waters. Three species, two from the North Atlantic and one from the Pacific Ocean, have been recorded. All North American specimens are small when compared to those from more southern locations. Only six peraeonal segments are visible in the dorsal view in most species and the first peraeopod has a subchelate prehensile apex.

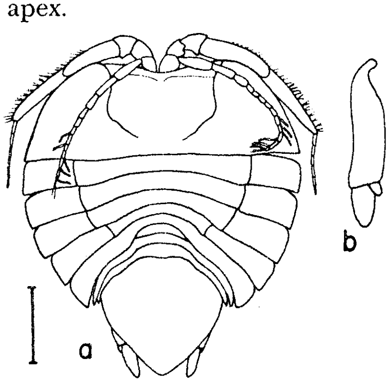


Figure 200. a. *Serolis vemae*. b. Uropod.

Fig. 200. *Serolis vemae* (Menzies) (4.3 mm)

Range: Between Martha's Vineyard and Bermuda (2682 to 5024 m)

This bottom dwelling species is blind. It was the first species of *Serolis* collected in the North Atlantic.

Fig. 201(a). *Serolis mgrayi* (Menzies) (4 mm)

Range: Off coast of Georgia (33 to 44 m)

This species has eyes and was taken from relatively shallow water.

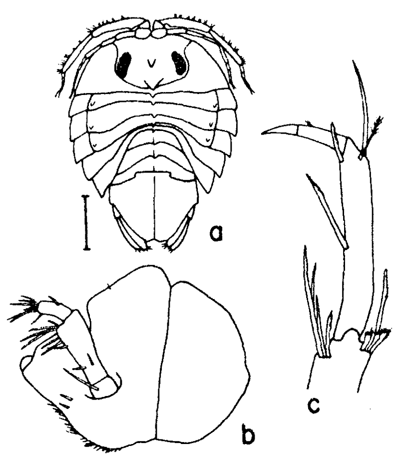


Figure 201(a). a. *Serolis mgrayi*. b. Maxilliped. c. Peraeopod VII.

Fig. 201(b). *Serolis carinata* (Lockington) (5 mm)

Range: Santa Monica to San Diego, California (13 to 55 m)

This species was taken in small numbers in relatively shallow water off the southern California coast. (see Hessler, 1972)

Serolis tropica West central America. Lacks cephalic spines. See Glynn (1976).

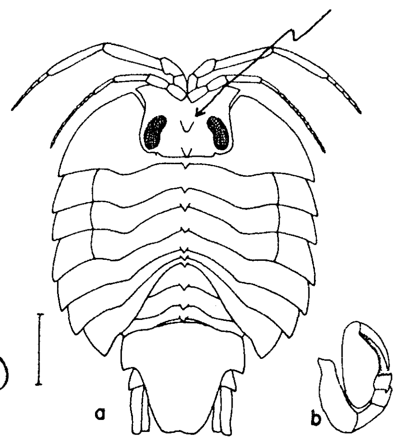


Figure 201(b). a. *Serolis carinata*. b. Peraeopod I.

ANUROPIDAE

Only species of the genus *Bathynomus* from the deep sea floor are larger than isopods of the family Anuropidae. The name of the family implies that the animals have no uropods; however, uropods are present which are only superficially different from the five pleopods. Many species are found in the deep sea, but they are not bottom dwellers as are species of *Bathynomus*. They are rather bathypelagic; i. e., they are found swimming in the deep

Serolis menzeisi Hessler, 1970 – Brazil

water and apparently only rarely go to the bottom. Instead of having a caudal fan composed of broadened uropods and a flattened pleotelson, only the pleotelson which is extremely large and flattened as a swimming structure is present. In proportion to the size of the isopod, the first antennae are extremely large and the second antennae are very small. The isopods are frequently taken in deep plankton tows and are occasionally taken near the surface as well. Only three species are recorded for the family and one is present in North American waters off the coast of California.

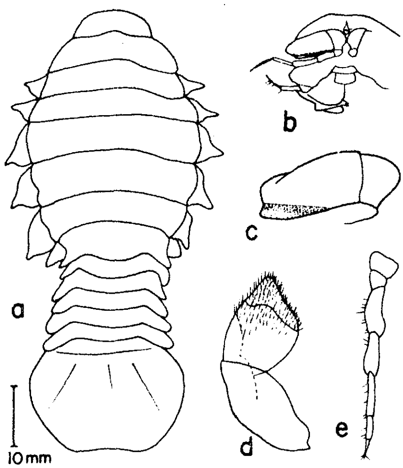


Figure 202. a. *Anuropus bathypelagicus*. b. Cephalon, ventral view. c. Antenna one. d. Maxilliped. e. Antenna two.

Fig. 202. *Anuropus bathypelagicus* (Menzies and Dow) (70 mm)

Range: Off central California (Surface to 2926 m)

The species is blind and is usually taken in very deep plankton tows, but occasionally is caught on or near the surface. At the depth where it is most frequently caught, it has no need of eyes.

LIMNORIDAE

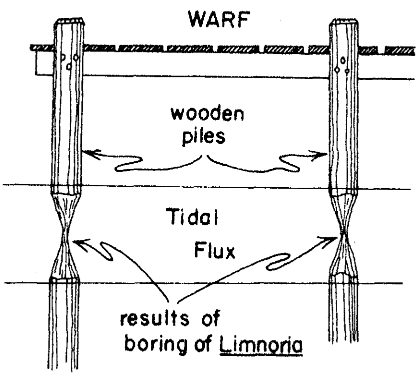


Figure 203. A wharf with a short useful life as the result of *Limnoria* borings.

Species of the family are wood and algae eaters. They are able to bore holes into the plant materials that are found naturally or placed by man in the sea and brackish water. Since much of the marine construction of man is supported on wooden pilings (Fig. 203) and many of his small boats are of wooden construction, a natural food source is supplied to the isopods and millions of dollars are spent to replace that which is eaten.

KEY TO GENERA AND SPECIES OF LIMNORIDAE

1a. **Branches of uropods similar; exopod and endopod elongate, each with claw-like apex (Fig. 204b)** .... *Paralimnoria*

Fig. 204. *Paralimnoria andrewsi* (Calman) (2 mm)

Range: Caribbean region including south Florida (Intertidal and subtidal)

The species is the type and only member of the genus and is apparently widespread being first described from Christmas Island in the Indian Ocean.

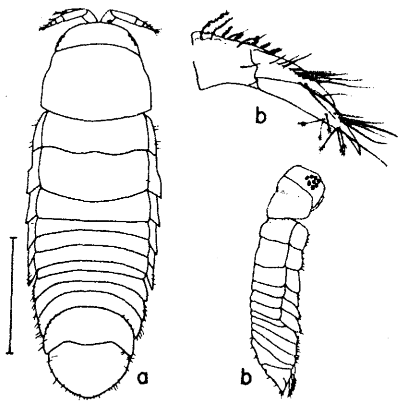


Figure 204. a. *Paralimnoria andrewsi*. b. Uropod. c. Lateral view.

1b. **Branches of uropods dissimilar; exopod short with claw-like apex, endopod long with apex blunt** **2**

2a. **Mandibles without file-like ridges or rasp-like arrangement of scales (Fig. 205a)** .... (*Phycolimnoria*)

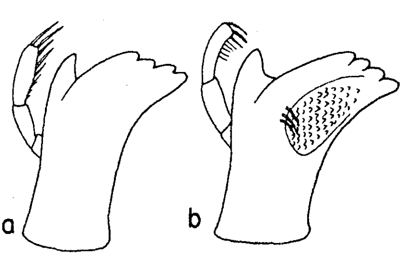


Figure 205. Mandibles of *Limnoria (Limnoria)* sp. and *Limnoria (Phycolimnoria)* sp. compared. a. *L. (Limnoria)*. b. *L. (Phycolimnoria)*.

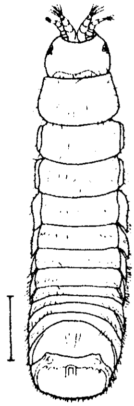


Figure 206. *Limnoria (Phycolimnoria) algarum.*

Fig. 206. *Limnoria* (*Phycolimnoria*) *algarum* (Menzies) (5.5 mm)

Range: Orgeon to southern California (Intertidal and subtidal)

The species is found in burrows that it makes in the holdfasts of the brown laminarian algae. The species is the only known North American *Limnoria* species that burrows exclusively in algae.

2b. Right mandible with file-like ridges on upper surface, left mandible with rasp-like arrangement of strongly sclerotized scales present (Fig. 205b) .... (*Limnoria*)

GENUS LIMNORIA (LIMNORIA)

Species of the genus *Limnoria* subgenus (*Limnoria*) are among the most economic important of the isopods. They attack wooden structures that are found in marine and brackish waters. This includes wooden bridge pilings, wharf pilings and any support pilings plus small boat hulls (Fig. 207). It is interesting to note that the water must be of a certain salinity for large populations of *Limnoria* species to flourish and become economically important. In the early history of San Francisco Bay in California, the water of the bay was composed mostly of the runoff of the rivers that flowed in and it was too brackish to support large populations of species of *Limnoria*. When the Central Valley irrigation projects were started and the amount of freshwater flowing into the bay decreased, the salt water of the ocean flowed into the bay. In a very short span of years the

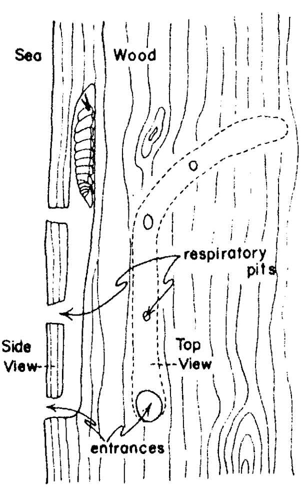


Figure 207. *Limnoria* species gnawing within a wooden pile. The burrows weaken the wooden structures in which they are located.

wooden pilings of bridges and wharfs began to crumble. The higher salinity of the bay changed the environment so that large populations of *Limnoria* species were able to become established and flourish. The economic loss from the invasion of the isopods was put at several million dollars.

In the Baltic Sea, on the other hand, the water is not saline enough to support large populations of *Limnoria* species. (Nor was it high enough to support large populations of the mullusca *Toredo* which also bores into wooden structures.) A wooden ship, the Swedish warship *Vesa,* was launched into the brackish estuary. Because of some architectural miscalculations the ship capsized and sunk soon after the launching and for several hundred years remained at the bottom of the brackish estuary. Because the water in the several hundred years was never saline enough to support large populations of *Limnoria,* the ship was raised intact and can be seen today as a well preserved example of a 17th century ship.

Unfortunately most wooden ships sunk in the coastal waters of the world soon are attacked and eaten by *Limnoria* species. It has yet to be discovered if wooden ships sunk in the deep sea are subjected to *Limnoria* attacks. Sometimes a wooded ship is saved and preserved in shallow water if it is quickly covered by sand or mud and thus is immune to the isopods. However, the wrecked ships, being covered by sand and mud, elude scuba divers.

Many species of the genus are world wide in distribution and were distributed early in maritime history by establishing colonies in the hulls of wooden ships. Some species of the Old World are found in local situations in the New World where they have been introduced and live but do not spread. Much research into the choices of wood made by the species, the chemicals and paints for treating the wood and the general biology of the species has been undertaken, but the species are still able to cause many millions of dollars of damage.

In southern California the isopod species *Caecijaera horvathi* (p. 257) is found as a commensal in the burrows of *Limnoria* species. The seven species described here are all wood eaters of the subgenus (*Limnoria*) of the genus *Limnoria.* They are all found in the intertidal zone.

KEY TO SPECIES OF LIMNORIA

3a. Pleotelson with 2, 3 or 4 tubercles on dorsum 4

3b. Pleotelson with no tubercles, but with two (or one bifurcating) or no ridges on pleotelson 6

4a. Three or four tubercles present on pleotelson; outer margin of uropodal basis crenulate or smooth 5

4b. Two tubercles present on pleotelson; outer margin of uropodal basis smooth .... *L. simulata*

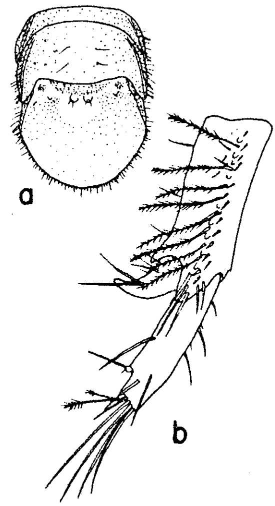


Figure 208. a. *Limnoria (L.) simulata*. b. Uropod.

Fig. 208. *Limnoria simulata* (Menzies) (3 mm)

Range: Virgin Islands

5a. Three tubercles present; outer branch of uropodal basis crenulate .... *L. tripunctata*

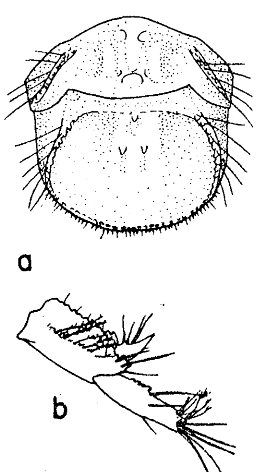


Figure 209 a. *Limnoria (L.) tripunctata*. b. Uropod.

Fig. 209. *Limnoria tripunctata* (Menzies) (2 mm)

Range: Bermuda, Gulf and Caribbean including southeastern United States; also southern California.

The species is found widespread in southern regions; whereas, *L. lignorum* is found widespread in northern regions.

5b. Four tubercles present; outer branch of uropodal basis smooth .... *L. quadripunctata*

Fig. 210. *Limnoria quadripunctata* (Holthuis) (3.4 mm)

Range: Mid- to southern California

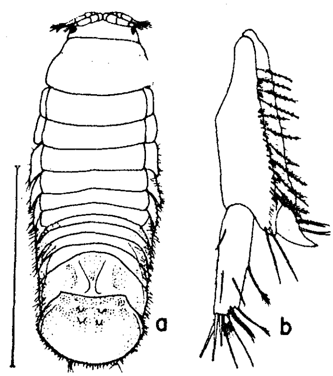


Figure 210. a. *Limnoria (L.) quadripunctata.* b. Uropod.

6a. Pleotelson with two conspicuous medial ridges or one bifurcating ridge 7

6b. Pleotelson with no conspicuous medial ridge .... *L. platycaudata*

Fig. 211. *Limnoria platycaudata* (Menzies) (2.5 mm)

Range: Caribbean Sea

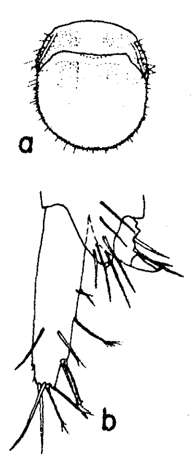


Figure 211. a. *Limnoria (L.) platycaudata.* b. Uropod.

7a. Outer margin of uropodal basis crenulate, distal margin produced; body and dorsal pleotelson setae if present short 8

7b. Outer margin of uropodal basis smooth, distal margin not produced; body with long setae .... *L. pfefferi*

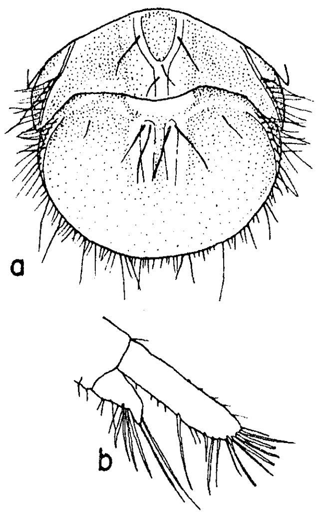


Figure 212. a. *Limnoria (L.) pfefferi.* b. Uropod.

Fig. 212. *Limnoria pfefferi* (Stebbing) (3.5 mm)

Range: Indian Ocean and Miami, Florida

8a. Pleonal segment 5 with two complete mediolateral ridges along almost entire length; pleotelson with two mediolateral ridges complete along their entire length .... *L. saseboensis*

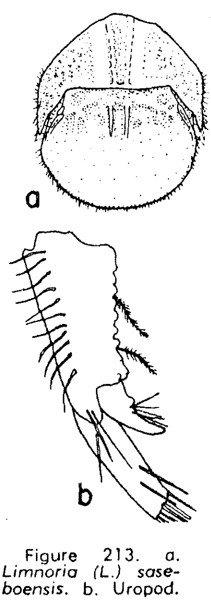


Figure 213. a. *Limnoria (L.) saseboensis.* b. Uropod.

Fig. 213. *Limnoria saseboensis* (Menzies) (3.5 mm)

Range: Sasebo, Japan and Miami, Florida

8b. Pleonal segment 5 with one medial ridge almost entire length; pleotelson with one bifurcating ridge on dorsum .... *L. lignorum*

Fig. 214. *Limnoria lignorum* (Rathke) (3.5 mm)

Range: Newfoundland to North Carolina and Alaska to California

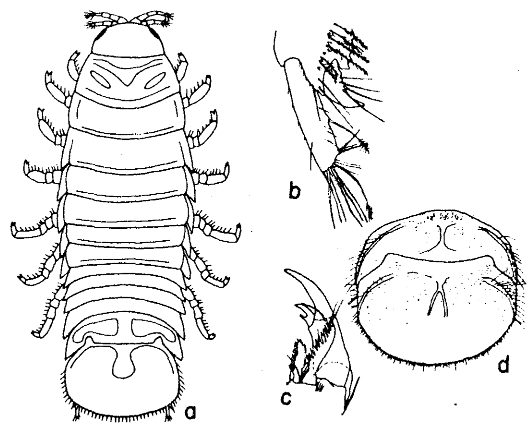


Figure 214. a. *Limnoria (L.) lignorum*. b. Uropod. c. Peraeopod I. d. Pleotelson.

The species is very important in the northern and temperate parts of North America and the world. It is also very common in Europe where it probably evolved as a species.

CYMOTHOIDAE

There are many species in this large important family of isopods. Most of them are fish parasites although they have been found on squid or not attached to any host at all. Some species have been shown to detach themselves from a host under unfavorable conditions and then reattach when conditions again become favorable. Members of the family get to be about 60 mm long, and they number among the largest of the isopods. The species are very much like members of the family Aegidae in general appearance, but cymothoids do not have the large eyes and symmetrical bodies that are characteristic of aegids. Cymothoids have a much greater dependence on their hosts than do aegids and this in part accounts for some of their differences. Species of the many genera of the family are found mainly as ectoparasites of fish as are aegid species, but there are other species that are found within the gill and mouth chambers of their hosts also.

The bodies of the clinging isopods are quite often much modified according to where they are found on the host. Those on the right side of the host's body can have their body axis twisted in one direction while those on the other side have their body twisted in the opposite direction. More complex changes in appendage shape and mouth parts structure (Fig. 215) also take place. Loss or reduction in size of the eyes frequently occurs in animals that become parasites during their evolution, and cymothoid isopods are no exception. In a sense a parasite utilizes the eyes of the host to which it is attached.

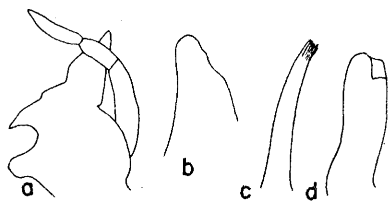


Figure 215. Mouth parts of *Olencira praegustator*. a. Mandible. b. Mandible without palp. c. Maxilla one. d. Maxilla two.

The young of the species are generally much alike in appearance (Figs. 216, 217 and 218). They generally are free living, but begin their parasitic life early. They have developed very large claws for attachment by the time that they reach the manca or six appendage stage. Indeed, the very young forms of many species are not known since they have not yet been found attached to a host. Attachment apparently does not take place immediately after release from the marsupium of the female. When they first attach to the host they are ~~often~~ males and their body is symmetrical. By the time that they are adults and have passed through several molts, they are asymmetrical and are females with brood pouches. The isopods are hermaphroditic, or more accurately andromorphic; i. e., they have the ability to change from male to female, the male stage coming first.

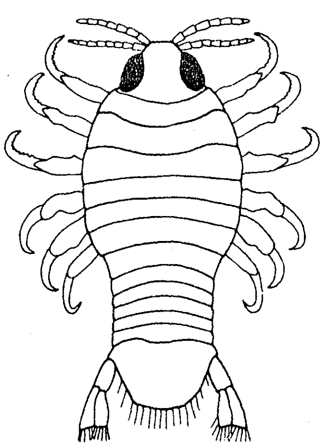


Figure 216. *Cymothoa excisa*, juvenile.

Animals of different ages and sexes are found on one host fish. Generally only particular species are found on particular fish, but more likely the particular isopod parasite has several fish host species. Some described species are perhaps the young of other described species that are already known as adults. There

Cymothoid genera of questionable validity include: Cterissa, Tetragonocephalon

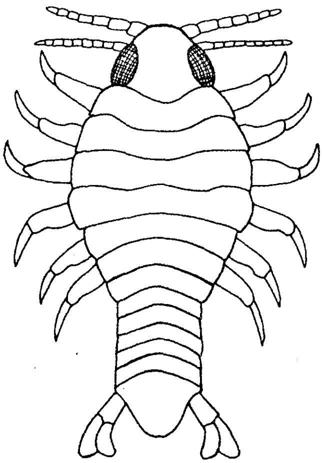
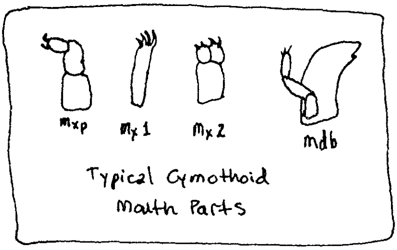


Figure 217. *Agarna carinata*, juvenile.

is much yet to be learned of the life cycle of the cymothoids. The fish themselves are frequently the host of one or more than one species of isopod, but usually two different species are not found on one host. The degree of specificity between host and parasitic species is much greater than that of the aegid species, probably because they are more dependent upon their host. Some species of cymothoids are found exclusively in the throat of certain fish species for instance. Since many host fish are commercially important, species of the family are included among the most important ecologically and economically important species of isopods.



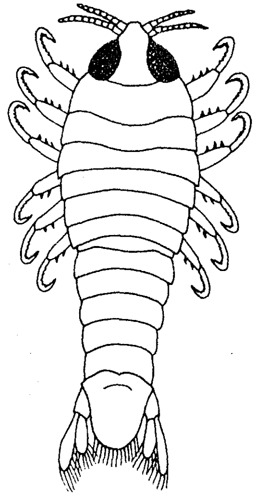


Figure 218. *Mothocya nana*, juvenile.

KEY TO GENERA AND SPECIES OF CYMOTHOIDAE

1a. Border between cephalon and peraeonal segment I trisinuate (with three lobes) or posterior border of cephalon produced into three lobes; cephalon never deeply immersed into peraeonal segment I 2

1b. **Border between cephalon and peraeonal segment I broadly rounded (never trisinuate); cephalon deeply immersed into peraeonal segment I** .... ~~8~~ 9

(but check Olencira, p. 152)

2a. **Posterior margin of uropodal rami with fringing setae; eyes very large; body symmetrical** .... *Aegathoa*

GENUS AEGATHOA

The species of this genus are undoubtedly the young of other cymothoid species. Three specimens have been recorded from North American waters—two are from fish and the other is from both fish and a squid. They are not proper species and will undoubtedly be placed in other genera when their adult forms are known. The specimens are frequently found unattached to a host, hence, it is only with luck that the actual host is known.

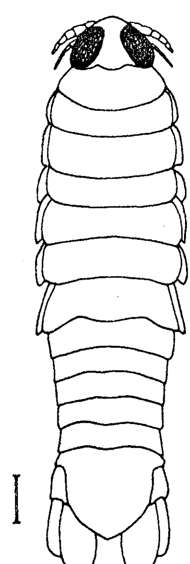


Figure 219. *Aegathoa oculata.*

Fig. 219. *Aegathoa oculata* (Say 1818) (3 mm)

Range: Connecticut to Yucatan, Mexico, including West Indies

The species has been found as a parasite on squid and also on the fishes mullet and sand perch. There is no medial rostral projection from the frontal border of the cephalon and epimeral plates are visible in the dorsal view in this species.

Fig. 220. *Aegathoa linguifrons* Richardson 1901
Range: Trinidad

The rostral projection is different than that found in *A. medialis.*

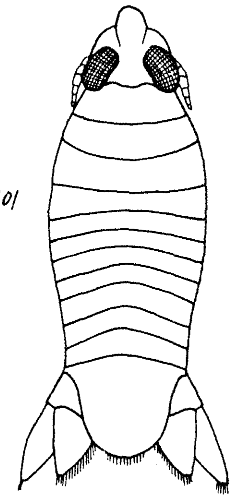


Figure 220. *Aegathoa linguifrons.*

Fig. 221. *Aegathoa medialis* Richardson 1900

Range: Barren Island, Chesapeake Bay (5 to 45 m)

The broad rostral projection of the frontal margin of the cephalon set it apart from other species.

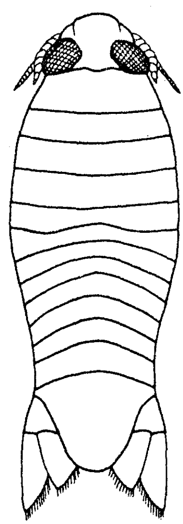


Figure 221. *Aegathoa medialis.*

2b. **Posterior margin of uropodal rami never with fringing setae; eyes if present, ~~only~~ small to moderately large 3**

3a. **Posterolateral angles of peraeonal segments scarcely or not at all produced, except those of peraeo~~pod~~nite VII 7**

3b. **Posterolateral angles of peraeonal segment I prominent or produced, sometimes acutely so; peraeonal segments increase in length and breadth moving back from peraeonal segment I; epimeres on peraeonal segments II, III and IV acutely pointed, posterolateral angles of V, VI and VII acutely pointed** .... *Nerocila*

GENUS NEROCILA

The species of this genus are ectoparasites of fish. They are symmetrical and moderately large, and can be found on the skin or on a fin of their hosts.

KEY TO SPECIES OF NEROCILA

4a. **With eyes** **5**

4b. **Blind** .... *N. lanceolata*

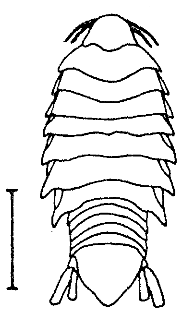


Figure 222. *Nerocila lanceolata.*

Fig. 222. *Nerocila lanceolata* (Say 1818) (19 mm)

Range: Cumberland Island, Georgia

This species was collected around 1817 by the American naturalist, Thomas Say, and it has not been collected since. The host is unknown.

5a. **Pleotelson with posterior margin produced** **6**

5b. **Pleotelson with posterior margin rounded** .... *N. munda*

Nerocila excisa Rich. 1914

tropical E Pacific

Fig. 223. *Nerocila munda* Harger 1873 (13 mm)

Range: Vineyard Sound, Woods Hole, Massachusetts

The species was found on the fin of *Alutera schoepfii.*

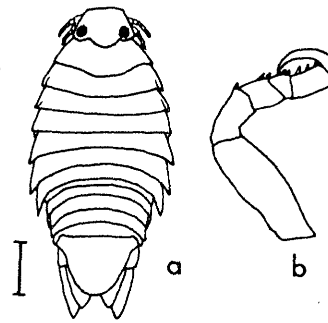


Figure 223. a. *Nerocila munda.* b. Peraeopod VII.

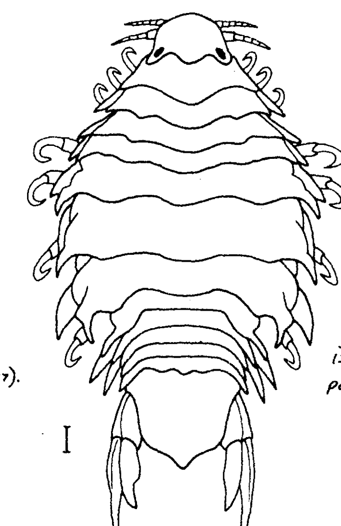
6a. Posterolateral angles of last three peraeonal segments produced .... *N. californica*

Fig. 224. *Nerocila californica* Schioedte and Meinert 1881 (19 mm)

Range: Southern California to Panama & throughout Gulf of California.

The species is found on the fin of many species of fish. See Brusca (1977).

This is now jr. syn. of N. acuminata (see Brusca, 1980)



note: this is a very poor drawing!

Figure 224. *Nerocila californica.*

6b. Posterolateral angles of last two peraeonal segments produced .... *N. acuminata*

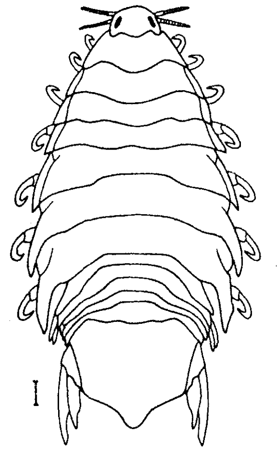


Figure 225. *Nerocila acuminata.*

Fig. 225. *Nerocila acuminata* Schioedte and Meinert (21 mm) 1881

Range: Virginia to Mexico and Bermuda

This external parasite has been found on dog fish and other species. *Pterisopodus bartachi* which was put in the family Pterisopodidae by the person who described it is probably only a small specimen of this species. Brusca (1978) claims this is the Atlantic analog of N. californica; (1980) claims is sr. synonym.

7a. Body compact; cephalon not constricted at base; uropods sometimes extend beyond posterior margin of pleotelson; peraeopod VII not abruptly longer than other six peraeopods 8

7b. Body elongate, slightly asymmetrical; cephalon constricted at base; uropods not extended beyond posterior margin of pleotelson; peraeopod VII abruptly longer than other six peraeopods .... *Olencira*

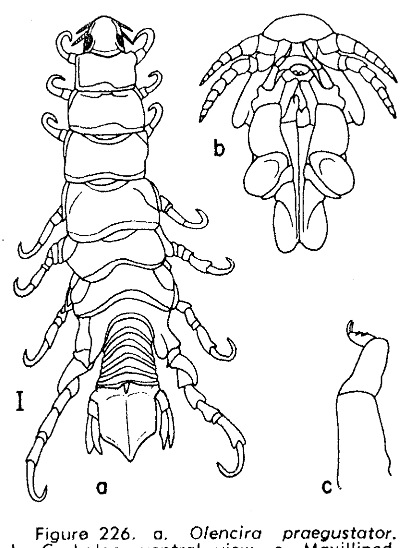


Figure 226. a. *Olencira praegustator.* b. Cephalon, ventral view. c. Maxilliped. (For mouth parts see Fig. 215).

Fig. 226. *Olencira praegustator* (Latrobe) (26 mm) 1802

Range: New Jersey to Texas

The species is found on fish of the coastal and brackish waters of the east coast of North America. It has been found in the mouth cavity of menhaden fish, *Brevoortia,* off south and southeastern United States.

8a. Pleon enveloped by posterolateral extensions of peraeonal segments VII; epimeres confined to anterolateral corners of segments, and never too distinct .... *Anilocra*

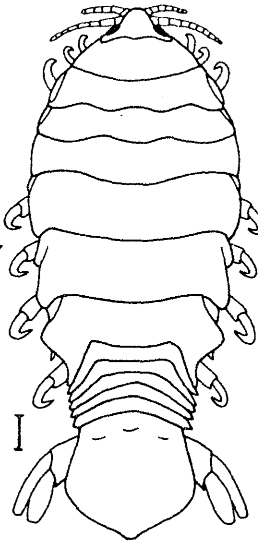


Figure 227. *Anilocra laticauda.*

Fig. 227. *Anilocra laticauda* Milne-Edwards ✓ (34 mm)
1840

Range: ~~Maryland southward~~ throughout Caribbean but in U.S. probably only in Florida!!

The species has been collected from the body surface of *Haemulon plumieri, Upeneus martinicus* and other fish. The pleotelson has an acuminate posterior margin and is widest in the distal two thirds of length.

= A. mexcana, A. leachii & A. laevis !!
(not Ceratothoa laticauda Milne Edwards)

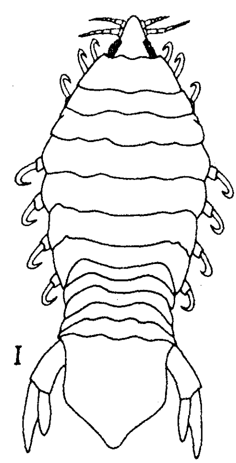


Figure 228. *Anilocra plebia.*

Fig. 228. *Anilocra plebia* Schioedte and Meinert ✓ (21.5 mm)
1881

Range: Costa Rica and Central America

The pleotelson of this species has an acuminate posterior border that is widest at the proximal part.

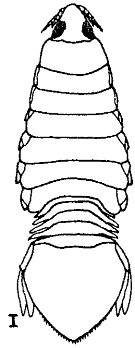


Figure 229. *Anilocra acuta.*

Fig. 229. *Anilocra acuta* Richardson 1910 (34 mm)

Range: Savannah, Georgia to Louisiana

A gar pike was the host fish in Georgia. It was taken on *Lepidosteus osseus* in the western part of its range.

See Bowman, et al., 1977

Anilocra meridionalis Rich. 1914 (near Galapagos)

Anilocra laevis Miers 1877 (Peru; Martinique)
(= A. laticauda based on Martinique syntype; see Brusca, in press).

8b. Pleon not enveloped because posterolateral corners of peraeonal segment VII not produced; epimeres cut off evenly on peraeonal segments II to VII .... *Braga*

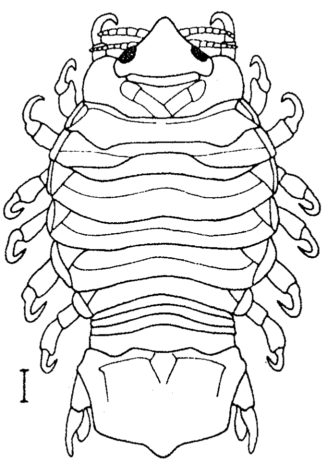


Figure 230. *Braga cichlae.*

Fig. 230. *Braga cichlae* Schioedte and Meinert 1881 (17 mm)

Range: Northern South America to Brazil (Fresh and brackish waters)

The species is parasitic on fish that are found in rivers that empty into the Caribbean Sea.

see Lemos de Castro (59) for a review of the genus.

Fig. 231. *Braga occidentalis* Boone 1918 (17 mm)

Range: Coast of California

The species has a rounded, not acuminate, posterior border on the pleotelson.

= B. patagonica [see Thun & Brusca, 1980]

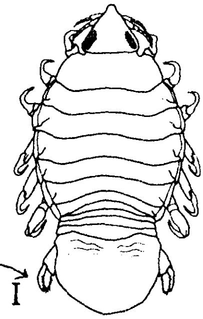


Figure 231. *Braga occidentalis.*

9a. Basal segments of antennae one dilated and touching; basal segments of antennae two compressed (Fig. 232a) 10

9b. Basal segments of both antennae one and two compressed; antennae one almost touching to wide apart at base (Fig. 232b,c) 14

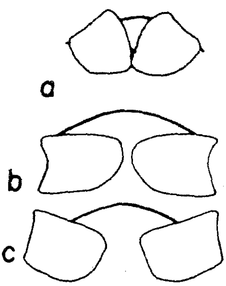


Figure 232. Antennal bases of Cymothoidae, ventral views. a. Contiguous. b. Slightly separate. c. Widely separate.

10a. Male with large tuberous "shoulders" on posteriorlateral corners of peraeonal segments I; female with coxal extensions produced anteriorly; pleon deeply set into peraeon; first segment of pleon with lateral borders hid under peraeonal segment VII .... *Ceratothoa*

Fig. 233. *Ceratothoa impressa* (Say 1818) (33 mm)

Range: Atlantic coast and Gulf Stream

This species is a parasite in the mouth of flying fish and their near relatives. It has a large bilaterally symmetrical body, and the female is relatively narrower than the male. The dactylus on peraeopod III

This is now Glossobius, by Bowman (1978).

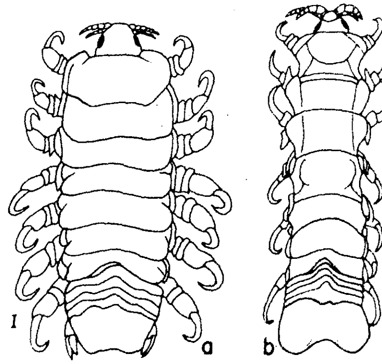


Figure 233. a. *Ceratothoa impressa* (male). b. Female.

is longer than the others and is a useful character for distinguishing species of the genus.

10b. **Cephalon set only to moderate depth into peraeonal segment I; pleon constricted where attached to peraeon and edges visible in dorsal view on first pleonal segment** ...... *Meinertia*

GENUS MEINERTIA*

The species of this genus are large isopods which are parasites of large fish. They are found in the gill and mouth cavity and are frequently taken from the throat of their host. (Fig. 12g-h).

KEY TO SPECIES OF MEINERTIA

11a. **Posterior margin of pleotelson rounded or pointed** **12**

11b. **Posterior margin of pleotelson truncate and very long** **13**

12a. **Posterior margin of pleotelson pointed; pleon broadly attached to peraeon** .... *M. transversa*

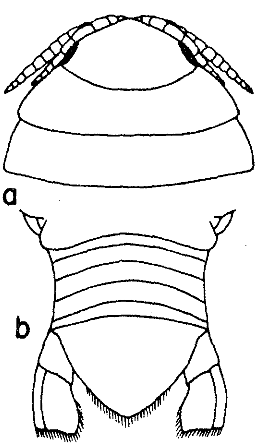


Figure 234. a. *Meinertia transversa*, anterior part. b. Posterior part.

Fig. 234. *Meinertia transversa* Richardson 1900

Range: Key West to Delta of Mississippi River

The species is most probably based on a very young individual.

Hale made Meinertia the jr. synonym of Codonophilus, but Bowman (1978) made both jr. synonyms of Ceratothoa!

12b. **Posterior margin of pleotelson rounded; pleon narrowly attached to peraeon** .... *M. deplanata*

Fig. 235. *Meinertia deplanata* (Bovallius, 1885) (18 mm)

Range: Coast of Haiti and West Indies

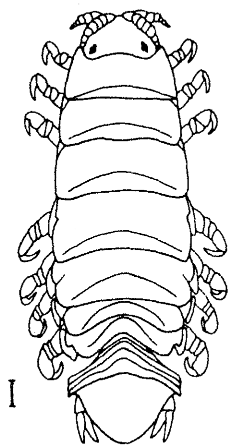


Figure 235. *Meinertia deplanata.*

(M. gilberti lacks the large carinae on pereopods 4-7 that M. gaudichaudii possess)

13a. **Posterior margin of cephalon trisinuate** .... *M. gaudichaudii*

Fig. 236. *Meinertia gaudichaudii* (Milne-Edwards, 1840) (45 mm)

Range: Mazatlan, Mexico and Baja to west coast of South America (Chile, Galapagos, Peru).

The species is frequently taken from the throat of a *Thynnus* species and *Sarda chilensis.*

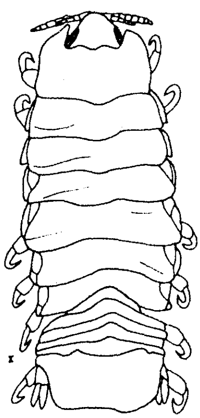


Figure 236. *Meinertia gaudichaudii.*

13b. **Posterior margin of cephalon not trisinuate** .... *M. gilberti*

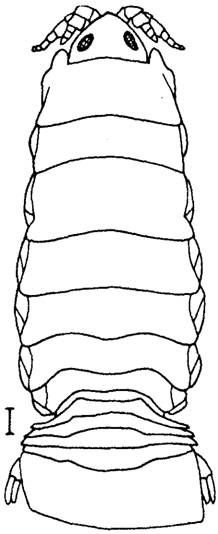


Figure 237.

Fig. 237. *Meinertia gilberti* Richardson 1904 (20 mm)

Range: Mazatlan, Mexico to upper Gulf & W. Baja.

The species was taken from a fish, *Mugil hospes.*

14a. Antennae one almost touching at bases (Fig. 232b) 15

14b. Antennae one widely separated at bases (Fig. 232c) 16

15a. Body hunched or compressed (lateral view—Fig 238); posterior border of pleotelson acutely pointed ....*Agarna*

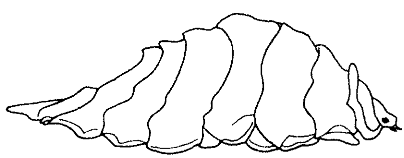


Figure 238. *Agarna carinata,* lateral view.

Fig. 239. *Agarna carinata* Schioedte and Meinert 1884 (18 mm)

Range: Florida and West Indies

The species is the type-species of the genus.

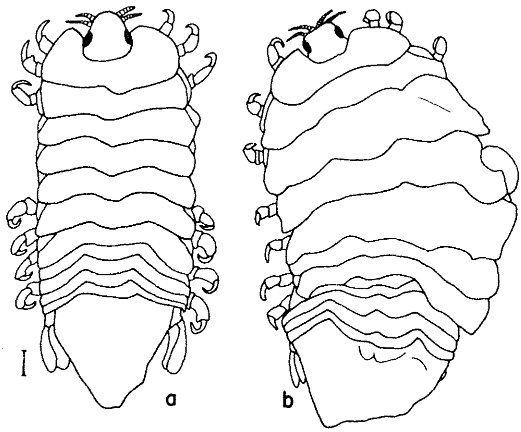


Figure 239. a. *Agarna carinata* (male). b. Female (Juvenile, Figure 217).

15b. Body margins evenly convex, not compressed; posterior border of pleotelson broadly rounded .... *Idusa*

Fig. 240. *Idusa carinata* Richardson ✓(13 mm)
1904

Range: West coast of Panama

The species was found in the mouth of a species of fish of the genus *Mugil.*

Note: Only USNM type material of Idusa is I. carinata.

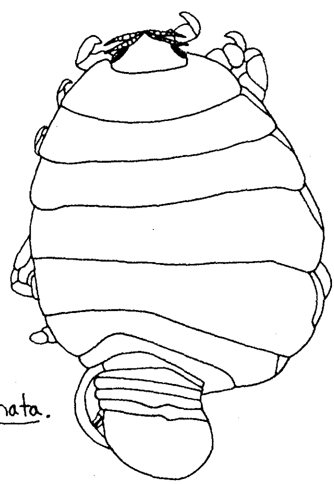


Figure 240. *Idusa carinata.*

16a. Pleon abruptly narrower than peraeon or narrowly attached to peraeon (body not forming continuous convex line between pleon and peraeon) 17

16b. Pleon and peraeon forming continuous convex body margin (or at least pleon and peraeon not abruptly constricted where they come together) 18

17a. **Pleon abruptly narrower than peraeon or abruptly narrower where it attaches to peraeon; frontal margin of cephalon truncate; body never ovate** .... *Cymothoa*

GENUS CYMOTHOA

The species of this genus are found on many of the economically important fish of the east coast of North America. They are parasites of the buccal region being found on the lip or within the mouth cavity itself.

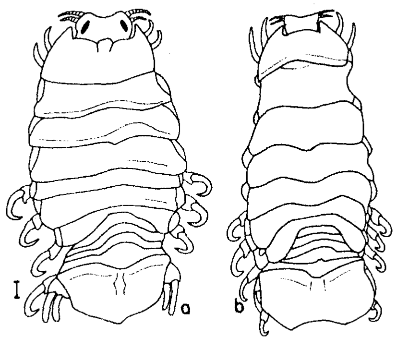


Figure 241. a. *Cymothoa excisa* (male). b. Female (Juvenile, Figure 216).

Fig. 241. *Cymothoa excisa* Perty 1830 (23 mm)

Range: Massachusetts to Brazil including West Indies

The species has been found as a parasite on the lips of the chub, the gills of a sparid and on other fish. The female has rudimentary eyes and the male has small eyes. See Weinstein & Heck (1977).

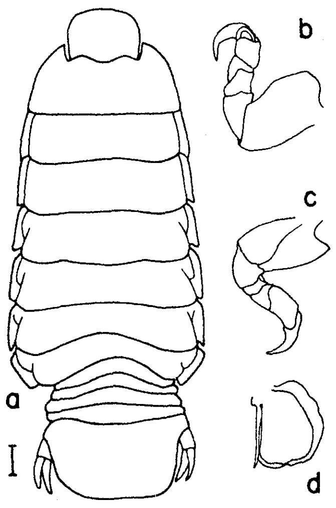


Figure 242. a. *Cymothoa caraibica*. b. Peraeopod VII. c. Peraeopod IV. d. Pleopod 2, male.

Fig. 242. *Cymothoa caraibica* Bovallius 1885 (17 mm)

Range: West Indies, south of Haiti

The small eyes in this species are not visible in the dorsal view.

Cymothoa recta Dana 1853

Endemic to Hawaii. USNM has 7 lots (28977 through 28983).

Fig. 243. *Cymothoa oestrum* (Linnaeus) (30 mm)
1758

Range: Virginia to Venezuela

The species is blind. It is very abundant being found on at least five genera of near-shore fish. Usually it is found in the buccal cavity of the host, but it has been taken from the stomach of red fish after having been eaten.

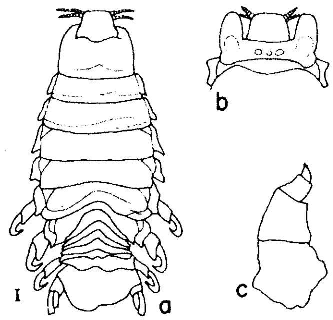


Figure 243. a. *Cymothoa oestrum* (male). b. Female, anterior part. c. Maxilliped.

Fig. 244. *Cymothoa exigua* Schioedte and Meinert (20 mm)
1884

Range: ~~West coast of North America and Galapagos Islands~~ (Gulf of Calif to Ecuador)

The eyes of the parasite are moderately large. It was found in the mouth of a flat fish.

Louisiana by Comeaux, 1941 (probably in error)

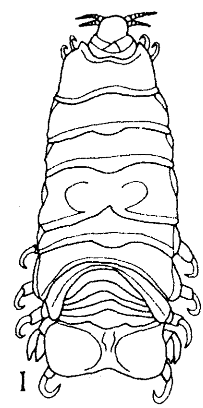


Figure 244. *Cymothoa exigua.*

17b. Pleon abruptly narrower than peraeon; frontal margin of cephalon broadly rounded; body nearly ovate or ovate .... *Telotha*

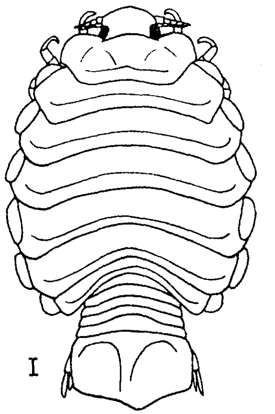


Figure 245. *Telotha hanselii.*

Fig. 245. *Telotha henselii* (von Martens 1869) (26 mm)

Range: Northern South America and West Indies

The species is found on cichlid fish and species of cat fish in brackish water.

18a. Pleon enveloped by peraeonal segment VII; only lateral borders of last two pleonal segments show in dorsal view .... ***Mothocya***
(= Irona)

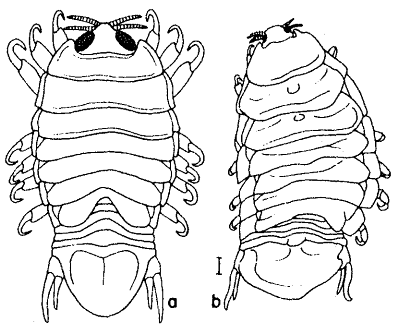


Figure 246. a. *Mothocya nana,* juvenile female. b. Male. (Juvenile, Figure 218).

Fig. 246. *Mothocya nana* Schioedte and Meinert 1884 (18 mm)

Range: Caribbean Sea, Bermuda and Brazil

The species is a non-obligate parasite found in the gill cavity of several species of fish.

18b. Pleon not greatly enveloped by peraeonal segment VII; lateral borders of all five or four pleonal segments show in dorsal view; eyes moderately large to large .... ***Lironeca***

GENUS LIRONECA

There are ten North American species in the genus. The animals are moderately large and are most frequently found in the gill cavities of their fish hosts. The species have moderately large eyes,

Livoneca was a typo - see Monod (1931) or Boman & Diaz-Ungria (1957) for explanation!

Bowman 1960
roneca puhi Endemic to Hawaii

and their body axes are symmetrical or slightly asymmetrical. The pleon is generally, but not always, broadly attached to the peraeon.

For key to E. Pacific *Lironeca* see Brusca (1978)

KEY TO SPECIES OF LIRONECA

19a. **Peraeon not enveloping pleon in any degree; body only slightly if at all asymmetrical; lateral edges of five pleonal segments visible on lateral margins 20**

19b. **Peraeon enveloping at least one pleonal segment; body symmetrical to greatly asymmetrical; lateral edges of four or five pleonal segments visible on lateral margins 22**

20a. **Peraeonal-pleonal separation straight 21**

20b. **Peraeonal-pleonal separation trisinuate ....** *L. redmannii*

Fig. 247. *Lironeca redmannii* Leach 1818 (25 mm)

Range: West Indies to Brazil

The species was taken from the gill cavity of a kingfish and many other fish. (See also *L. ovalis*)

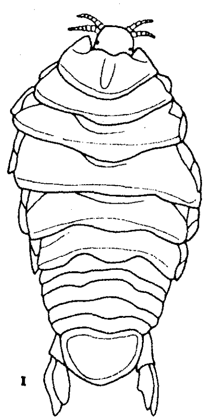


Figure 247. *Lironeca redmannii.*

21a. **Uropods with long rami, each extending beyond posterior margin of pleotelson ....** *L. tenuistylis* Milne Edwards 1840

Lironeca raynaudii, Australia, N.Z., Japan, Africa, S. Chile

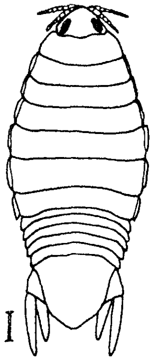


Figure 248. *Lironeca tenuistylis.*

Fig. 248. *Lironeca tenuistylis* Richardson 1912 (13 mm)

Range: Fox Bay, Colon, Panama (E. gate of canal)

The host fish was *Anchovia browni.*

= L. longistylis

21b. Uropods with rami short, slightly if at all longer than posterior margin of pleotelson .... *L. ovalis*

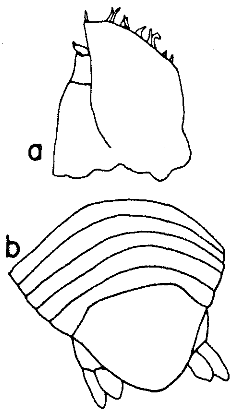


Figure 249. a. *Lironeca ovalis,* maxilliped. b. Posterior part.

Fig. 249. *Lironeca ovalis* (Say 1818) (21 mm)

Range: Woods Hole, Massachusetts to Mississippi River and Texas

The species, although never well described, has been recorded as a parasite on many fish. It is most always taken from the gill chamber. It might be the same species as *L. redmannii* (p. 163)

22a. Posterior border of pleotelson acutely pointed, rounded or broadly rounded or indented, never acuminate 24

22b. Posterior border of pleotelson acuminate or trisinuate 23

23a. Body one and one-half times as long as wide; proximal edge of pleotelson trisinuate .... *L. vulgaris*

Fig. 250. *Lironeca vulgaris* Stimpson 1857 (32 mm)

Range: Washington State to Baja California

The species is parasitic on the rock cod, flounder and fish of other genera. This is Sr. syn. of L. panamensis (see Brusca, 1978)

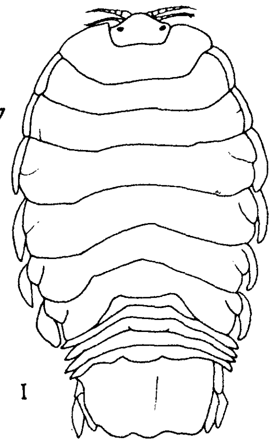


Figure 250. *Lironeca vulgaris*.

23b. Body less than half as wide as long; proximal edge of pleotelson indented medially only .... *L. symmetrica*

Fig. 251. *Lironeca symmetrica* Van Name 1925 (20.6 mm)

Range: Guyana and Caribbean Sea

The species is parasitic on river fish that are occasionally taken in the Caribbean Sea.

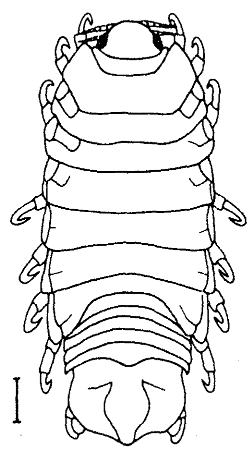


Figure 251. *Lironeca symmetrica*.

24a. Posterior border of pleotelson acutely pointed, rounded or broadly rounded **25**

24b. Posterior border of pleotelson indented .... *L. texana*

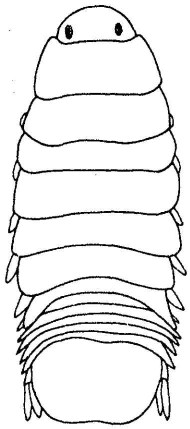


Figure 252. *Lironeca texana.*

Fig. 252. *Lironeca texana* Pearse 1952 (23 mm)

Range: Off Padre Island, Texas (23 to 33 m)

Three fishes—the lizzard fish, the sea bass and the gaff-topsail catfish—serve as a host for this species.

25a. Peraeonal segment III widest part of body; cephalon with pointed frontal margin; five lateral edges of pleonal segments visible on lateral margins .... *L. californica*

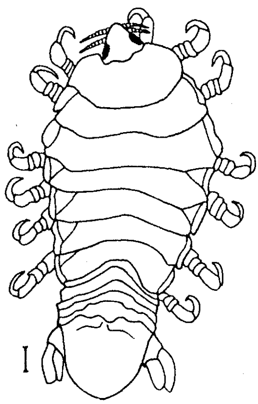


Figure 253. *Lironeca californica.*

Fig. 253. *Lironeca californica* Schioedte and Meinert 1883 (16 mm)

Range: ~~Mid- to southern California~~ Alaska to N. Baja (Bahía San Quintín)

This species is parasitic on the "shiner."

25b. Peraeonal segment III not widest part of body; cephalon truncate or broadly rounded; four lateral margins of pleonal segments visible on lateral borders of body (on both sides—one side on *L. panamaensis* could be considered to have five) **26**

26a. Frontal margin of cephalon rounded **27**

26b. Frontal margin of cephalon truncate .... *L. panamaensis*

Fig. 254. *Lironeca panamaensis* Schioedte and Meinert v (27 mm) 1884

Range: West coast of Mexico to Panama

Host unknown. This is the jr. synonym of L. vulgaris (Brusca, 1978)

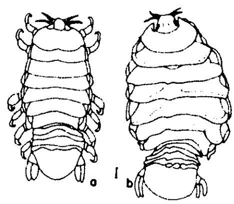


Figure 254. a. *Lironeca panamaensis* (male). b. Female.

27a. Medial body axis straight .... *L. convexa*

Fig. 255. *Lironeca convexa* Richardson 1905 (21 mm)

Range: Southern California to Ecuador

The host is *Chloroscombrus orgneta,* a bait fish used for catching tuna.

These figs. are of a juvenile

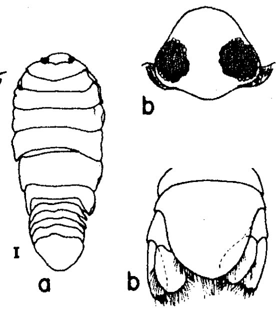


Figure 255. a. *Lironeca convexa.* b. Cephalon, bent upwards. c. Posterior part.

27b. Medial body axis curved markedly .... *L. reniformis*

Fig. 256. *Lironeca reniformis* Menzies and Frankenberg v (7 mm) 1966

Range: Off Georgia

Host unknown.

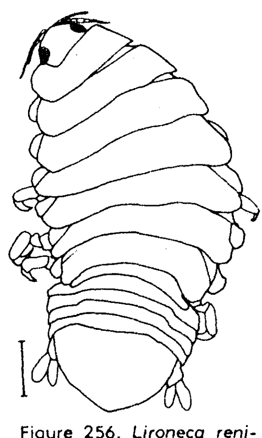


Figure 256. *Lironeca reniformis.*

CIROLANIDAE

Cirolanidae contains 12 genera divided into six with eyed species and six with blind species. One of the genera with blind species has two species and the other five have only one species each so there are only seven blind species. Of the genera that have eyed species one has only a single species and two have only two species, but the three other genera contain many species several of which are worldwide in distribution. The species in the genera in which most species are eyed live mainly in the near shore habitats. All the blind species, with the exception of a deep sea species, were found in caves on the approximate shore line of an ancient sea. The shore line of the ancient sea extended from northern Mexico to Yucatan, Mexico, then to Cuba.

The species are fairly common and are told from others by the presence of four or five free (one species has only one) visible pleonal segments. The number of prehensile and ambulatory pleopods vary. Some species have been found clinging on fish just as the fish parasites. The mouth parts are developed for biting and many species are scavengers. The maxillipedal palp has five articles of approximately equal width, and without large lobes. There are always three articles on the mandibular palp and the molar process is of a peculiar shape (Fig. 283a).

KEY TO GENERA AND SPECIES OF CIROLANIDAE

The following species, *Colopisthus parvus,* was keyed out in the family key (p. 111) because it is different from other flabelliferans in having no free pleonal segments.

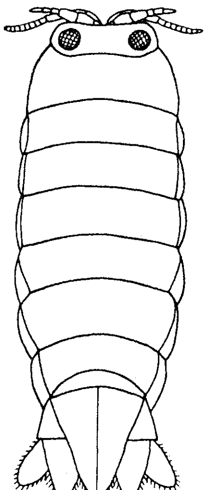


Fig. 257. *Colopisthus parvus* (Richardson)

Range: Bermuda (Shallow water)

This unusually formed isopod is the type-species of the genus. It was found among the corals. The pleon is apparently fused into one very short segment.

Figure 257. *Colopisthus parvus.*

1a. Eyes not visible in dorsal view (they are very large when viewed ventrally); posterior margin of uropodal rami truncate and fringed with setae; posterior margin of pleotelson fringed with 11 short processes .... *Bathynomus*

Fig. 258. *Bathynomus giganteus* (Milne-Edwards) (280 mm)

Range: Off the gulf and south Atlantic coast of United States

This species is truly a giant among the isopods growing to at least 280 mm or about 11 inches in length. Specimens have been taken in the nets of fishermen, and they are probably more commonly caught than reports from the literature indicate. They can probably avoid most deep sea bottom dredges. A species of the genus is found in the Indian Ocean and another in the Sea of Japan. The Japanese utilize the animals as food. The specimens of the genus are excellent examples to be used for the study of isopod morphology and anatomy since they represent a primitive type of isopod with five free pleonal segments and many other features of the primitive isopod. Use of microscope is not required in order to study them.

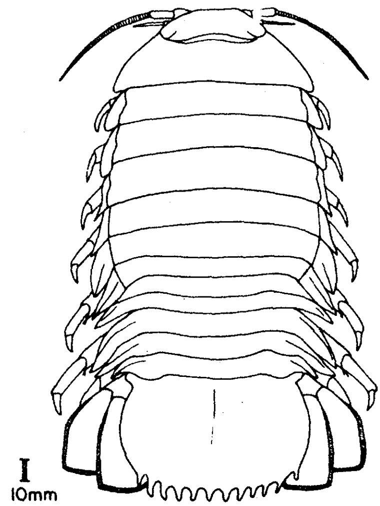


Figure 258. *Bathynomus giganteus*.

1b. Eyes visible in dorsal view (if present); posterior margin of uropodal rami and pleotelson various 2

2a. Basal segments of antennae one exit from cephalon at oblique or lateral angle; posterior border of pleotelson never with special pattern of setae or teeth on medial part of posterior margin 8

2b. Basal segments of antennae one exit from cephalon so as to make the antennae proper come off at right angles to them (Fig. 259a); groove or slot present between basal segments; posterior border of pleotelson indented with setal and tooth pattern of various configurations .... *Eurydice*

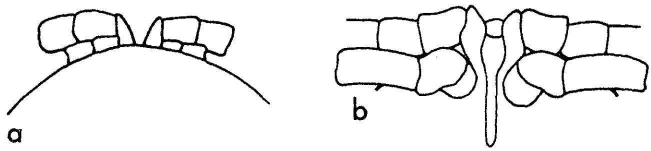


Figure 259. Bases of antennae. a. Coming off at right angles. b. Not coming off at right angles.

GENUS EURYDICE

Species of this genus are distinguished by the different patterns of fringing setae and spines along the posterior margin of the pleotelson (Fig. 260).

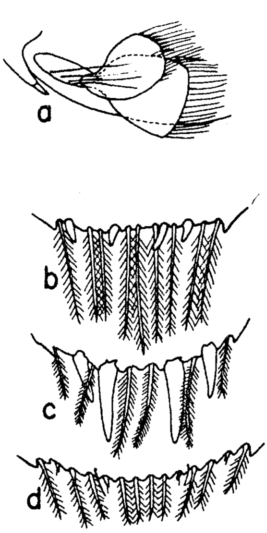


Figure 260. Some characters of *Eurydice* species. a. Uropod of *E. littoralis*. b. Posterior margin of pleotelson of *E. branchuropus*. c. of *E. littoralis*. d. of *E. piperata*.

KEY TO SPECIES OF EURYDICE

3a. Spines on posterior margin of pleotelson all of about same size or length 4

3b. Spines on posterior margin of pleotelson with two medial spines much longer than others .... *E. littoralis*

Fig. 261. *Eurydice littoralis* (Moore) (6 mm)

Range: Puerto Rico to Georgia (37 m)

On beaches in tropical regions the species can be very abundant in the surf and it will attack swimmers or skin divers. The bites can be annoying but they cause no damage to humans.

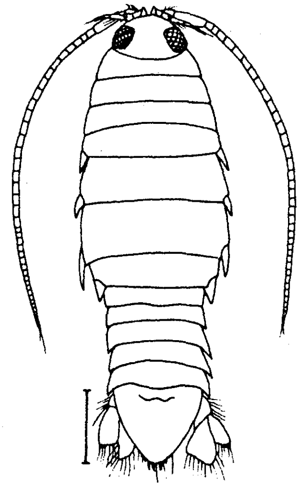


Figure 261. *Eurydice littoralis.*

4a. Posterior margin of pleotelson straight or convex **5**

4b. Posterior margin of pleotelson concave .... *E. spinigera*

Fig. 262. *Eurydice spinigera* (Hansen) (9 mm)

Range: Eastern Atlantic

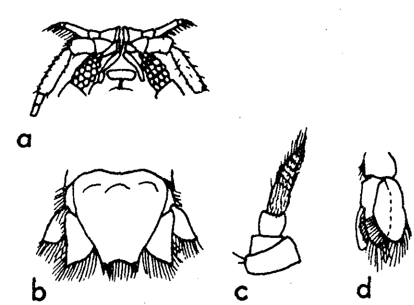


Figure 262. a. *Eurydice spinigera*, anterior part ventral aspect. b. Posterior part. c. Antenna one. d. Pleopod 2, male.

5a. Eight spines on posterior margin .... *E. convexa*

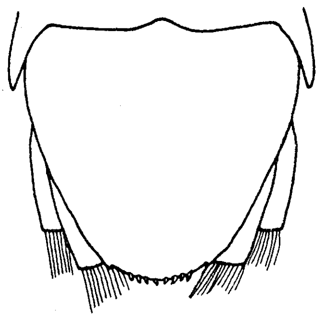


Figure 263. *Eurydice convexa.*

Fig. 263. *Eurydice convexa* (Richardson)

Range: Cape San Blas, Florida

5b. Four spines on posterior margin of pleotelson 6

6a. Spines very small, as long as or shorter than posterolateral corners .... *E. piperata*

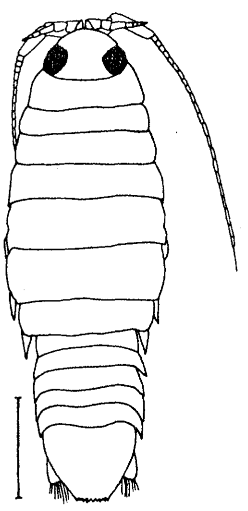


Figure 264. *Eurydice piperata.*

Fig. 264. *Eurydice piperatá* (Menzies and Frankenberg) (5 mm)

Range: Off coast of Georgia (49 to 137 m)

6b. Spines moderately large, longer than posterolateral corners 7

7a. Uropodal rami distally truncate .... *E. caudata*

Fig. 265. *Eurydice caudata* (Richardson)

Range: Catalina Island, California
to Sea Of Cortez; so. to Ecuador. (see Bowman, 1977)

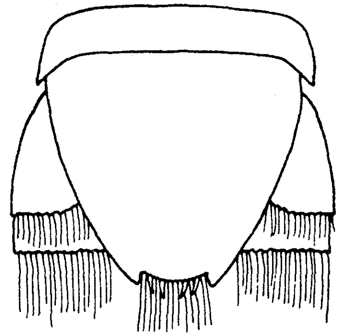


Figure 265. *Eurydice caudata.*

7b. Uropodal rami not distally truncate .... ***E. branchuropus***

Fig. 266. *Eurydice branchuropus* (Menzies and Barnard) (3 mm)

Range: South of Pt. Loma, California (44 m)
→ this is a jr. synonym of E. caudata (see Bowman, 1977)

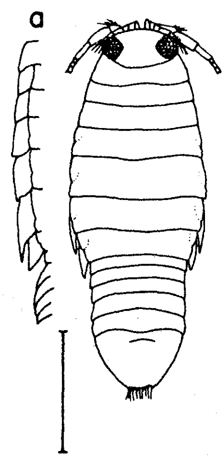


Figure 266. a. *Eurydice branchuropus*, lateral margin. b. Dorsal view.

8a. Eyes absent or present; peraeopods I, II, and III only prehensile; all others ambulatory or modified natatory (Fig. 31b) **9**

8b. Blind; peraeopods all prehensile; only peraeopod I prehensile or no peraeopods prehensile **28**

9a. First and second pairs of pleopods different from one another; first pair with both branches indurate and operculate, second pair normal or like third and fourth pairs .... ***Conilera***

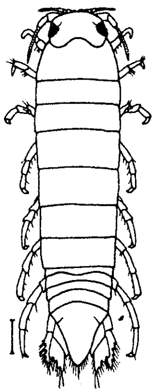


Figure 267. *Conilera cylindracea.*

Fig. 267. *Conilera cylindracea* (Montague) (10.5 mm)

Range: South Carolina to Mississippi (103 to 291 m)

Two species of the genus have been described from North American waters. *C. cylindracea* is parasitic on the pilchard, the young of which are caught and sold as sardines. Species of the genus in Europe are abundant as scavengers, eating dead fish found on the sea coast. The species *C. stygia Packard* (25 mm) from well in Monterey, Mexico, is blind and has been recorded only once and perhaps is not a member of the genus.

9b. First and second pleopods similar and normal; i. e., thin or membranous, not operculate and indurate 10

10a. Cephalon only slightly produced medially if at all (Fig. ~~272~~ 273) 14

10b. Cephalon with medial spatuliform process (Fig. ~~268~~ 269) .... *Excirolana*

KEY TO SPECIES OF EXCIROLANA Rich. 1912.

NOTE: 3 distinguishing attributes characterize species of Excirolana: (1) spatulate frontal process; (2) lateral margins of pleonite 5 not overlapped & hidden by pleonite 4; (3) dorsal surface of pleotelson with a pair of depressions, 1 on either side of midline (may not always be visible or present).

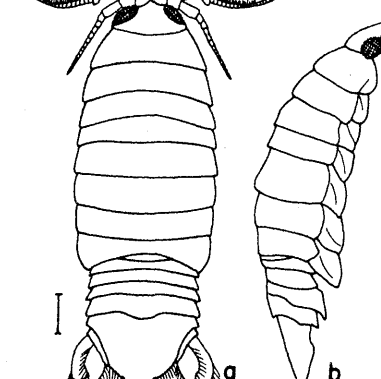


Figure 268. a. *Excirolana mayana.* b. Lateral view.

Four of the five species of *Excirolana* from North America are from the Pacific coast, and they are included in the key. *E. mayana* from the Caribbean Sea is not included in the key.

Fig. 268. *Excirolana mayana* (Ives 1891) (10 mm)

Range: Caribbean Sea (Intertidal)

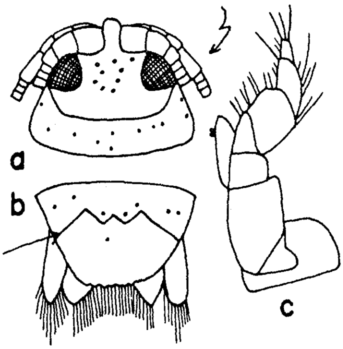
= Cirolana mayana

see Menzies & Glynn (1968) & Lemos de Castro (1969).

Richardson says this species occurs in tropical E. Pacific.

11a. Pleotelson rounded and crenulate .... *E. linguifrons*

antennae are setose



X Fig. 269. *Excirolana linguifrons* (Richardson, [illegible]) (3.8 mm)

Range: Monterey Bay, California to So. Calif.

this structure is on the pleotelson

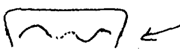
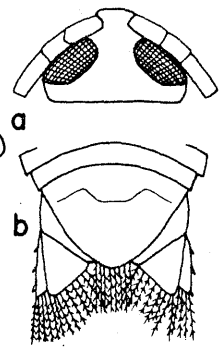


Figure 269. a. *Excirolana linguifrons*, anterior part. b. Posterior parts. c. Maxillii ed.

11b. Pleotelson obtusely angulate or obtusely rounded **12**

12a. Pleotelson obtusely rounded; spatulate frontal process almost as long as broad; distance between eyes about diameter of eyes .... *E. chiltoni*



X Fig. 270. *Excirolana chiltoni* (Richardson, 1905) (11 mm)

Range: San Francisco, California to So. Calif.

includes: E. kincaidi (Hatch, 1947)
E. vancouverensis (Fee, 1926)
E. japonica Richardson, 1912
[see Bruce & Jones, 1981 for synonymy]

Figure 270. a. *Excirolana chiltoni*, anterior part. b. Posterior part.

12b. Pleotelson obtusely rounded or angulate; spatulate frontal process longer than broad; distance between eyes greater than diameter of eyes **13**

13a. Posterior margin of pleotelson obtusely angulate .... *E. kincaidi*

Excirolana hirsuticauda Menzies 1962 (Chile) - frontal process not expanded distally!
Excirolana chilensis Rich. 1912 (Chile)
Excirolana braziliensis Rich. 1912 (Gulf of Calif. to N. Chile; also in Caribbean)

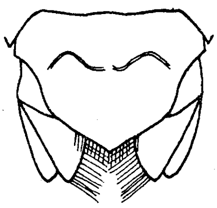


Figure 271. *Excirolana kincaidi*.

Fig. 271. *Excirolana kincaidi* (Hatch 1947) (7.6 mm) this is now a jr. syn. of E. chiltoni

Range: Washington and Oregon coasts to So. Calif.

The species was taken under dead crabs at the midtidal level on a beach so it apparently is a scavenger.

13b. Posterior margin of pleotelson obtusely rounded .... *E. vancouverensis*

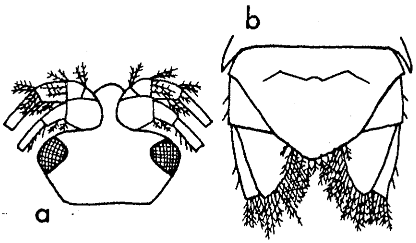


Figure 272. a. *Excirolana vancouverensis*, anterior part. b. Posterior part.

Fig. 272. *Excirolana vancouverensis* (Feě) 1926 (7 mm)

Range: Vancouver Island, British Columbia

note: Fee described this species as a subspecies of E. chiltoni; Hatch (1947) appears to have erected it to species level. It is now a jr. syn. of E. chiltoni.

14a. Blind; endopods of only pleopods 1 and 2 fringed with setae .... *Speocirolana*

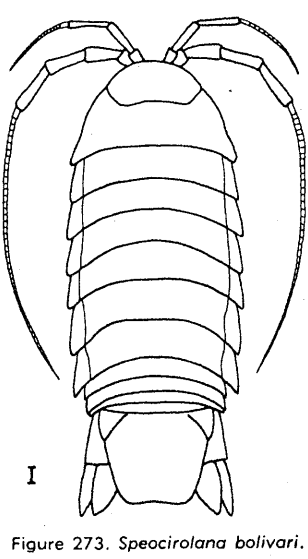


Figure 273. *Speocirolana bolivari*.

Fig. 273. *Speocirolana bolivari* (Rioja) (33 mm)

Range: Caves near Valles, San Luis Potosi, Mexico

This large blind species was found in the freshwater of the limestone caves found in northern Mexico.

Fig. 274. *Speocirolana pelaezi* (Bolivar y Pieltain) (26 mm)

Range: Cave, San Luis Potosi, Mexico

This species was found in the same limestone cave region as the above species. The posterior margin of the pleotelson in this species is concave in contrast to the broadly rounded posterior margin in *S. bolivari*.

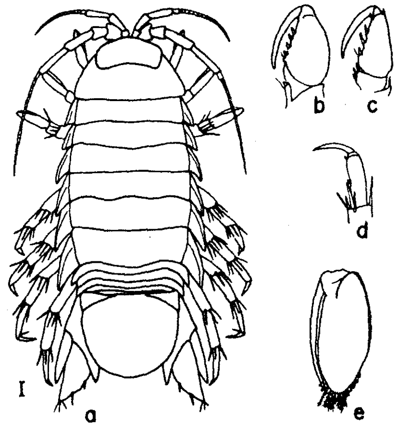


Figure 274. a. *Speocirolana pelaezi*. b. Peraeopod I. c. Peraeopod III. d. Peraeopod IV. e. Pleopod 2, male.

14b. Eyes absent or present; endopods of pleopods 1 to 4 usually fringed with setae .... *Cirolana*

GENUS CIROLANA

For key to California Cirolana see Brusca & Ninos, 1978.

The species of the genus are common, widespread and abundant in almost every near shore isopod habitat. They are found in all marine waters at many depths and are abundant in brackish waters as well. The species have been found in freshwater caves and have occasionally been recorded as being attached to fish. It was perhaps as fish parasites that the ancestors of the cave cirolanids reached the freshwater habitats. In North American waters, both marine and brackish water species are abundant. So far there have been 16 species recorded, the largest number of species for any genus with North American representatives.

One of the characters usually mentioned as being definitive of species of *Cirolana* is the presence of five free pleonal segments plus a pleotelson. In many instances the first pleonal segment is completely covered by peraeonal segment VII or in some instances only the very narrow posterior margin of pleonal segment 1 shows. Some illustrations of the same species will show five free segments, others only four.

Cirolanids are distinguished by reference to tooth and setal arrangement on the posterior margin of the pleotelson. Also the configuration of the pleotelson margin and the structure of the pleopodal rami are to be considered. Pleopods 1 and 2 are similar and in most species the medial angle of the uropodal basis is produced.

By examining the above characters and recording the nature of the second male pleopod, the species of the genus can be separated from one another. All characters mentioned should of course be mentioned in new species descriptions when they are made.

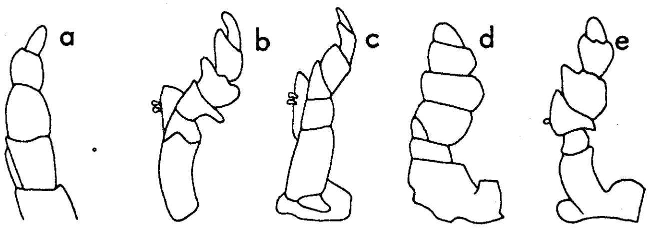


Figure 275. Maxillipeds of *Cirolana* species. a. *C. concharum*. b. *C. obtruncata*. c. *Cirolana* sp. d. *C. polita*. e. *C. joanneae*.

KEY TO SPECIES OF CIROLANA

15a. With eyes **16**

15b. Blind (or eyes w/o pigmentation) .... *C. californiensis*

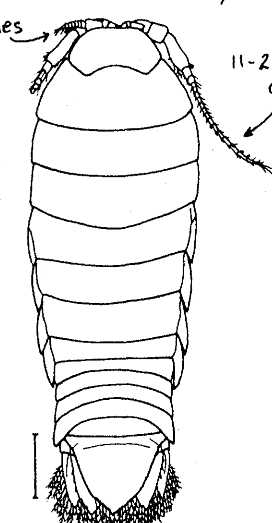


Figure 276. *Cirolana californiensis*.

Fig. 276. Natatolana ~~*Cirolana*~~ *californiensis* (Schultz 1966 (8 mm)

Range: Coronado, Tanner & Catalina Canyon on shelf off southern California (& San Diego Trough), S. to Peru-Chile Trench. 40-2,000 m.

This blind, pigmentless species is found at a depth much greater than that of any other species of *Cirolana* in North American waters. This is the Sr. synonym of C. deminuta (see Brusca & Ninos, 1978)

16a. Lateral margins of cephalon pointed; anterolateral margins of cephalon straight; cephalon medially produced .... *C. sphaeromiformis*

Cirolana arcuata Hale, 1925 - San Francisco Bay

Key to the Species of *Cirolana* Known From California

1. Margin of pleotelson with fine setae but without spines; maxilliped with 1 coupling hook; edges of pleonite 5 not hidden by pleonite 4; distal margin of pleotelson truncate, but strongly scalloped *C. joanneae*

– Margin of pleotelson with spines; maxilliped with 2 coupling hooks; edges of pleonite 5 hidden by pleonite 4; distal margin of pleotelson subacute 2

2. Without eyes, or eyes unpigmented; antenna 2 with flagellum of 10–21 articles; frontal lamina narrow; pleotelson with 8–12 spines; uropods not notched apically; rarely encountered in depths less than 100 m *C. californiensis*

– Blindness extremely rare; antenna 2 with flagellum of 22–32 articles; frontal lamina broad; pleotelson with 8–32 spines; uropods notched apically, *or* not notched; rarely encountered in depths greater than 100 m 3

3. Uropodal rami with deep apical notch; pleotelson margin always with 8 spines *C. parva*

– Uropodal rami without apical notch; pleotelson margin with at least 9–32 spines *C. harfordi*

C. arcuata: plt. w/setae & spines; mxp w/1 coupling hook: S.F. Bay only

16b. Lateral and anterolateral margins of cephalon rounded 17

17a. Edges of pleonal segment five covered by pleonal segment four 18

17b. Edges of pleonal segment five not covered by pleonal segment four .... *C. joanneae*

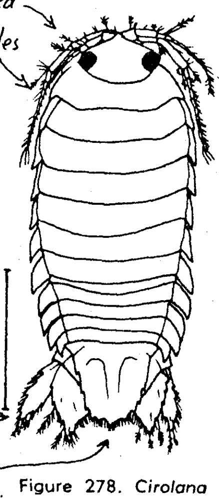


Figure 278. *Cirolana joanneae.*

Fig. 278. ~~*Cirolana*~~ Metacirolana *joanneae* Schultz 1966 (3 mm)

Range: Santa Cruze Canyon on shelf off southern California (218 m)

I've ID'ed specimens from Gulf of Alaska (subtidal, soft bottom), for R. Cimberg.

e examined (incl···ing Schultz's types) conform to the figure presented Menzies and Ge... We have redrawn these structures from Schultz's ›type (Fig. 1). Schultz's figure of the first maxilla differs conisderably n that given by Menzies and George. Examination of this appendage n both holotypes has revealed Schultz's figure to be misleading, in that igured the exopod (outer ramus) only (see Fig. 2, this paper).

lenzies and George suggested that *C. deminuta* could represent a :enic species, as evinced by the reduced size of the seventh pereopods. erials we have studied, however, reveal that the reduction of the nth pereopods is, like reduction of the eyes, a variable character. The e of this reduction is not known; however, when reduction does occur ı right and left pereopods are always affected, suggesting a genetic s (rather than predation or some other exogenous factor).

ıere are now 12 species of *Cirolana* known from the eastern Pacific: *:aliforniensis* Schultz 1966 (= *C. deminuta*), southern California to e; *C. joanneae* Schultz 1966, also known from the submarine canyons outhern California; *C. harfordi* (Lockington, 1877), a shallow water ies ranging from British Columbia to central west Baja California; *›arva* Hansen 1890 (= *C. diminuta*), a eurythermal, circumtropical, ow water species known in western America from Point Conception fornia) south at least to central west Mexico; *C. bathyalis* Menzies

15b. Blind (or eyes w/o pigmentation) .... *C. californiensis*

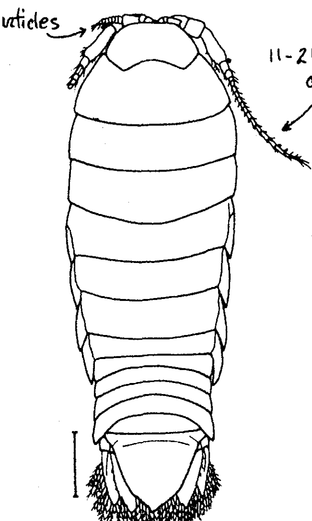


Figure 276. *Cirolana californiensis.*

Fig. 276. ~~*Cirolana*~~ Natatolana *californiensis* (Schultz 1966 (8 mm) Tanner & Catalina

Range: Coronado, ^Canyon on shelf off southern California (& San Diego Trough), S. to Peru-Chile Trench. 40-2,000 m.

This blind, pigmentless species is found at a depth much greater than that of any other species of *Cirolana* in North American waters. This is the Sr. synonym of C. deminuta (see Brusca & Ninos, 1978)

16a. Lateral margins of cephalon pointed; anterolateral margins of cephalon straight; cephalon medially produced .... *C. sphaeromiformis*

Cirolana arcuata Hale, 1925 - San Francisco Bay

Fig. 277. ~~Cirolana~~ Metacirolana *sphaeromiformis* Hansen, 1890 (4.3 mm)

Range: St. Thomas, West Indies, Bermuda, Puerto Rico, Hawaii, Pacific Costa Rica.

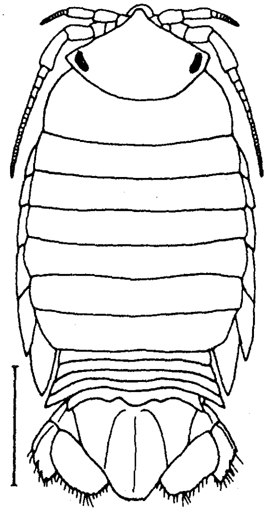


Figure 277. *Cirolana sphaeromiformis.*

16b. Lateral and anterolateral margins of cephalon rounded 17

17a. Edges of pleonal segment five covered by pleonal segment four 18

17b. Edges of pleonal segment five not covered by pleonal segment four ...... *C. joanneae*

Fig. 278. ~~Cirolana~~ Metacirolana *joanneae* Schultz 1966 (3 mm)

Range: Santa Cruze Canyon on shelf off southern California (218 m)

I've ID'd specimens from Gulf of Alaska (subtidal, soft bottom), for R. Cimberg.

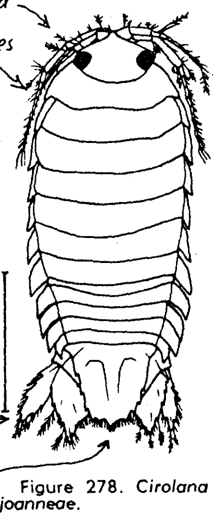


Figure 278. *Cirolana joanneae.*

18a. Epimeral extension of peraeonal segment VII completely visible in dorsal view 20
18b. Epimeral extension of peraeonal segment VII not completely visible in dorsal view 19
19a. Posterior margin of pleotelson and endopod of uropod broadly rounded .... *C. minuta*

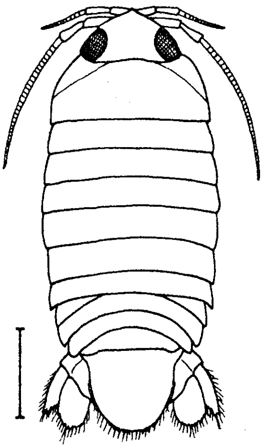


Figure 279. *Cirolana minuta.*

Fig. 279. *Cirolana minuta* (Hansen) (4.8 mm)

Range: St. Thomas, West Indies

19b. Posterior margin of pleotelson and endopod of uropod obtusely rounded .... *C. albida*

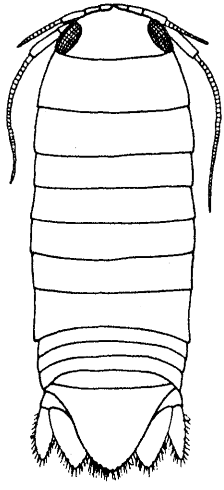


Figure 280. *Cirolana albida.*

Fig. 280. *Cirolana albida* (Richardson)

Range: Sugarloaf Key, Florida

The species is close to *C. parva* in appearance and it should be more closely examined.

20a. **Posterior margin of pleotelson broadly rounded or truncate ... 21**
20b. **Posterior margin of pleotelson obtusely rounded or narrowly rounded (more or less pointed) ... 24**
21a. **Posterior margin truncate ... 22**
21b. **Posterior margin broadly rounded ... 23**
22a. **Posterior margin broadly truncate; exopod and endopod of uropod apically rounded ...** *C. obtruncata*

Fig. 281. *Cirolana obtruncata* (Richardson)

Range: Puerto Rico and Jamaica (Shallow water)

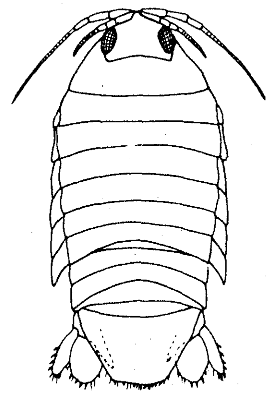


Figure 281. *Cirolana obtruncata.*

22b. **Posterior margin narrowly truncate; exopod or uropod narrow, endopod with deep notch on exterior margin ...** *C. concharum*

Figs. 282 and 283. *Cirolana concharum* (Stimpson) (23 mm)

Range: Nova Scotia to South Carolina (Surface to 33 m)

The species was taken on muddy and sandy bottoms.

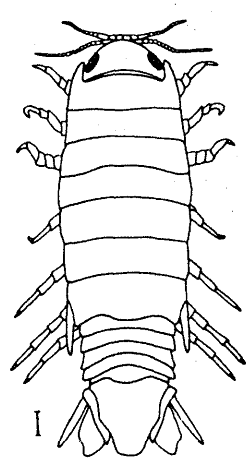


Figure 282. *Cirolana concharum.*

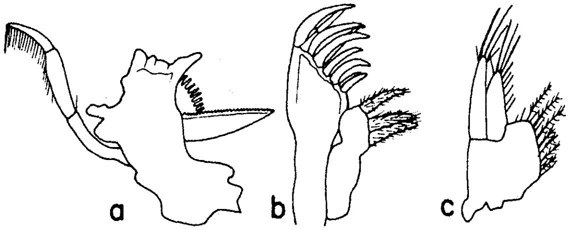


Figure 283. Mouth parts of *C. concharum*. a. Mandible. b. Maxilla one. c. Maxilla two.

23a. Both exopod and endopod apically pointed .... *C. borealis*

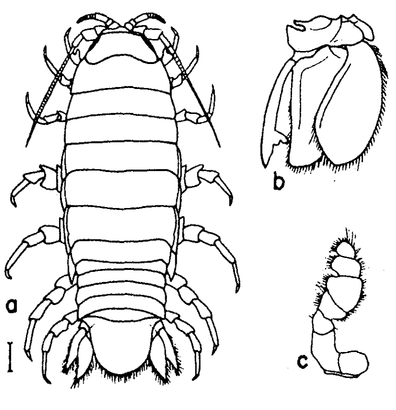


Figure 284. a. *Cirolana borealis*. b. Pleopod 2, male. c. Maxilliped.

Fig. 284. ~~*Cirolana*~~ Natatolana *borealis* (Lilljeborg) (12 mm)

Range: Atlantic coast of North America (55 to 1478 m)

23b. Exopod of uropod pointed; endopod with notch on exterior margin .... *C. polita*

Fig. 285. Politolana ~~*Cirolana*~~ *polita* (Stimpson, 1853) (16 mm)

Range: Bay of Fundy to Georgia (2 to 587 m)

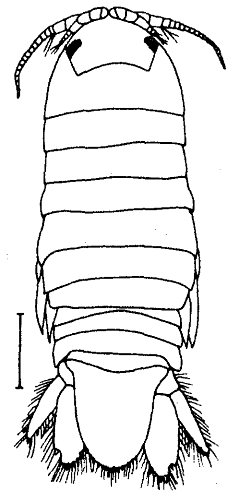


Figure 285. *Cirolana polita.*

24a. **Lateral margins (i. e., epimeral extensions) of peraeonal segment VII much wider than pleon 25**
24b. **Lateral margins (i. e., epimeral extensions) of peraeonal segment VII not much wider than pleon 26**
25a. **Posterior margin of pleotelson narrowly obtusely pointed; notches not present on exterior margin of endopods ....** *C. harfordi*

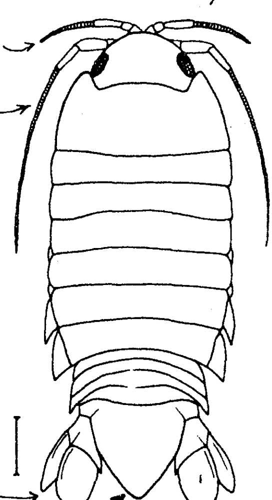


Fig. 286. *Cirolana harfordi* (Lockington, 1877) (8 mm)

Range: British Columbia to Baja California (Pt. Eugenio). I have also examined 2 collections made by Iverson in Japan that contain C. harfordi.

Figure 286. *Cirolana harfordi.*

25b. Posterior margin of pleotelson obtusely pointed; notches present on external border of endopods .... *C. impressa*

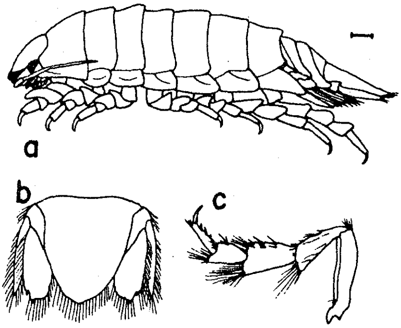


Fig. 287. *Cirolana impressa* (Harger) (21 mm)

Range: New York to North Carolina (183 to 587 m)

Figure 287. a. *Cirolana impressa*. b. Posterior part. c. Peraeopod VII.

26a. Peraeonal segment VII much shorter (narrower) than other peraeonal segments; frontal margin of cephalon not produced .... *C. diminuta*

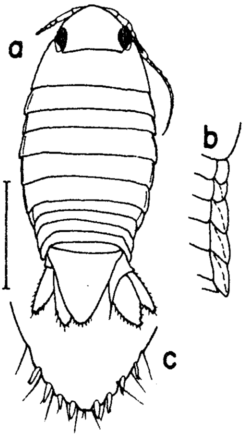


Fig. 288. *Cirolana diminuta* Menzies, 1962 (3.2 mm)

Range: San Quintin Bay, Baja California (Shallow water)

This was made the jr. synonym of C. parva by Menzies & Glynn (1968:38). A circumtropical species, on our coast Pt. Conception south to at least Costa Rica. However, Bruce & Bowman (1982) removed it from synonymy!

Figure 288. a. *Cirolana diminuta*. b. Lateral margin. c. Detail, posterior margin of pleotelson.

26b. Peraeonal segment VII as long (wide) as other peraeonal segments; frontal margin of cephalon very slightly produced 27

27a. Eyes large occupying about one-half length of cephalon border; endopod of uropod reaches to posterior margin of pleotelson .... *C. gracilis*

Fig. 289. *Cirolana gracilis* (Hansen) (8 mm)

Range: St. Thomas, West Indies

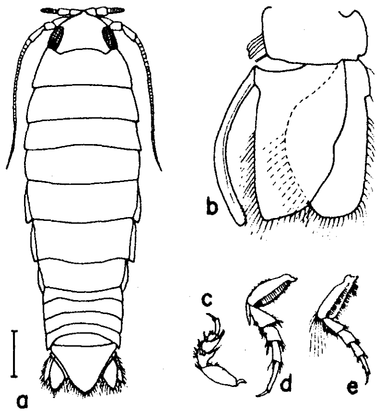


Figure 289. a. *Cirolana gracilis*. b. Pleopod 2, male. c. Peraeopod II. d. Peraeopod VII. e. Peraeopod V.

27b. Eyes small, not on border of cephalon; endopod of uropod reaching beyond posterior margin of pleotelson .... *C. parva*

Fig. 290. *Cirolana parva* Hansen, 1890 (9.5 mm)

Range: ~~Georgia and West Indies~~ (18 to 49 m) Circumtropical

(see Menzies & Glynn, 1968: 38; Bruce & Bowman, 1982)

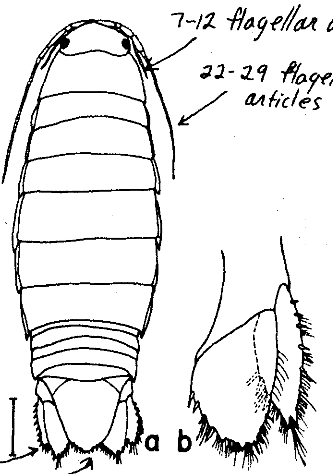


Figure 290. a. *Cirolana parva*. b. Uropod.

margin of pleotelson always with 8 spines

C. parva, of the world literature, is a complex of 12+ sibling species (see Bruce & Bowman, 1982)

28a. All peraeopods prehensile .... *Haptolana*

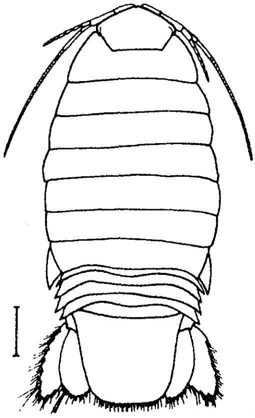


Figure 291. *Haptolana trichostoma.*

Fig. 291. *Haptolana trichostoma* (Bowman) (13.8 mm)

Range: Camaguey Province, Cuba (Cave)

This blind, unpigmented cave species has seven pairs of prehensile peraeopods. Whether it clings to a fish host or to the wall of the cave is unknown.

28b. Peraeopod I only, or no peraeopods prehensile **29**

29a. Peraeopods I prehensile **30**

29b. No peraeopods clearly prehensile **31**

30a. Exopod of pleopod 2 and endopod of pleopods 3 to 5 with two segments .... *Cirolanides*

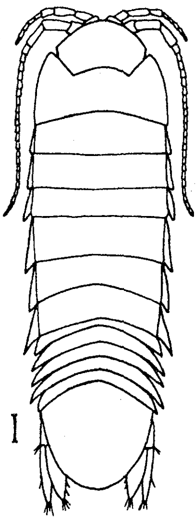


Figure 292. *Cirolanides texensis.*

Fig. 292. *Cirolanides texensis* (Benedict) (17 mm)

Range: South central Texas (Caves and underground water)

This species was first taken from a well at San Marcos, Texas, and was the first North American freshwater cirolanid described.

30b. Exopod of pleopod 2 and endopods of pleopods 3 to 5 with only one segment .... *Antrolana*

Fig. 293. *Antrolana lira* (Bowman) (12 mm)

Range: Madison Cave, Virginia

The species is the type and only one in the genus, and is morphologically much different from the cirolanids of Texas, Mexico and Cuba. It is also the most geographically isolated of the species.

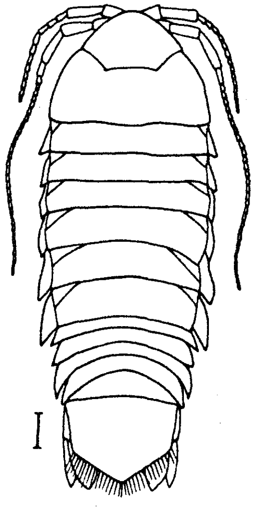


Figure 293. *Antrolana lira.*

31a. Able to roll into ball .... *Creaseriella*

Fig. 294. *Creaseriella anops* (Creaser) (18 mm)

Range: Yucatan, Mexico (Cave)

This species was found in a cave in the same region where very primitive terrestrial isopods were obtained also.

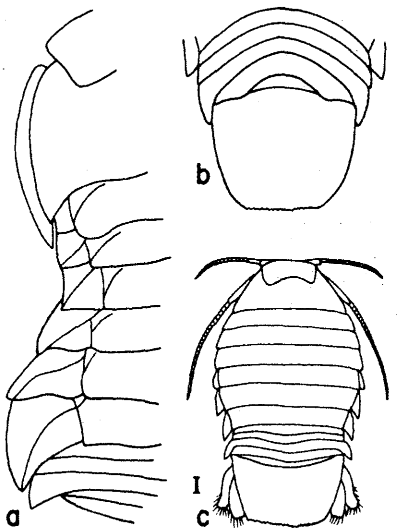


Figure 294. a. *Creaseriella anops*, detail lateral margin. b. Posterior part. c. Dorsal view.

31b. Not able to roll into ball .... *Troglocirolana*

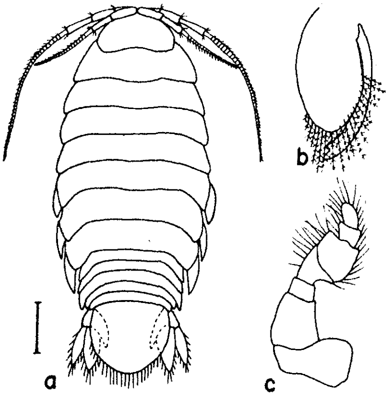


Figure 295. a. *Troglocirolana cubensis.* b. Pleopod 2, male. c. Maxilliped.

Fig. 295. *Troglocirolana cubensis* (Hay) (7 mm)

Range: San Isidro, Cuba (Cave)

The first pair of legs are somewhat prehensile; all others are ambulatory.

AEGIDAE ~~Leach~~ Dana, 1853

The species of this family are moderately large, common ecto-parasites on body fishes, sharks and skates. They generally are found clinging to the outside skin of the fish host, but occasionally they have been found just inside the gill slit. Apparently the species are able to live when not attached to the hosts because many times they have been collected in bottom samples. Fish on which the isopods have been clinging are usually scarred or wounded where the claws of the specimens were attached. They are probably of ecological importance since many economically valuable fish—halibut, haddock and cod—are parasitized by the species of the family.

The species with very few exceptions have eyes which are generally quite distinct and sometimes extremely large. All peraeonal segments are well developed, and the pleon is usually composed of five segments plus a pleotelson; but in some species there are only four free segments plus the pleotelson. The pleotelson and the uropods usually form a broad caudal fan. The first three pairs of peraeopods are modified into distinct prehensile hooks and the next four are usually ambulatory. The distinction between the two types of peraeopods is usually quite marked. On the tip of the maxillipedal palp there are usually large teeth or spines, but they are sometimes absent in gravid females.

KEY TO GENERA AND SPECIES OF AEGIDAE

1a. Eyes present or absent; body depressed; maxillipedal palp composed of only two articles; front of cephalon covers peduncle of antenna one; flagellum of antenna one of four to six articles .... *Rocinela & Syscenus* 15

1b. Eyes large, sometimes converging at center of cephalon; body compact; maxillipedal palp of five articles; front of cephalon with medial point separating basal articles of antenna one; flagellum of antenna one with many articles .... *Aega*

GENUS AEGA

Fourteen species of this genus have been recorded from North America. The species are very common ectoparasites of fish, but are occasionally taken from the bottom not attached to fish.

KEY TO SPECIES OF AEGA

2a. Eyes moderately large to large 3

2b. Eyes small .... *A. microphthalma*

No Fig. *Aega microphthalma* (Dana)

Range: Monterey Bay, California

This species is perhaps the young of one of the west coast species of the genus. It is difficult to tell since there are no figures available.

3a. Pleotelson triangulate or with posterior margin smooth and produced medially; crenulations or teeth never present; lateral margins straight (or slightly concave) or convex 4

3b. Pleotelson various; posterior margin many times with crenulations or teeth 6

4a. Lateral margins of pleotelson straight (or slightly concave); eyes touching .... *A. antillensis*

Aega deshaysiana (H. Milne-Edwards, 1840). Circumtropical. West Indies; Hawaii (Rich.).

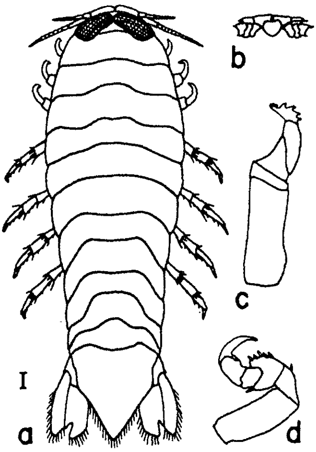


Figure 296. a. *Aega antillensis.* b. Frontal lamina. c. Maxilliped. d. Peraeopod II.

Fig. 296. *Aega antillensis* (Schioedte and Meinert) (35 mm)

Range: West Indies (298 to 422 m)

4b. Lateral margin of pleotelson convex; eyes large but separate **5**

5a. Pleotelson triangulate; rostral process extending well beyond antennal bases .... ***A. psora***

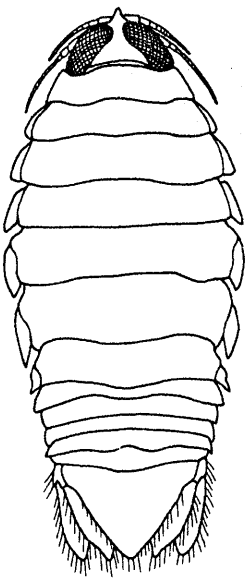


Figure 297. *Aega psora.*

Fig. 297. *Aega psora* (Linnaeus) (16 mm)

Range: North Greenland to Florida Keys (60 to 1280 m)

The fish that are frequently the host are bottom fishes—halibut and skates—so when they become detached from one host there is probably little difficulty in finding a new one. Cod fish are also parasitized by the isopod.

5b. Pleotelson shield-shaped; frontal margin not extended well beyond antennal bases .... *A. ventrosa*

Fig. 298. *Aega ventrosa* (M. Sars) (30 mm)

Range: Greenland (37 to 571 m)

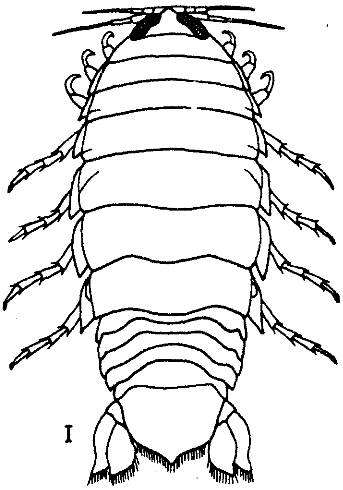


Figure 298. *Aega ventrosa.*

6a. Pleotelson broadly rounded, posterior margin various; i. e., smooth or with crenulations or medial notch or both; basal segments of antennae usually not broad and set in front of cephalon (dorsal view) .... ~~8~~ 7

6b. Pleotelson truncate, sinuate, concave, never with crenulations; basal segment of antennae broad and set in front of cephalon (dorsal view) 12

7a. Pleotelson with posterior margin smooth; eyes touching medially .... *A. tenuipes*

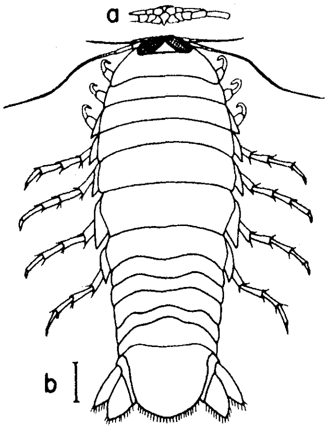


Figure 299. a. *Aega tenuipes*, frontal lamina. b. Dorsal view.

Fig. 299. *Aega tenuipes* (Schioedte and Meinert) (11.5 mm)

Range: Mid- to southern California

Richardson (1901, 1905) reports it from Cuba – following S & M's original record. I have no idea how Schultz came up with California on this one!

7b. Pleotelson with crenulated posterior margin, simple or with small medial notch or projection; eyes touching only in one species 8

8a. Posterior margin with medial notch 9

8b. Posterior margin with simple crenulations or with crenulations and medial projection 10

9a. Eyes touching medially; medial length of first pleonal segment very short (or segment thinner than others) .... *A. incisa*

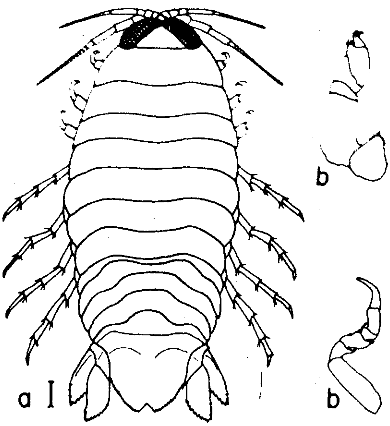


Figure 300. a. *Aega incisa*. b. Maxilliped. c. Peraeopod II.

Fig. 300. *Aega incisa* (Schioedte and Meinert) (18 mm)

Range: Georgia to Florida (481 to 805 m)

9b. **Eyes separated medially; medial length of first pleonal segment about as long as others** .... *A. arctica*

Fig. 301. *Aega arctica* (Lutken) (34 mm)

Range: Greenland

The species is parasitic on *Somniosus microcephalus.*

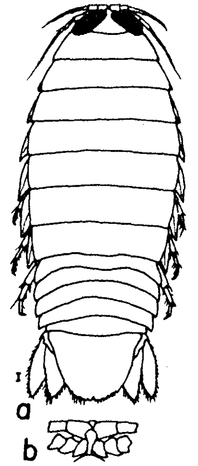


Figure 301. a. *Aega arotica.* b. Frontal lamina.

10a. **Crenulated posterior margin of pleotelson with small medial projection; less than five pleonal segments apparent** **11**

10b. **Simple broadly rounded, crenulated posterior margin; all five pleonal segments apparent and about equal in length** .... *A. symmetrica*

Fig. 302. *Aega symmetrica* Richardson) (17 mm)

Range: Alaska to mid-California (75 to 878 m)

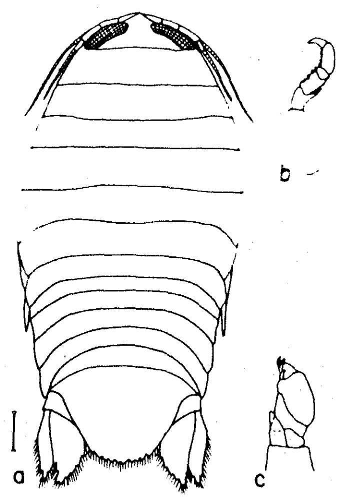


Figure 302. a. *Aega symmetrica.* b. Peraeopod III. c. Maxilliped.

11a. Bases of antennae separated by truncate frontal process; endopod with distal exterior notch; few, if any, epimeral extensions visible in dorsal view .... *A. dentata*

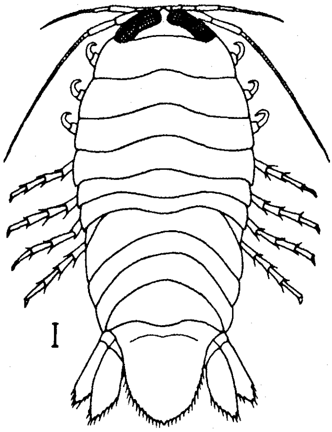


Figure 303. *Aega dentata.*

Fig. 303. *Aega dentata* (Schioedte and Meinert) (7.5 mm)

Range: Cuba

11b. Bases of antennae barely separated by acute frontal projection; notch not present distally on endopod; all six epimeral extensions visible in dorsal view .... *A. gracilipes*

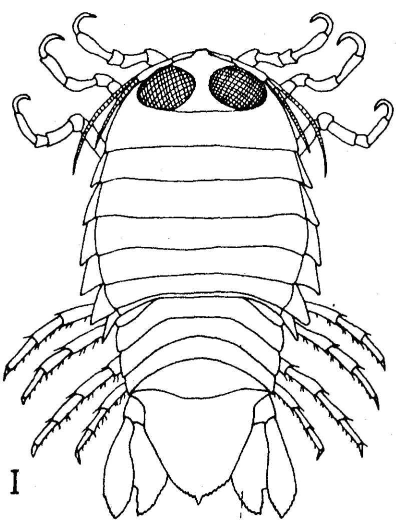


Figure 304. *Aega gracilipes.*

Fig. 304. *Aega gracilipes* (Hansen) (21 mm)

Range: North Atlantic to Gulf of Mexico (1335 to 2787 m)

12a. Posterior margin of pleotelson sinuate. .... *E. ecarinata*

Fig. 305. *Aega ecarinata* (Richardson) (24 mm)

Range: West Indies (298 to 422 m)

Coventry (1944) reported this species from off Acapulco.

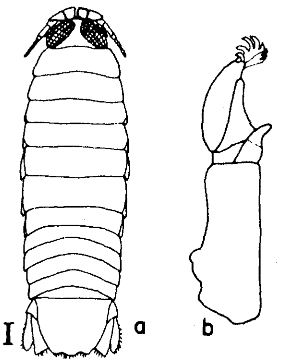


Figure 305. a. *Aega ecarinata*. b. Maxilliped.

12b. Posterior margin of pleotelson truncate, concave or convex **13**

13a. Posterior margin of pleotelson truncate; eyes touching medially .... *A. crenulata*

Fig. 306. *Aega crenulata* (Lutken) (28 mm)

Range: Greenland

The species is parasitic on the Greenland shark.

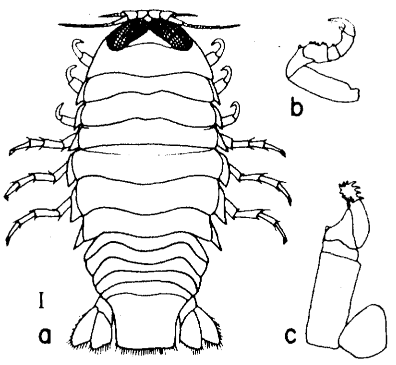


Figure 306. a. *Aega crenulata*. b. Peraeopod II. c. Maxilliped.

13b. Posterior margin of pleotelson concave or convex; eyes large, but not touching medially **14**

14a. Posterior margin of pleotelson convex .... *A. lecontii*

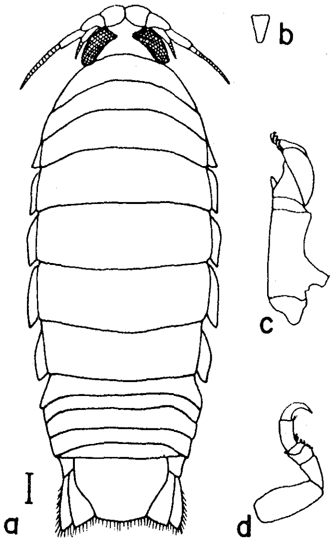


Figure 307. a. *Aega lecontii*. b. Frontal lamina. c. Maxilliped. d. Peraeopod II.

Fig. 307. *Aega lecontii* (Dana) (20 mm)

Range: Mid- and southern California

14b. Posterior margin of pleotelson concave .... *A. webbii*

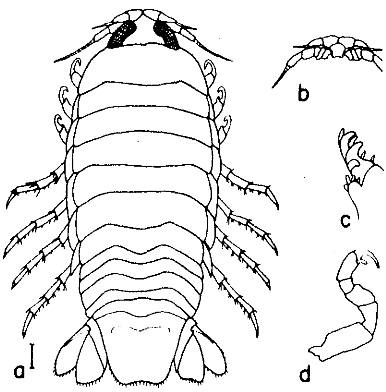


Figure 308. a. *Aega webbii*. b. Frontal lamina. c. Apex of maxilliped. c. Peraeopod II.

Fig. 308. *Aega webbii* (Guerin) (16 mm)

Range: Off Fernandina, Florida (609 m)

15a. Blind; peraeopods I, II and III without expanded propodal segments (Fig. 307d); dactyli abruptly curved in middle and terminating in very sharp point (Fig. 298); pleon abruptly narrower than peraeon .... *Syscenus*

Fig. 309. *Syscenus infelix* (Harger) (28 mm)

Range: Atlantic coast south to Delaware Bay (146 to 1170 m)

This large isopod is blind. All peraeopods are prehensile, but there is a gradual change towards more ambulatory kind from front to rear. The species is apparently the only one in the genus.

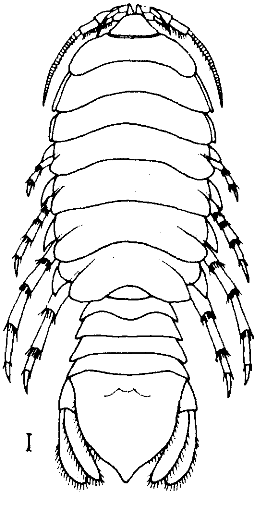


Figure 309. *Syscenus infelix.*

15b. Eyes present; peraeopods I, II and III with propodus more or less expanded and armed with spines (Fig. 312b); dactyls forming large evenly rounded hooks on peraeopods I to III; pleon slightly narrower than peraeon .... *Rocinela*

GENUS ROCINELA

The species in this genus, like those in *Aega,* have been found both as parasites on the skin of fish and apparently living free on the bottom. Sometimes they have been taken from the gill cavity of fish. The species are common and there are about 15 of them in North American waters.

KEY TO SPECIES OF ROCINELA

16a. Frontal part of cephalon greatly produced more than length of eyes **17**

16b. Frontal part of cephalon broadly rounded or produced, but never more than length of eyes **19**

17a. Frontal projection of cephalon with single process **18**

17b. Frontal projection of cephalon trifid .... *R. tridens*

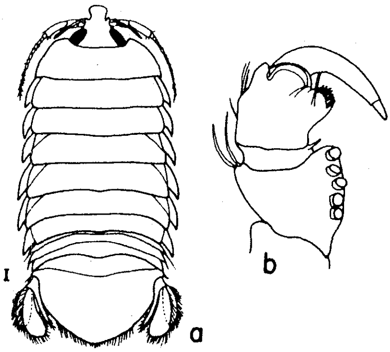


Figure 310. a. *Rocinela tridens*. b. Pereopod I.

Fig. 310. *Rocinela tridens* (Hatch) (25 mm)

Range: San Juan County, Washington State

note: heavily setose uropods
unusual "rostrum"

18a. Frontal margin broadly rounded wider along most of length than distance between eyes .... *R. cubensis*

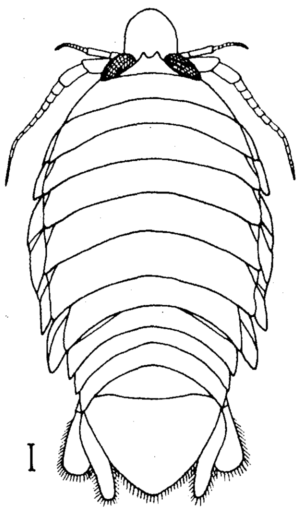


Figure 311. *Rocinela cubensis*.

Fig. 311. *Rocinela cubensis* (Richardson) (16 mm)

Range: Cuba (261 m)

18b. Frontal margin gradually tapers to truncate end, end much less wide than distance between eyes .... *R. cornuta*

Fig. 312. *Rocinela cornuta* (Richardson) (30 mm)

Range: Off Shumagin Bank, Alaska (1143 m) ~ Gulf of Alaska

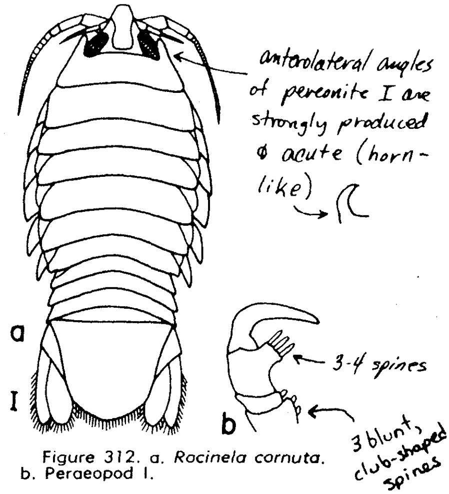


Figure 312. a. *Rocinela cornuta*. b. Peraeopod I.

19a. Body about two and one-half times as long as broad; pleotelson about as wide as peraeon .... ***R. laticauda***

Fig. 313. *Rocinela laticauda* (Hansen) (40 mm)

Range: West coast of Mexico

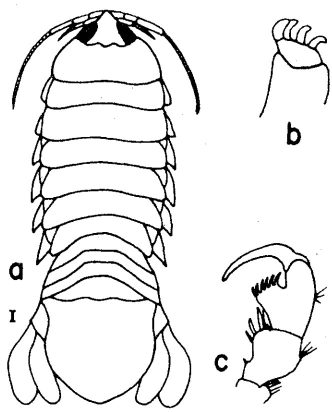


Figure 313. a. *Rocinela laticauda*. b. Apex of maxilliped. c. Peraeopod II.

19b. Body less than two and one-half times as long as broad; pleotelson narrower than peraeon **20**

20a. Eyes touching medially .... ***R. oculata***

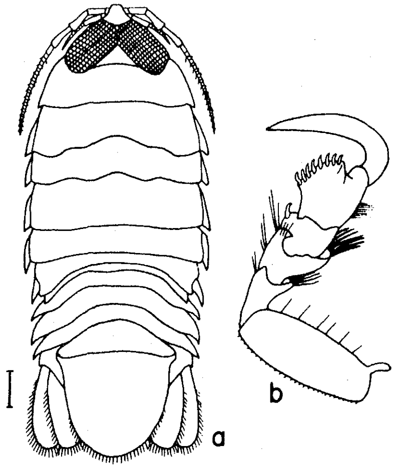


Figure 314. a. *Rocinela oculata*. b. Peraeopod I.

Fig. 314. *Rocinela oculata* (Harger) (13.5 mm)

Range: Near Bermuda (461 m)

20b. Eyes not touching medially **21**

21a. Five pleonal segments distinct, but not necessarily along entire width **22**

21b. Only four pleonal segments distinct (they are distinct along entire width) — i.e. pleonite 1 more-or-less hidden by peraeonite VII. **24**

22a. First pleonal segment not distinct along entire width **23**

22b. First pleonal segment distinct along entire width .... *R. americana*

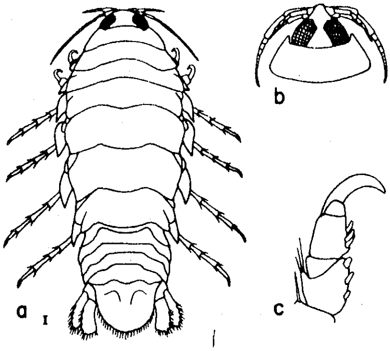


Figure 315. a. *Rocinela americana* (female). b. Male. c. Peraeopod II.

Fig. 315. *Rocinela americana* (Schioedte and Meinert) (20 mm)

Range: North Atlantic and Maine (155 to 287 m)

23a. First pleonal segment distinct only on lateral margins .... *R. signata*

Fig. 316. *Rocinela signata* (Schioedte and Meinert) (13 mm)

Range: West Indies and Central America (4 to 48 m)

The species was found on groupers. It also has been taken on bottoms of coarse sand and in coral formations.

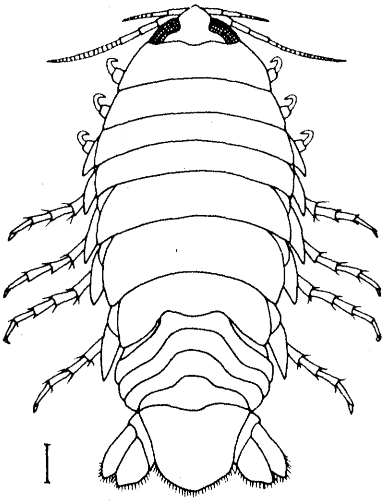


Figure 316. *Rocinela signata.*

23b. First pleonal segment distinct only medially .... *R. aries*

Fig. 317. *Rocinela aries* (Schioedte and Meinert) (20 mm)

Range: Gulf of California and west coast of Mexico

= R. signata (syn. by Menzies + Glynn, '68)
(see Moreira, 1971, 1972, 1977)
(see Bowman, 1977)

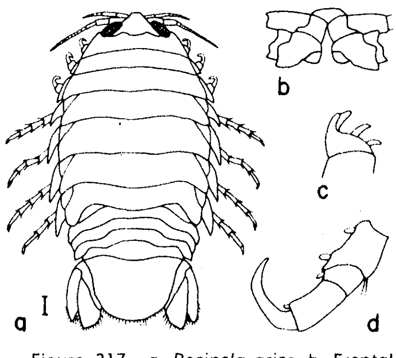


Figure 317. a. *Rocinela aries.* b. Frontal lamina. c. Apex of maxilliped. d. Peraeopod II.

24a. Posterior margin of cephalon trisinuate .... *R. maculata*

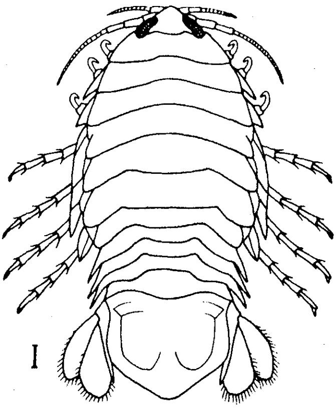


Figure 318. *Rocinela maculata.*

Fig. 318. *Rocinela maculata* (Schioedte and Meinert) (23 mm)

Range: Greenland

24b. Posterior margin of cephalon not trisinuate 25

25a. Eyes almost touching medially; ~~edges of pleonal segments not acutely pointed~~ .... *R. insularis*

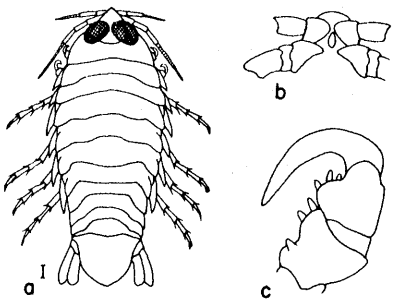


Figure 319. a. *Rocinela insularis.* b. Frontal lamina. c. Peraeopod II.

Fig. 319. *Rocinela insularis* (Schioedte and Meinert) (25 mm)

Range: Florida to Mississippi and West Indies (415 to 499 m)

25b. Eyes large but not almost touching; ~~edges of pleonal segments mostly all acutely pointed~~ 26

26a. Frontal margin of cephalon only slightly produced and only acutely pointed; peraeonal segment VII much shorter than others 27

26b. Frontal margin of cephalon moderately produced or truncate (if broadly round then peraeonal segment VII much shorter or equal to other peraeon~~y~~ites in length) 28

27a. Peraeonal segment VII laterally quite like pleonal segments 1, 2 and 3, and also about same length along entire width .... *R. belliceps*

anterolateral angles of pereonite I are rounded

Fig. 320. *Rocinela belliceps* (Stimpson) (22 mm)

Range: Alaska to southern California (9 to 1258 m)

This species is a non-obligate parasite on cod and sculpin and other fish. At times it is found under shells and stones on intertidal beaches.

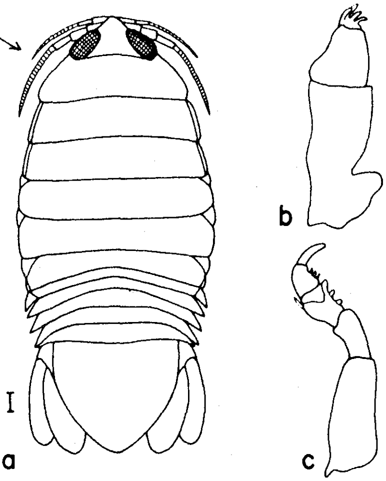


Figure 320. a. *Rocinela belliceps*. b. Maxilliped. c. Peraeopod III.

27b. Peraeonal segment VII with epimeral extensions much larger than lateral ends of pleonal segments 1 and 2 and also shorter (or thinner) medially .... *R. tuberculosa*

Fig. 321. *Rocinela tuberculosa* (Richardson) (13 mm)

Range: Southern part of Gulf of California (15 to 18 m)

The species has small tubercles on the dorsal surface.

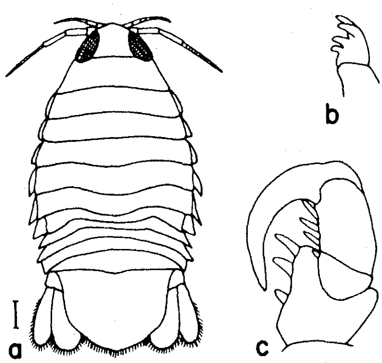


Figure 321. a. *Rocinela tuberculosa*. b. Apex of maxilliped. c. Peraeopod II.

28a. Frontal margin of cephalon broadly rounded or with truncate frontal margin 29

28b. **Frontal margin of cephalon produced into knob (Fig. 322a, b)** .... *R. dumerilii*

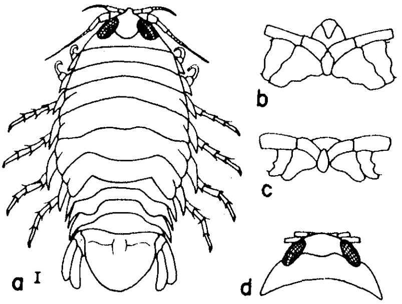


Figure 322. a. *Rocinela dumerilii* (male). b. Frontal lamina (male). c. Frontal lamina (female). c. Cephalon (female).

Fig. 322. *Rocinela dumerilii* (Lucas) (30 mm)

Range: Cuba (421 m)

29a. **Frontal margin of cephalon not greatly produced; peraeopods with comparatively elongate segments (Fig. 323d)** .... *R. propodialis*

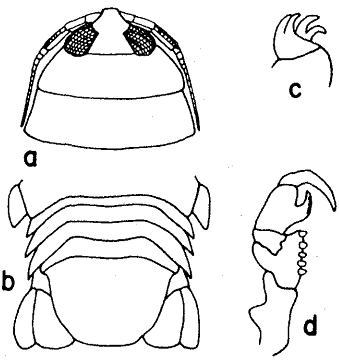


Figure 323. a. *Rocinela propodialis*, anterior part. b. Posterior part. c. Apex of maxilliped. d. Peraeopod III.

Fig. 323. *Rocinela propodialis* (Richardson) (22 mm)

Range: Port Townsend, Puget Sound, Washington (27 to 48 m)

29b. **Frontal margin of cephalon produced, ending truncate; peraeopods with comparatively compressed segments (Fig. 324b)** .... *R. angustata*

Fig. 324. *Rocinela angustata* (Richardson) (28 mm)

Range: Alaska to mid-California (123 to 461 m)

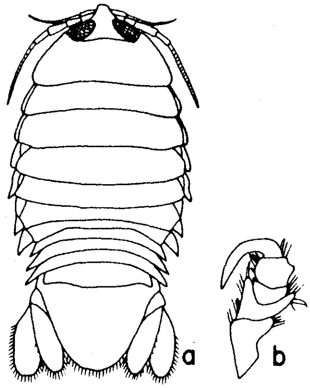


Figure 324. a. *Rocinela angustata.* b. Peraeopod I.

EXCORALLANIDAE

This small family is represented in ~~North American waters~~ the New world by only one genus, *Excorallana,* of 13 species. The species are moderately large and the posterior part of the body in many species is covered with long setae which sometimes are thick and look like encrusting protozoans. This latter character is only found in some members of the corallanid genus *Alcirona.* The species of the excorallanids, however, differ from those of *Alcirona* in the structure of the mouth parts. In species of excorallanids the mandibles are very long and the molar process is rudimentary (Fig. 341b). There is a characteristic uncinate process on the first maxilla (Fig. 325b). The maxillipedal palp is narrow and the ~~second~~ third to last article is elongate (Fig. ~~156a~~ 154a). Although species of the single genus are free living, they occasionally are found as external ~~parasites~~ predators on fish. The eyes are extremely large in most species, and in some they cover the whole length of the frontal margin, in effect forming one large eye.

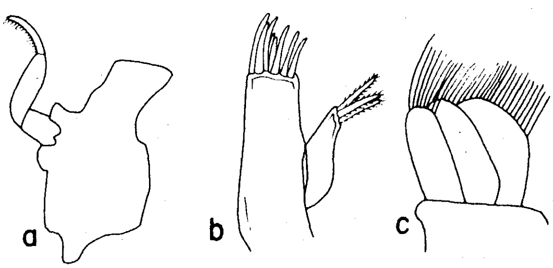


Figure 325. Mouth parts of Excorallanidae species. a. Mandible. b. Maxilla one. c. Maxilla two.

KEY TO SPECIES OF EXCORALLANA

1a. Eyes large taking up about 1/3 or more of frontal margin; pleotelson various 3

1b. Eyes moderately large, not taking up 1/3 or more of frontal margin of cephalon; pleotelson truncate or broadly rounded .. 2

2a. Pleotelson truncate; pleotelson much narrower than peraeon .... *E. subtilis*

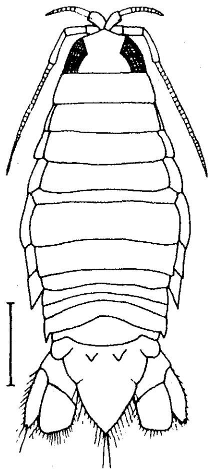


Figure 326. *Excorallana subtilis.*

Fig. 326. *Excorallana subtilis* (Hansen) (4.7 mm)

Range: St. Thomas and West Indies (Shallow water)

2b. Pleotelson broadly rounded; pleotelson continuous with peraeon .... *E. berbicensis*

Fig. 327. *Excorallana berbicensis* (Boone) (3 mm)

Range: Rio Berbice, Guyana

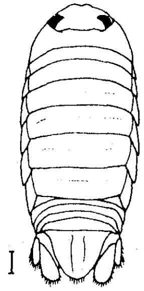


Figure 327. *Excorallana berbicensis.*

3a. Eyes large, but extending with only small medial across gap across frontal margin of cephalon 4
3b. Eyes large, but not extending across frontal margin of cephalon 5
4a. Pleotelson with posterior margin broadly rounded; no notches on lateral margins .... *E. warmingii*

Fig. 328. *Excorallana warmingii* (Hansen) (9 mm)

Range: West Indies

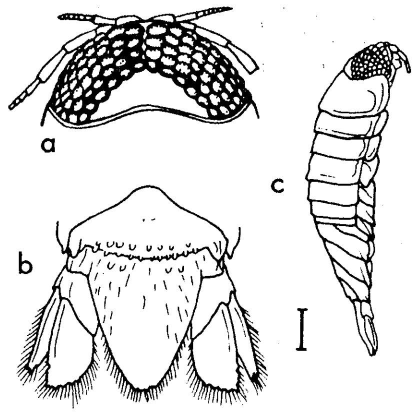


Figure 328. a. *Excorallana warmingii*, cephalon. b. Posterior part. c. Lateral view.

4b. Pleotelson with posterior margin pointed; notches present on lateral margins .... *E. oculata*

Fig. 329. *Excorallana oculata* (Hansen) (11.5 mm)

Range: West Indies

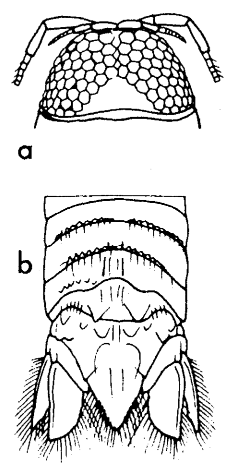


Figure 329. a. *Excorallana oculata*, cephalon. b. Posterior part.

5a. Posterior margin of pleotelson pointed, notch present on lateral margin **7**

5b. Posterior margin of pleotelson deeply excised or truncate **5**

6a. Pleotelson with posterior margin deeply excised .. *E. fissicauda*

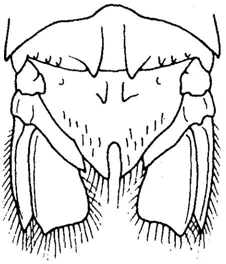


Figure 330. *Excorallana fissicauda*, posterior part.

Fig. 330. *Excorallana fissicauda* (Hansen) (11 mm)

Range: West Indies

6b. Pleotelson with posterior margin truncate .... *E. truncata*

Fig. 331. *Excorallana truncata* (Richardson) (4.2 mm)

Range: Southern California and northern Mexico (Shallow water)

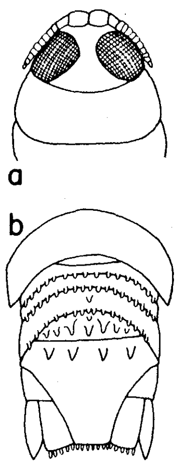


Figure 331. a. *Excorallana truncata*, anterior part. b. Posterior part.

7a. Lateral margin of pleotelson with excision, not notched **8**

7b. Lateral margin of pleotelson with notch **9**

8a. Pleon abruptly narrower than peraeon and separated from it on straight line .... *E. kathae* y

Fig. 332. *Excorallana kathae* (Menzies) (11 mm)

Range: San Quintin Bay, Baja California (Shallow water) to So. California.

now a jr. syn. of E. truncata (see Delaney, 1982)

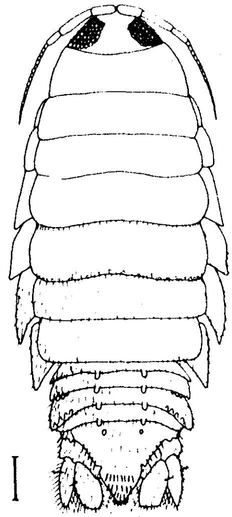


Figure 332. *Excorallana kathae.*

8b. Pleon continuous with peraeon; first and part of second pleonal segment enclosed within margins of peraeonal segment VII .... *E. mexicana*

Fig. 333. *Excorallana mexicana* (Richardson) (8 mm)

Range: Gulf of Mexico (Shallow water to 48 m)

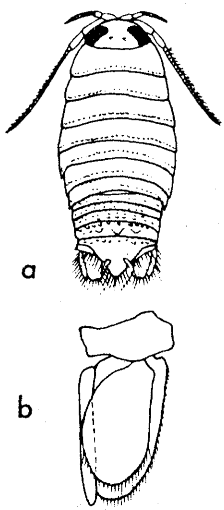


Figure 333. a. *Excorallana mexicana.* b. Pleopod 2, male.

9a. Cephalon with dorsal and frontal tubercles **10**
9b. Cephalon smooth with no tubercles **12**
10a. Cephalon with six large tubercles .... *E. sexticornis*

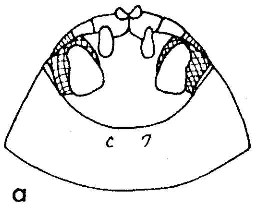


Fig. 334a. *Excorallana sexticornis* (Richardson)

Range: Key West, Florida

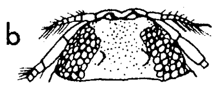


Figure 334. a. *Excorallana sexticornis*. b. *E. quadricornis*.

10b. Cephalon with less than six tubercles **11**
11a. Cephalon with four tubercles .... *E. quadricornis*
Fig. 334b. *Excorallana quadricornis* (Hansen) (12 mm)
Range: West Indies and Bermuda (Shallow water)
The species was found in grass patches and in sponges.
11b. Cephalon with two dorsal and one medial rostral tubercles .... *E. tricornis*

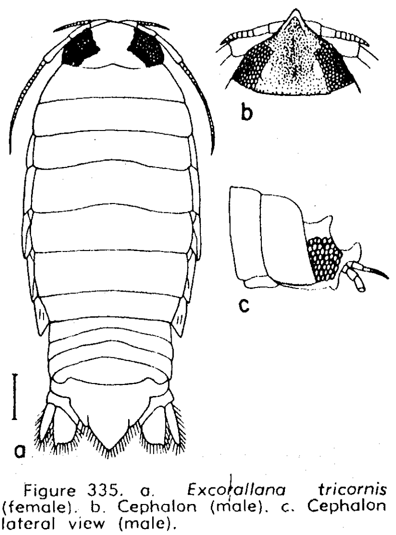


Fig. 335. *Excorallana tricornis* (Hansen) (12 mm)

Range: Southern Florida, West Indies and Central America (44 to 503 m)

Figure 335. a. *Excorallana tricornis* (female). b. Cephalon (male). c. Cephalon lateral view (male).

12a. Body widest at about 1/2 length, abruptly tapering towards each end (pyriform) .... *E. rapax*

Fig. 336. *Excorallana rapax* (Moore) (8.5 mm)

Range: Southeastern United States and Puerto Rico (46 to 137 m)

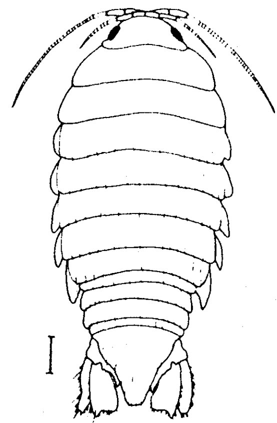


Figure 336. *Excorallana rapax*.

12b. Body with lateral margins ovate or convex 13

13a. Antenna one not extending beyond posterior margin of cephalon .... *E. antillensis*

Fig. 337. *Excorallana antillensis* (Hansen) (16 mm)

Range: Florida and West Indies (Intertidal)

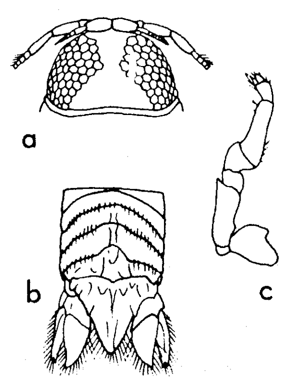


Figure. 337. a. *Excorallana antillensis*, cephalon. b. Posterior part. c. Maxilliped.

13b. Antenna one extending well beyond posterior margin of cephalon .... *E. tricornis* **(see figure 335)**

The female of the species lacks the three tubercles on the cephalon. Other females of other species can perhaps be keyed out at this point so it is very necessary to consider just where the specimens were caught and to use a male for identification if possible to be correct in the determination of *Excorallana* species.

CORALLANIDAE

This small family of Flabelliferans are set apart from other species on particulars in the structure of the mouth parts. The distal half of the mandibles are narrow and directed inwardly. There is no molar process on the mandible in most species. The second to the last article of the maxillipedal palp is not elongate as in species of Excorallanidae. The mouth parts are illustrated in figures ~~338 and~~ 341. There are five or three free pleonal segments plus a pleotelson present. Much work must be done with actual specimens of members of the family so that a more rigid definition of it can be made.

KEY TO THE GENERA OF CORALLANIDAE

1a. Molar parts of mandible present; clypeus short and wide in form of inverted "V" (Figs. 338a and 339b) .... *Tridentella*

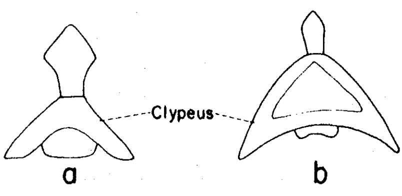


Figure 338. Clypeus of two corallanid species compared. a. *Tridentella virginiana*. b. *Alcirona krebsii*.

see Richardson (1905)

Fig. 339. *Tridentella virginiana* (Richardson) (9 mm)

Range: Chesapeake Bay (148 m) and (southern California)

This species was taken in Chesapeake Bay and also in southern California. It is not a well defined genus and species and more specimens should be collected. It is rare among isopods to have the same species present on both coasts of North America, except for those species easily transported by man.

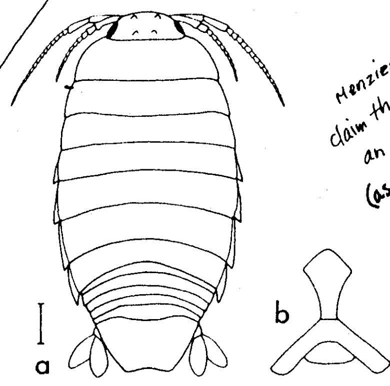


Figure 339. a. *Tridentella virginiana*. b. Clypeus and frontal lamina.

Menzies & Glynn (1968) claim this is probably an Excirolana! (as is the entire genus perhaps) I disagree.

1b. Molar parts of mandible absent; clypeus long, wide and semilunar in shape (Fig. 338b) .... *Alcirona*

GENUS ALCIRONA – Ant 1 with on 2 peduncular articles.

This genus is not well defined as are some other isopod genera. There are five free pleonal segments in *A. krebsii* and three in *A. hirsuta*.

Figs. 340 and 341 *Alcirona krebsii* (Hansen) (11 mm)

Range: Yucatan, Mexico; St. Thomas, W. I.; Bermuda (50 to 56 m)

This species is found in sponges and dead coral and as an ectoparasite on the fin of a grouper. The species is not really modified as a parasite so that its presence on a fish was probably only casual.

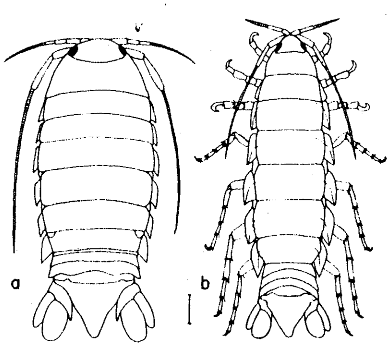


Figure 340. a. *Alcirona krebsii* (male). b. Female.

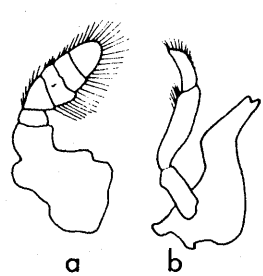


Figure 341. Mouth parts of *Alcirona krebsii*. a. Maxilliped. b. Mandible.

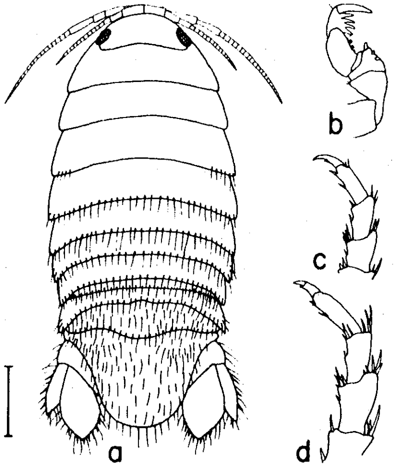


Figure 342. a. *Alcirona hirsuta*. b. Peraeopod I. c. Peraeopod IV. d. Peraeopod VII.

Fig. 342. *Alcirona hirsuta* (Moore) (6 mm)

Range: St. Thomas, W. I. (37 to 42 m)

SUBORDER MICROCERBERIDEA
MICROCERBERIDAE

There are only about 22 described species of this suborder and family of isopods and only five of them have been recorded from North America. All 22 species are placed in one genus, *Microcerberus*, which apparently is represented on all continents of the world except Antarctica. The blind, pigmentless species are very tiny, and are the smallest known isopods. They most nearly resemble the anthurids to which they are closely related. The North American members of the genus sometimes get to be slightly over one millimeter long. They live among the fine grains of sand on intertidal beaches, especially where there is calcareous sand as on many tropical beaches. They are at times found in great abundance.

Freshwater species have been taken from the sand on the banks of streams in Hungary and from subterranean water in caves in Yugoslavia, but most species were collected from the beaches along the Mediterranean Sea. Like many tiny animals, they have been found only in places where particular people who have knowledge of their habitats have gone, and consequently there are many beaches of the world where no one has ever looked for them.

The species of *Microcerberus* live in sand like their nearest relatives the anthurids, but the *Microcerberus* species do not burrow into the sand as do the anthurids, but are found between the grains of sand. Species of animals that live between grains of sand are called psammophils or sand loving animals. All of them are very tiny. Another species of isopod has been found exclusively in the sand of beaches (*Caecianiropsis psammophila*, p. 257), but it like the anthurids is large and lives among, not between, the sand grains. *Microcerberus abbotti* was found near to where *C. psammophila* was found in California. Three of the five known North American species were found on the small Bahaman island of Bimini so there are probably many more unrecorded species in subtropical and tropical North America.

The species are thought to be relict species; i. e., they have a morphological structure that is characteristic of the majority of animals of an earlier geological era or time. They are thought to approximate what the early anthurids were like. There are many characters of the species that can be called primitive, but there are also many modifications which are adaptations for living in the psammitic environment. No one has ever made a definitive, comparative study of the animals.

Since they are extremely small, a very good compound microscope is necessary for observing them. Very fine instruments are also necessary in order to properly dissect them. For easy observation, the animals must be mounted on slides. They can be collected from the sand by gathering sand in which they are thought to live and putting it into a pail and washing it. The animals will come off the sand and get into the wash water that is then strained through a very fine mesh screen. A screen made from a woman's silk or nylon stocking will do nicely. The animals can then be placed in 70% alcohol as is done for other isopods.

Fig. 343. *Microcerberus mexicanus* (Pennak) (1 mm)

Range: West coast of Mexico (Intertidal in sand)

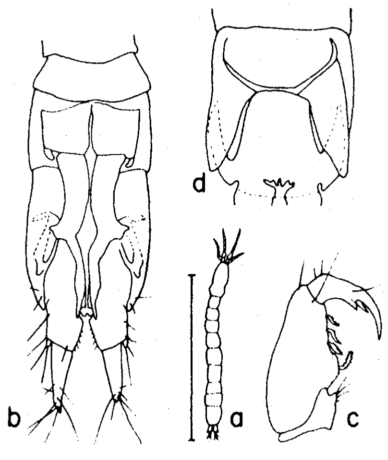


Figure 343. a. *Microcerberus mexicanus*. b. Ventral aspect posterior part with uropods. c. Peraeopod I. d. Ventral aspect posterior part without uropods.

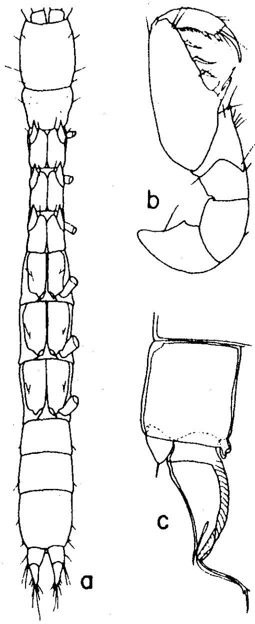


Figure 344. a. *Microcerberus abbotti*. b. Peraeopod I. c. Pleopod 2, male.

Fig. 344. *Microcerberus abbottii* (Lang) (1 mm)

Range: Monterey Bay, California (Intertidal in sand)

The species was taken from the wet sand of an intertidal beach. It was found in the same general habitat as the asellote, *Caecianiropsis psammophila* which is larger although it too has only been found in beach sand.

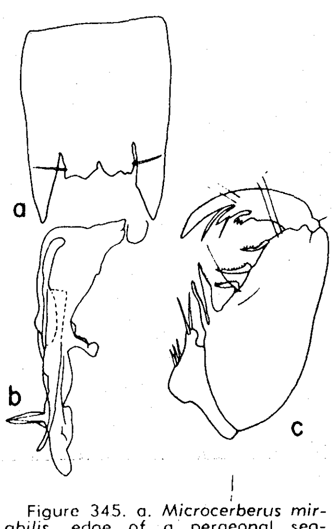


Figure 345. a. *Microcerberus mirabilis*, edge of a peraeonal segment. b. Pleopod 2, male. c. Peraeopod I.

Fig. 345. *Microcerberus mirabilis* (Chappuis and Delmare Deboutteville) (1 mm)

Range: Bimini, Bahamas (Near surface to 80 cm in sand)

Fig. 346. *Microcerberus renaudi* (Chappuis and Delmare Deboutteville) (1 mm)

Range: Bimini, Bahamas (To 40 cm in sand)

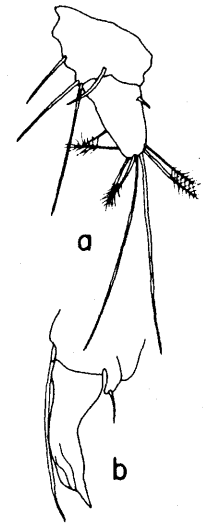


Figure 346. a. *Microcerberus renaudi*, uropod. b. Pleopod 2, male.

Fig. 347. *Microcerberus littoralis* (Chappuis and Delmare Deboutteville) (1 mm)

Range: Bimini, Bahamas (Near surface of sand)

This species was found in the reefs near the location where the other two species from Bimini were found.

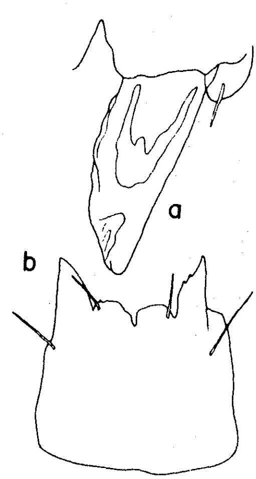


Figure 347. a. *Microcerberus littoralis*, pleopod 2, male. b. Edge of a peraeonal segment.

SUBORDER GNATHIIDEA
GNATHIIDAE

Species of the family Gnathiidae are found in the deep sea as well as in the shallow waters off most of the continents of the world. Specimens range from small to moderately large and there are well over 65 known species in the group. The family is divided into six genera but many of them are based on only one or a few species. The largest number of species is in the nominal genus *Gnathia*. Because females look so much different than males, early taxonomists placed the males in the genus *Gnathia* and the females

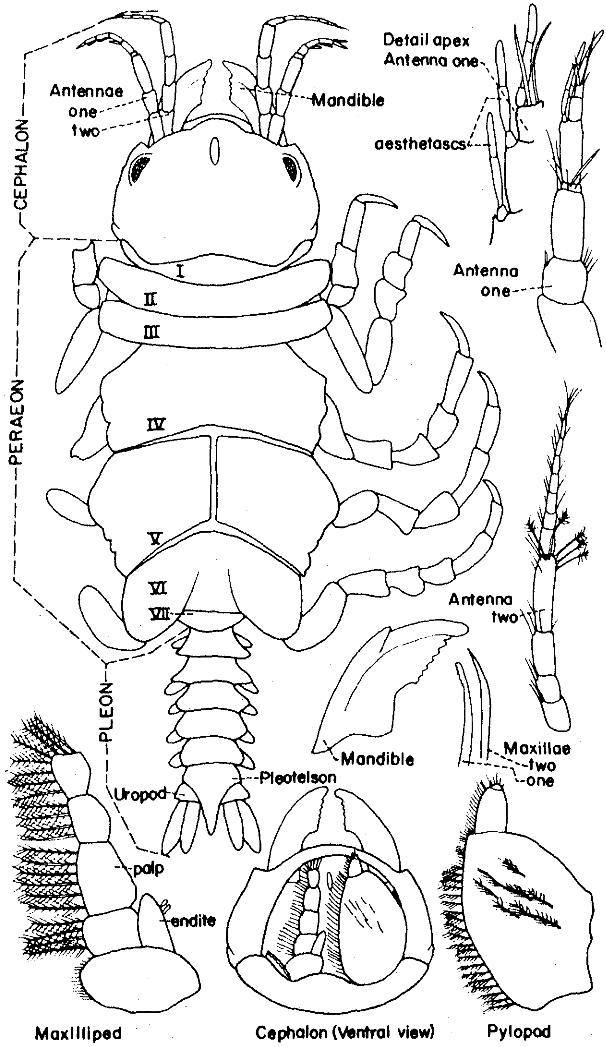


Figure 348. Gnathiidea (General nomenclature).

in a separate genus. The juveniles were placed in *Pranzia*. There are still many males, females and juveniles that have not been associated as a species unit.

Male gnathiids with their large mandibles are like termite or ant workers in appearance. However, when the ventral aspect of the male cephalon is examined, the mandibles are discovered to be apparently ineffectual as gnathal structures and are not even able to transport anything to the buccal cavity. The mandibles are apparently secondary sexual characters such as are found in many lucanid beetles that have mandibles 1/3 the length of their body but have a rudimentary or no mouth (see Fig. 349a). Female gnathiids have no mandibles. The males are free living on the bottom, and they are many times taken in sponges or from the burrows of tubiferous worms. Apparently they obtain their food by straining the mud on the bottom through their maxillipeds.

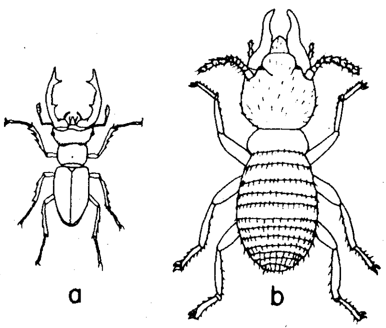


Figure 349. Two insects that resemble a gnathiid. a. Lucanid beetle. b. Termite.

The body of the gnathiid, both male and female, has only five pairs of peraeopods. It is the presence of the five pairs of peraeopods and the presence of the very large mandibles that set the group apart from other isopods. Their bodies are highly calcified and elaborately ornamented. Some species are quite rococo in appearance (Fig. 359).

The females are also easily distinguished from other species of isopods, but there is no immeditae reason to believe that they are in any way related to the males. They have a very large, rotund peraeon with a translucent wall that is large even if not filled with eggs. The cephalon is narrow and generally with a pointed or rounded produced rostrum, with proportionately large eyes and without mandibles or without a conspicuous buccal cavity as in the males. The pleon is narrow and without any apparent long spines or processes. The pleotelson is "T" shaped or triangulate. The pleon in males and females is very much the same and is the most conspicuous reason why male and female, although placed in different genera, were not placed in even more widely divergent groups by early zoologists. The juveniles (Fig. 350) resemble the female in size and

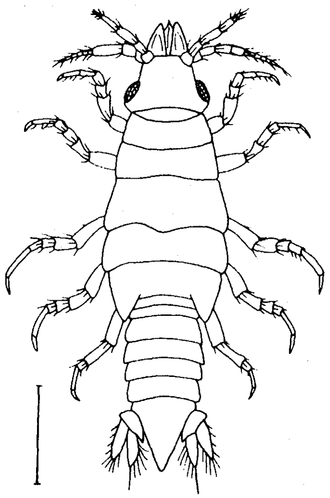


Figure 350. *Gnathia cerina*, a juvenile gnathiid.

general body configuration. Juvenile males have small mandibles protruding from the frontal margin of the cephalon. For most species where the juvenile is known it is a parasite on the body and sometimes in the gill chamber of fish.

The cephalon of the male is large and broad and with a very large distinct buccal cavity. The first pair of peraeopods or what really should be peraeopods, the pylopods, forms a covering over the large buccal cavity (Fig. 348), and the only mouth appendage that is well developed except for the large mandibles is the maxilliped which is found within the buccal cavity. The first and second maxillae are rudimentary structures. On the top of the buccal cavity in some species there is a hole that opens to the dorsal surface (perhaps an artifact of preservation?). Its function is not known. The pylopods are fringed with large plumose setae as are the articles of the maxillipeds, and they most probably serve as filter feeder mechanisms.

Eyes usually are present, even in many deep water forms, and they are at times on short stalks. The female has a very small cephalon compared to that of the male. The eyes are about the same size of a comparable size male and they consequently appear large on the small cephalon of the female. Apparently the mouth parts of the female are modified for sucking. Only the pylopods and maxillipeds are present. The cephalons of the females of different species are very similar, and it is difficult, if not impossible, to determine the species of a female gnathiid if only female specimens are present. There are some differences in the pylopods, pleons and pleotelsons of females of different genera, however.

The species of the genus are occasionally found in large numbers in relatively shallow water. Benthic samples contain males, females and juveniles so the juveniles are apparently non-obligate parasites on the fish. Without a doubt, they play an important role in the ecology of the benthic ecosystem. Their general abundance and the presence of particular species on particular bottom types are facts that demonstrate that gnathiids deserve much more attention of investigators.

Only two genera have representatives in North American waters —*Gnathia* and *Bathygnathia*. *Bathygnathia* contains only one species. In the key female gnathiids are keyed out as if they were an independent group. If males and females are taken at one collection site, then it is safe to assume that they are of the same species. However, if more than one species of male are taken then it is difficult to state which male belongs with which female without careful study.

see "Winn key"

KEY TO THE GENERA AND SPECIES OF GNATHIIDAE

1a. **Peraeon with segments distinct; mandibles large and visible in dorsal view; pleon abruptly narrower than peraeonal segment VI 2**

1b. **Peraeon round and large, segments not distinct; cephalon small and narrow; pleon also small and narrow .... Female gnathiid (Figs. 21 and 360c)**

not keyed

2a. **Blind; front of cephalon with frontal line expanded into very long pointed process ....** *Bathygnathia*

Fig. 351. *Bathygnathia curvirostris* (Richardson) (11 mm)

Range: Georges Bank and south of Martha's Vineyard (709 to 1232 m)

It would be interesting to know if the species are parasites on deep water fish, but so far no juveniles have been recorded. The species is the type and only one in the genus.

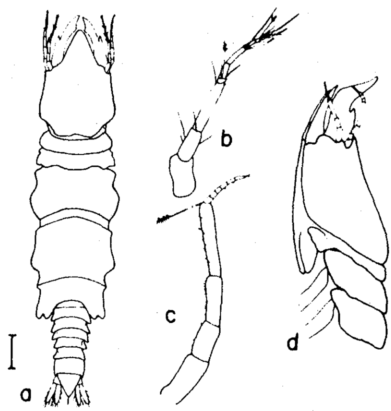


Figure 351. a. *Bathygnathia curvirostris*. b. Antenna one. c. Antenna two. d. Anterior part, lateral view.

2b. **Blind or with eyes; front of cephalon not expanded into very long pointed process ....** *Gnathia*... 3

GENUS GNATHIA

For the discussion of the genus see the general discussion under the family.

3a. Blind (Careful! One species has the eyes visible only in the ventral view.) .... *G. coronadoensis*

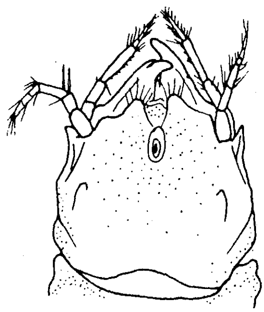


Figure 352. *Gnathia coronadoensis.*

Fig. 352. *Gnathia coronadoensis* (Schultz) (3.5 mm)

Range: Coronado Canyon on shelf off southern California (812 m)

3b. With eyes **4**

4a. Eyes visible in dorsal view **5**

4b. Eyes visible in ventral view only .... *G. serrata*

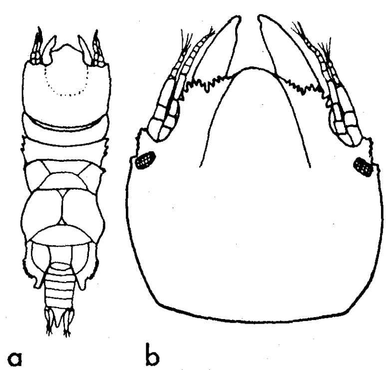


Figure 353. a. *Gnathia serrata.* b. Cephalon, ventral aspect.

Fig. 353. *Gnathia serrata* (Richardson) (3.4 mm)

Range: South of Martha's Vineyard (713 m)

5a. Cephalon longer than wide .... *G. triospathiona*

Fig. 354. *Gnathia triospathiona* Boone, 1918 (2.9 mm)

Range: Gulf Stream off Key West, Florida (199 m)

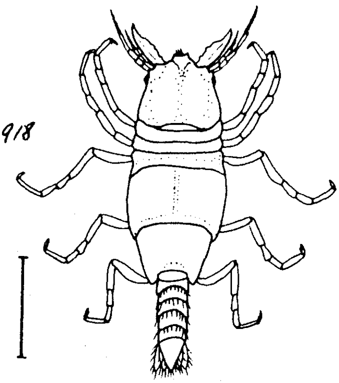


Figure 354. *Gnathia triospathiona.*

5b. Cephalon shorter than wide 6

6a. Eyes not stalked 7

6b. Eyes on short stalks .... *G. clementensis*

Fig. 355. *Gnathia clementensis* (Schultz) (8.5 mm)

Range: San Clemente Canyon on shelf off southern California (162 m)

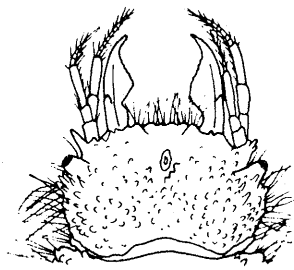


Figure 355. *Gnathia clementensis.*

7a. Frontal margin of cephalon crenulate; cephalon about as long as wide .... *G. crenulatifrons* apex of cephalon not produced.

this angle more rounded than acute!

this break is a ...d character, but ...n't this distinct!

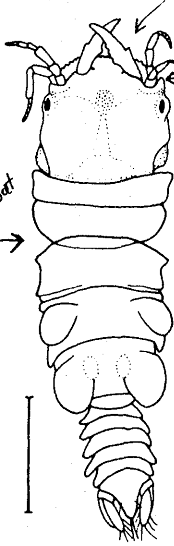


Figure 356. Gnathia latifrons.

Fig. 356. *Gnathia crenulatifrons* Monod 1926 (4.3 mm) (oceanside)

Range: Southern California coastal shelf and basins (9 to 1258 m) to Monterey Bay.

This species is extremely abundant over its whole range. It is also found in relatively shallow water as well as deep water. The host fish of the female is still unknown.

7b. Not as above 8

8a. Frontal margin of cephalon with more than one frontal process, extension or crenulation 9

8b. Frontal margin of cephalon with only single or without large frontal process 12

9a. Frontal margin without large medial process; eyes small and surrounded by long tubercles .... ***G. multispinis***

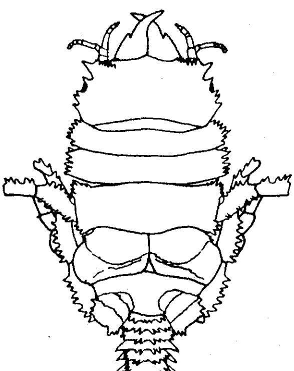


Figure 357. Gnathia multispinis.

Fig. 357. *Gnathia multispinis* (Richardson)

Range: Off Delaware (1765 m)

The specimen from which the posterior part of the pleon is missing is 5.5 mm long.

9b. **Frontal margin of cephalon expanded into large rounded process; eyes surrounded by short tubercles** **10**

10a. **Rounded process on frontal margin of cephalon set above anterior border of cephalon** .... *G. hirsuta*

Fig. 358. *Gnathia* ~~*hirsuta*~~ sanctaecrucis Schultz (4 mm)

Range: Santa Cruz Canyon on shelf off southern California (218 m)

(see Schultz 1972: 112)

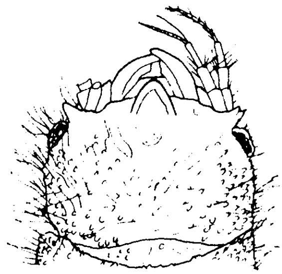


Figure 358. *Gnathia hirsuta.*

10b. **Rounded process of frontal margin set below or at about same level as frontal margin of cephalon** **11**

11a. **Mandibles with secondary teeth on dorsolateral surface; eyes very large; peraeonal segment about 2/3 width of other peraeonal segments** .... *G. cristata*

Fig. 359. *Gnathia cristata* (Hansen) (3.5 mm)

Range: North Atlantic, 72° N X 58° W (212 m)

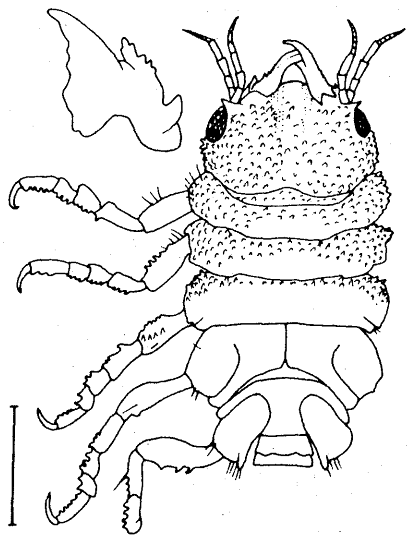


Figure 359. *Gnqthia cristata.*

11b. Mandibles apparently without secondary teeth on dorsolateral surface; eyes prominent but not large; peraeonal segment VI more than 2/3 width of other segments .... *G. cerina*

Fig. 360. *Gnathia cerina* (Harger) (4.8 mm)

Range: Gulf of St. Lawrence to south of Martha's Vineyard (18 to 891 m)

This species is found in the northern waters off the Atlantic coast of North America. The female is a parasite on sculpin, cod and other fish.

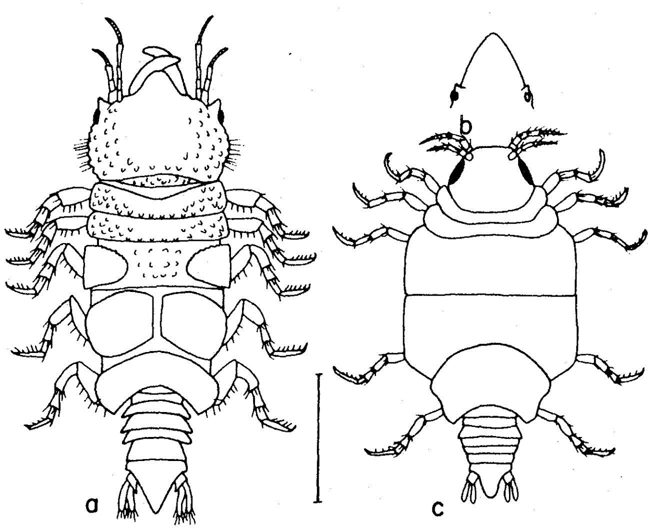


Figure 360. a. *Gnathia cerina* (male). b. Frontal view cephalon female. c. Female.

12a. Eyes very large; cephalon very short; medial lobe of frontal margin of cephalon much longer than two lateral lobes; large secondary tooth on dorsolateral surface of mandible .... *G. steveni*

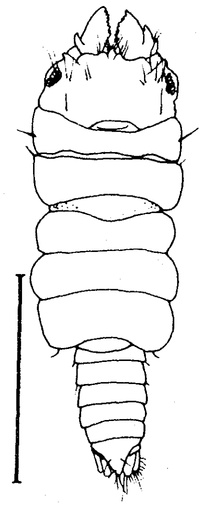


Fig. 361. *Gnathia steveni* (Menzies) (2.3 mm)

Range: Northern Baja California (Shallow water) Collected in King Harbor by D. Straughn surveys.

Figure 361. *Gnathia steveni.*

12b. Eyes large or prominent; frontal margin with three small lobes, teeth or crenulations of about equal length; mandibles various 13

13a. Eyes prominent; hole or conspicuous deep spot medial on cephalon .... *G. trilobata*

Fig. 362. *Gnathia trilobata* (Schultz) 1966 (5 mm)

Range: Coronado Canyon on shelf off southern California (812 m)

This species was caught in the same canyon as *G. coronadoensis,* but it is not blind as is that species.

I've seen what appears to be G. trilobata from Gulf of Alaska soft bottom subtidal (amberg material))

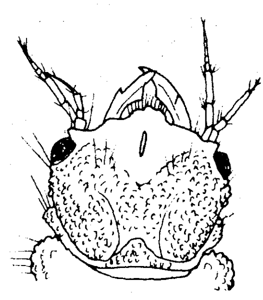


Figure 362. *Gnathia triliobita.*

13b. Eyes of moderate size; cephalon depressed, but without hole or conspicuously deepened spot on dorsal surface 14

14a. Cephalon rectangulate; anteriolateral corners prominent .... *G. elongata*

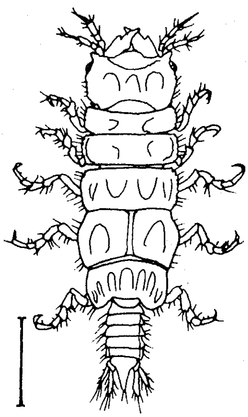


Figure 363. *Gnathia elongata.*

Fig. 363. *Gnathia elongata* (Kroyer) (4 mm)

Range: Greenland (90 to 101 m)

14b. Cephalon not especially rectangulate and without prominent anterolateral corners 15

15a. Telson triangulate, posterior margin strongly produced; about 1/3 longer than wide .... *G. productatridens*

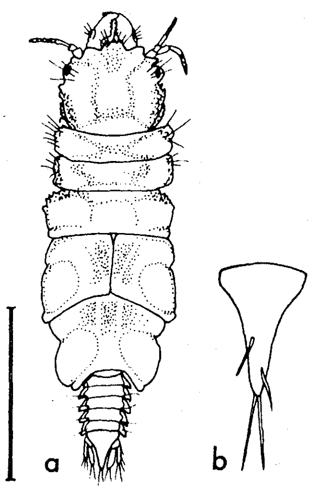


Figure 364. a. *Gnathia productatridens.* b. Pleotelson.

Fig. 364. *Gnathia productatridens* (Menzies and Barnard) (3.2 mm)

Range: Pt. Conception to Santa Barbara, California (73 to 91 m)

15b. Telson triangulate, posterior margin not strongly produced; about as long as wide .... *G. tridens*

Fig. 365. *Gnathia tridens* (Menzies and Barnard) (3 mm)

Range: Pt. Conception, California (11 to 27 m)

I've seen specimens from Gulf of Alaska. (Cimberg material)

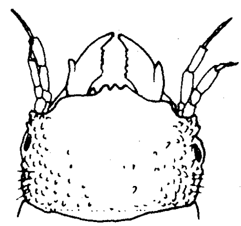


Figure 365. *Gnathia tridens.*

SUBORDER ASELLOTA

The Asellota are small isopods that are very abundant in certain intertidal and near-shore habitats and in the deep-sea as well. There are many species and they are divided into about 17 families, the largest number for any isopod suborder. The major portion of asellote species are small, blind, pigmentless animals found in the deep-sea, but the larger, pigmented, eyed relatives in the near-shore habitats are the most frequently encountered. One family with the largest number of recorded species, the Janiridae, has many species that are found in both the near-shore habitats and in habitats of the deep-sea as well. Several other families also have deep-sea and near-shore species in them, but species of most families are found exclusively in the deep-sea. The Asellidae are mainly freshwater species, and only *Asellus* sp. (Fig. 379) is included in this book for comparison. The suborder Asellota contains a large number of species, and has a great economic importance in the near-shore habitats. However, species of Asellota are abundant in the deep-sea and are perhaps the dominant crustacean found there so they are of undoubtedly of greater importance than at first is apparent. They probably account for much of the organic transformation of bottom organic material to soil or its deep-sea equivalent.

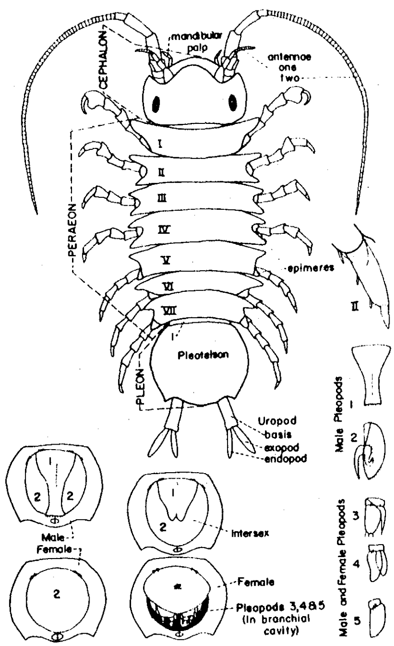


Figure 366. Asellota (General nomenclature). (Pleopods of Paraselloidea). See Fig. 373 for stenetrioidea and Fig. 378 for a selloidea.

Asellota species are best characterized by the structure of their pleon. All, or all but one or two, of the pleonal segments are fused, and there is a branchial cavity which contains the respiratory pleopods, usually pleopods 3, 4 and 5. One pleopod or a combination of pleopods 1 and 2 (in males) forms as operculum to the branchial cavity. Male sexual pleopods are sometimes enclosed within the operculate covering, or they are a part of the operculum or they are sometimes outside of it. The suborder Asellota is divided into three superfamilies on the basis of the pleopodal structures. The three superfamilies are the Aselloidea, the Stenetrioidea and the Paraselloidea. Aselloidea consists of the single family, the Asellidae, which are freshwater forms and which have the male pleopods one and female pleopods two separate; i. e., they are never fused on the midline (Fig. 378d, e). The third pleopods are operculate in both sexes.

The Stenetrioidea also consists of a single family (in North American waters), the Stenetriidae. They are perhaps the most primitive species of the suborder Asellota and have two free pleonal segments and their pleopods are arranged in various ways. Male pleopods 1 are operculate to sexual pleopods 2 and they are fused at least at the basal part of the appendages. The female operculate pleopods are large, but not fused. The forms of the pleopods found on the North American members of the family are shown in figure 373.

The Paraselloidea which contains the species of all other families found in North American waters has the first male pleopods always fused into a narrow structure that fits between the separated second pleopods which together with the first fused pair form the operculum to the branchial cavity. The second pleopods of the female are always fused and operculate to the other pleopods (Fig. 373b).

The peraeon of the species many times has fused segments, and it is frequently fused to the cephalon and/or the pleon. The degree of fusion varies somewhat with age, sex (intersexes are frequently encountered) and amount of calcification of the integument. A suture is sometimes present to indicate fusion. Sometimes fusion is indicated laterally by the presence of slits, or at times it is absent. Other structures such as spines and rostral processes are also altered according to age, sex or degree of calcification so that Asellota species must always be examined with care when encountered, since the differences found among the various forms of one species are frequently larger than those found between species in other suborders of isopods. On the other hand, the differences between isopod species in the Asellota are sometimes quite subtle and great care must be used to make sure that two very similar looking animals are not of different species. An Asellota species at first appearance appears to be quite different and indeed at times unique, but the differences soon disappear when they are compared to other asellote species and they can be at times confusing. Much work is necessary to identify species of Asellota.

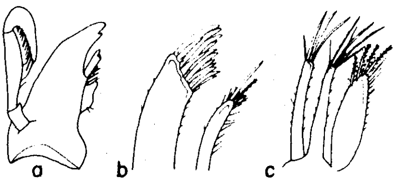


Figure 367. Mouth parts of Asellota. a. Mandible. b. Maxilla one. c. Maxilla two.

Species of Asellota generally have well developed antennae, antenae two almost always being the longest. Eyes are not present in most species, but the species that will be encountered by most

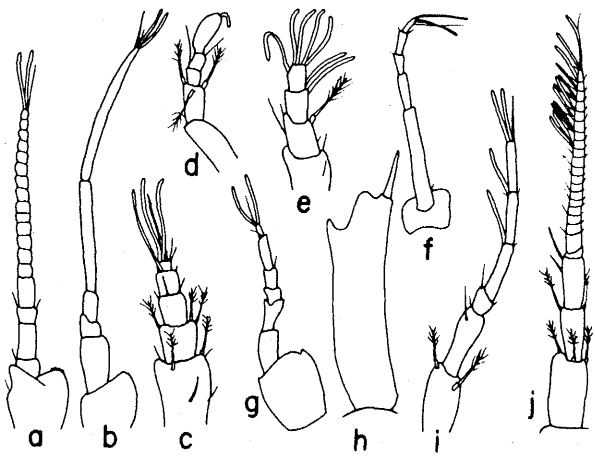


Figure 368. Antenna one types of Asellota. a. Eurycopidae (*Eurycope*). b. Munnidae (*Munna*). c. *Jaeropsis*. d. Nannoniscidae (*Nannoniscus*). e. Macrostylidae (*Macrostylis*). f. *Haplomesus*. g. *Ianirella*. h. *Echinothambema*. i. Haploniscidae (*Haploniscus*). j. *Stenetrium*.

collectors do have eyes. They are usually dorsally or dorsolaterally placed on the cephalon. The mouth parts are generally of the biting and chewing types with maxillae that are fringed with long setae for straining food particles.

The maxillipeds are well developed and when more is known about them in some genera, their forms will probably become very good criteria for separation of the Paraselloidea into further subgroups and revealing the evolution of the group. The peraeopods

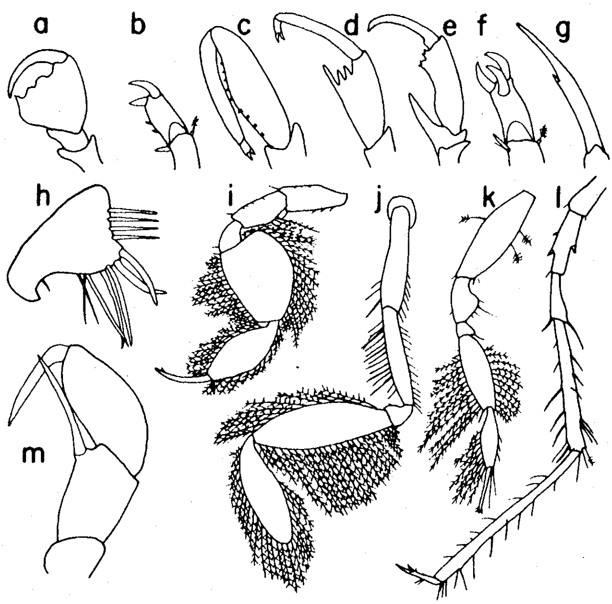


Figure 369. Peraeopods of Asellota. a. *Stenetrium* (I). b. *Jaeropsis* (I). c. *Janiralata*. d. *Janira*. e. *Stenetrium* (I). f. *Jaeropsis* (II-VII). g. Haploniscidae. h. *Macrostylis*. i. *Ilyarachna* j. *Munnopsis*. k. *Desmosoma* (II-VII). l. *Munna*. m. *Desmosoma* (I).

for the most part are ambulatory, but natatory peraeopods with broaded segments are found in some deep-sea and some partially planktonic species. Peraeopod I is generally gnathal and sometimes the male will have a large sexually modified grasping peraeopod. The number of large dactyl claws varies from one to three in the different species and on different peraeopods. Frequently if there are three dactyl claws on most peraeopods, peraeopod I will have only two. Many times the third claw is not observed, even in a compound microscope, because it is in a different plane of focus than the other two, and hence out of focus when the others are observed. Knowledge of peraeopod type and dactyl claw number

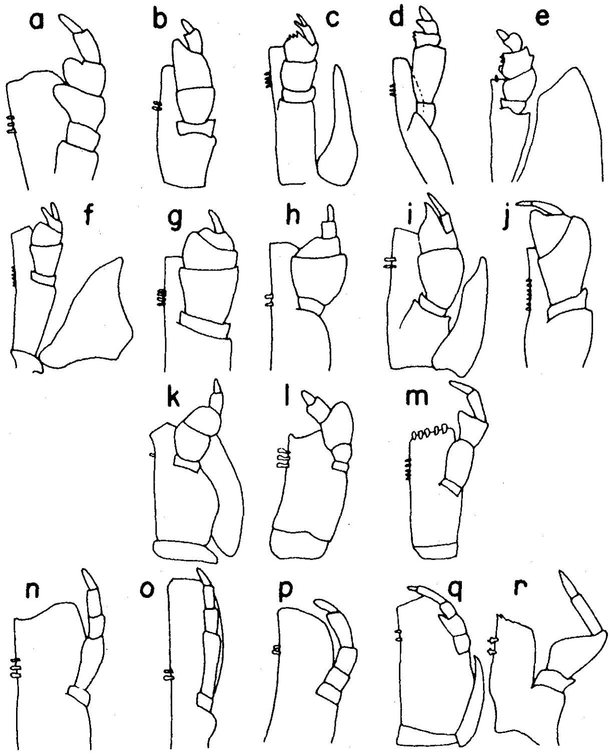


Figure 370. Maxillipeds of Asellota (for species of Janiridae, see Fig. 392). a. *Munna*. b. Desmosomatidae. c. Nannoniscidae. d. *Ilyarachna*. e. *Syneurycope*. f. *Eurycope*. g. *Storthyngura*. h. *Macrostylis*. i. *Munnopsis*. j. *Acanthccope*. k. *Ischnomesus*. l. *Haplomesus*. m. *Stenetrium*. n. Haploniscidae. o. *Mesosignum*. p. *Dendrotion*. q. *Jaeropsis*. r. *Abyssijaera*.

also will be useful criteria for identification of Asellota, but unfortunately in some genera it has never been described.

KEY TO FAMILIES OF ASELLOTA

1a. Male pleopods 1 and 2 and female pleopod 2 much smaller than pleopods 3 which are fused and operculate to pleopods 4 and 5 (Fig. 373) .... Stenetriidae (p. 238)

1b. Male and female pleopods not as above 2

2a. Male pleopods 1 and 2 and female pleopods 2 forming covering operculate to pleopods 3 to 5 (Fig. 366) .... (Paraselloidea) 3

2b. Male pleopods 1 and 2 and female pleopods 2 distinctly separated and branchial only (never operculate) .... Asellidae (p. 241) – freshwater

3a. Only five peraeonal segments visible in dorsal view; lateral borders of peraeonal segments II to V with small spines; spines also present on dorsum of cephalon, peraeon and pleotelson; cephalon and pleotelson narrower than widest part of peraeon; antenna two more than twice length of body .... *Haplomunna caeca* (p. 242)

3b. Not as above 4

4a. Cephalon fused with peraeonal segment I; blind; peraeonal segments IV and V elongate, twice as long as wide .... Ischnomesidae (p. 243)

4b. Not as above 5

5a. Blind; cephalon not fused to peraeon, but peraeonal segment VI and VII fused and also fused to pleotelson (which has indications of one pleonal segment); antenna one with very long, flattened basal segment (Fig. 368h) .... *Echinothambematidae* (p. 247)

5b. Not as above 6

6a. Body with any or all of these structures—dorsal spines, elongate lappets on peraeonal segments, cephalon or pleotelson; long coxal processes or other produced structures; elongate peraeopods (spider-like) or extremely long antennae; peraeopods I subchelate or ambulatory, peraeopods II to IV always ambulatory; peraeopods V to VII sometimes natatory; anterolateral borders of peraeonal segments sometimes acutely produced 15

6b. Body without any long or strongly produced spines or processes (see above couplet part 6a for types), except perhaps posterolateral projections or rostral projection; never with greatly elongate peraeopods; never with more than first three peraeonal segments acutely produced or with strongly produced coxal processes; peraeopods I prehensile or ambulatory, sometimes sexually modified or gnathal (i. e., subchelate); natatory peraeopods if present on segments II to VII, never fewer segments 7

7a. With eyes 13

7b. Blind (or occassionally with eyes) 8

8a. Frontal margin rounded and serrated; antennae deeply set into cephalon .... Antiasidae (p. 248)

8b. Not as above 9

9a. Antennae one and two large and well developed; body oblong and dorsoventrally compressed; uropods always distinct and most always biramus; peraeonal segments always shorter than broad and of approximately uniform length; co:.al plates always visible in dorsal view .... Janiridae (p. 250)

9b. Not as above 10

10a. Maxilliped with palp very narrow (Fig. 370n); coxal plates never visible in dorsal view; posterolateral angles not developed, moderately developed or well developed (Fig. 371a-c) (If posterolateral angles are not visible in dorsal view then the peraeonal segments I and IV are free and V to VII plus the pleotelson are fused) .... Haploniscidae (p. 270)

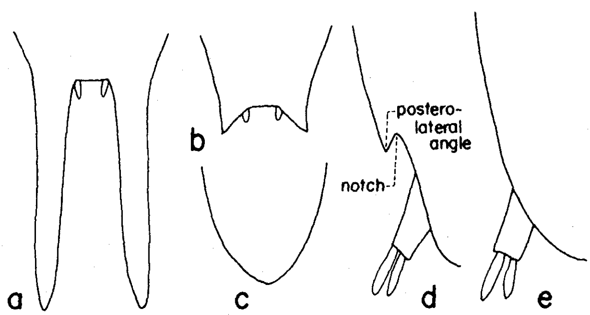


Figure 371. Posterolateral angles and notches. a-c. Haploniscidae. a. Elongate. b. Moderately long. c. Absent *(Hydroniscus)*. d. A large notch. e. Absent

10b. Not as above 11

11a. Uropods uniramus and very elongate, emerging from posterior border of pleotelson; posterolateral border of pleon never with posterolateral notches (Fig. 371e); mandibles without palp; dactylus of peraeopods triangulate with single unguis (claw) (Fig. 369h) .... Macrostylidae (p. 275)

11b. Not as above 12

12a. Coxal extensions present on at least anterior three peraeonal segments; peraeonal segment IV almost quadrangular with subparallel lateral margins; all peraeopods except first natatory .... Desmosomatidae (p. 278)

12b. Coxal extensions absent or very inconspicuous on peraeonal segments I to III; peraeonal segment IV always constricted where attached to peraeonal segment III; all peraeopods ambulatory .... Nannoniscidae (p. 281)

13a. Cephalon with rounded frontal margin; antenna one and two small and closely adherent to frontal margin (especially antenae two); lateral margins of body subparallel including cephalon and pleotelson; coxal extensions never present, but coxal bulges present on margins between peraeonal segments; posterolateral notch present on border of pleotelson; notched border of pleotelson where uropods emerge; mandibular molar process spiniform (Fig. 37e) .... Jaeropsidae (p. 284)

13b. Not as above 14

14a. Eyes somewhat stalked; frontal margin of cephalon concave with antennae inserted in deep grooves ..... Antiasidae (p. 248)

14b. Eyes not stalked; frontal margin of cephalon and antennal insertions various .... Janiridae (p. 250)

15a. Body without spines or processes; peraeonal segments of markedly different widths; uropods small and inconspicuous or moderately long and uniramus; pleotelson always narrower than peraeon; peraeopod I gnathal and short, others long or extremely long and ambulatory or natatory; if eyes present they are stalked or laterally placed on bulges of cephalon 16

15b. Body usually with spines or processes or scales or if none of these present, first and sometimes other anterolateral corners of peraeonal segments produced anteriorwardly and usually those of peraeons III and IV acutely pointed; uropods conspicuous or inconspicuous and uni- or biramus; pleotelson with broadly rounded posterior border or shield-shaped, sometimes with medial posterior spine or posterior border; peraeopods various 17

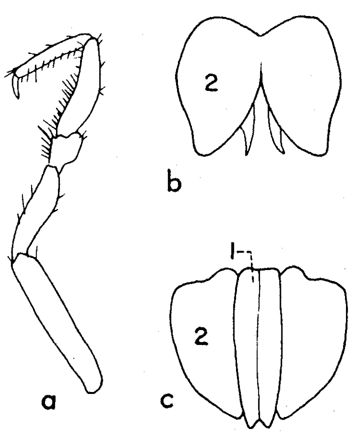


Figure 372. Peraeopod I and pleopods 2 (male) of Munnopsidae. a. Gnathal peraeopod I. b. Pleopods 2, male (fused) of eurycopids. c. Pleopod 1 and 2 *Munnopsis*.

16a. Blind; peraeon constricted after peraeonal segment IV; peraeopod I gnathal (Fig. 372a), II long and ambulatory, III and IV very long and ambulatory, V to VII natatory (and without dactyls); antennae one and two long; male pleopods two not fused at base (Fig. 372c) .... Munnopsidae (p. 288)

16b. Blind or not blind; pleotelson constricted where it attaches to peraeon, and always longer than wide; if eyes present they are laterally placed on stalks or bulges; peraeopod one short and gnathal, others elongate and ambulatory .... Munnidae (p. 289)

17a. Eyes, if present, dorsally located; maxillipedal palp always wide with articles two and three always much wider than four and five; peraeonal segment I usually with lateral lappets and dorsal spines (i. e., it is not markedly different from other segments); natatory peraeopods never present; pleotelson generally shield-shaped .... Janiridae (p. 250)

17b. Blind; maxillipedal palp various; peraeonal segments various; natatory peraeopods sometimes present on segments V and VI and VII 18

18a. Maxillipedal palp narrow for complete length (much narrower than endite) (Fig. 370n-p); peraeon I and VII simple and abruptly narrower than others; without dorsal spines or long lappets; all peraeopods ambulatory 19

18b. Maxillipedal palp with articles two and three wider than four and five, and generally as wide as or nearly as wide as endite; peraeonal segments never abruptly narrower than body; peraeopods I to IV ambulatory, V and VI or V, VI and VII natatory 20

19a. One lateral spine or lappet (sometimes with secondary spines on tip) on peraeonal segments II, III and IV; dorsal spines usually present .... Dendrotionidae (p. 299)

19b. Two lappets on peraeonal segments II, III and IV; dorsal spines rarely present .... Mesosignidae (p. 298)

20a. Antenna two very close together on medial part of frontal line; frontal line never greatly produced; body rarely with any fused segments; peraeonal segment V produced anteriorwardly; peraeonal segments VI and VII virtually never produced anteriorwardly; peraeopods I to IV ambulatory with I and II shorter than III and IV, V and VI natatory and VII ambulatory with natatory setal configuration .... Ilyarachnidae (p. 300)

20b. Antenna two never close together, almost always separated by produced anterior margin of cephalon; body sometimes with fused segments (usually peraeonal segments V, VI and VII); peraeonal segments V and also V, VI and VII produced anteriorwardly in most specimens; peraeopods I to IV ambulatory with only I much shorter than II, III and IV, V, VI and VII natatory (with dactyls) .... Eurycopidae (p. 302)

STENETRIIDAE

The species of this family represent primitive though modified members of the Asellota. They are much like species of the freshwater family Asellidae in their general body structure, and they have two free pleonal segments. There are also differences in the structure of the pleopods, the first three pleopods being very much modified (Fig. 373). The genus *Stenetrium,* the only representative of the family in North American waters, is composed of many species from both shallow and deep sea habitats. Species are frequently taken in coral reefs in tropical parts of the world. The North American species were taken from coral reefs in Bermuda and the West Indies. Males have the first peraeopod highly modified as a grasping appendage. The North American members of the genus are among the shorter species found in the genus.

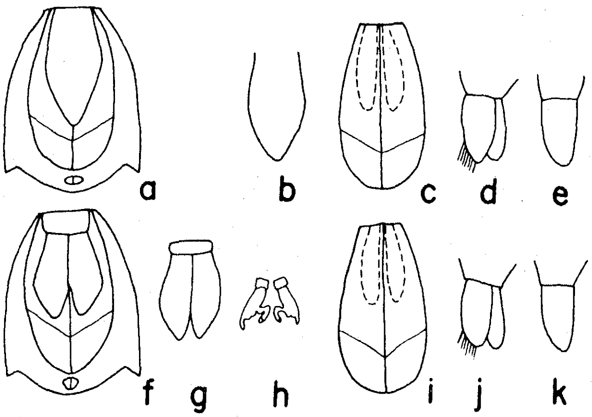


Figure 373. Ventral aspect of pleon and pleonal appendages of *Stenetrium.* a-e. Female. a. Ventral aspect of pleon. b. Pleopod 2. c. Operculate pleopods 3. d. Pleopod 4. e. Pleopod 5 (uniramus) f-k. Male. f. Ventral aspect of pleon. g. Pleopod 1. h. Pleopods 2. i. Pleopods 3. j. Pleopod 4. k. Pleopod 5 (uniramus).

Fig. 374. *Stenetrium serratum* (Hansen) (6 mm)

Range: St. Thomas, West Indies (Coral reef)

This species has very large teeth on the lateral edges of the pleotelson.

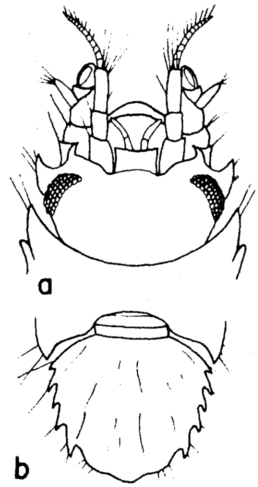


Figure 374. a. *Stenetrium serratum*, anterior part. b. Posterior.

Fig. 375. *Stenetrium occidentale* (Hansen) (3.3 mm)

Range: St. Thomas, West Indies (Coral reef)

This species has very large posterolateral angles on the pleotelson and the posterior margin is produced into a broad lobe.

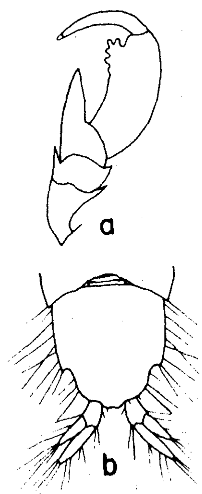


Figure 375. a. *Stenetrium occidentale*, peraeopod I (male). b. Posterior part.

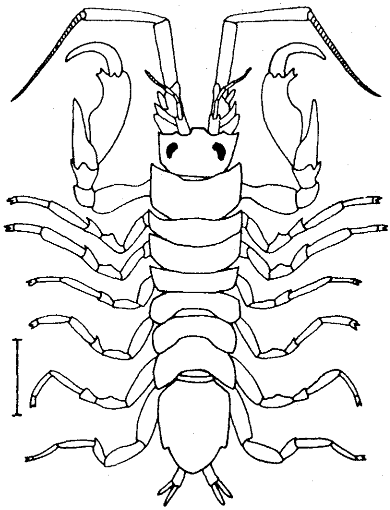


Figure 376. *Stenetrium antillense.*

Fig. 376. *Stenetrium antillense* (Hansen) (4.5 mm)

Range: West Indies (Shallow water)

This species has only two teeth on the produced inner distal angle of the propodus of male peraeopod I.

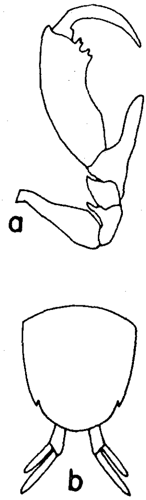


Figure 377. a. *Stenetrium stebbingi*, peraeopod I (male). b. Posterior part.

Fig. 377. *Stenetrium stebbingi* (Richardson)

Range: Bermuda (1/2 to 4 m)

This species, much like *S. occidentale* in appearance, has small posterolateral angles and a broadly rounded posterior margin on the pleotelson.

ASELLIDAE

Species of the family are found in most still and permanent bodies of freshwater in southern Canada and the northeastern part of the United States. There are many additional species and subspecies from caves and other underground water sources. Some species have been living in the underground dark habitats long enough to have become blind. The loss of eyes in total darkness is similar to that of species in the deep-sea.

Several species of asellids are commonly found widespread in North America. Specimens never have been critically examined and compared and they have not been consistently named. The genus with no named species is included here because there is no agreement as to what is the name of the most common North American species, or even if there is one "most common" North American species. Most freshwater isopods are in the family Asellidae, but species of the other families of other suborders get into freshwater. The freshwater species have different ancestors than terrestrial species. The asellid species are most closely related to the species of Stenetridae.

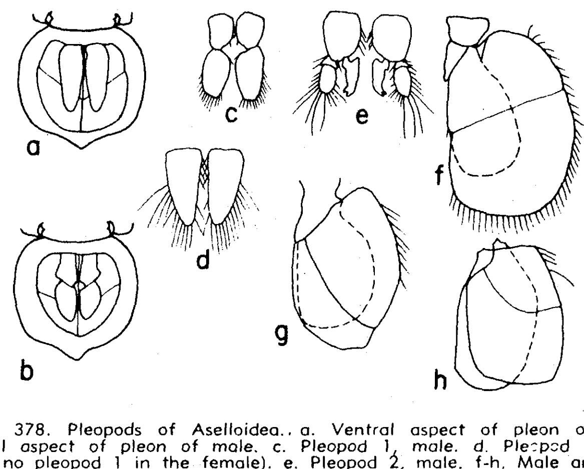


Figure 378. Pleopods of Aselloidea.. a. Ventral aspect of pleon of female. b. Ventral aspect of pleon of male. c. Pleopod 1, male. d. Pleopod 2, female (There is no pleopod 1 in the female). e. Pleopod 2, male. f-h. Male and female pleopods. f. 3. g. 4. h. 5 (biramus).

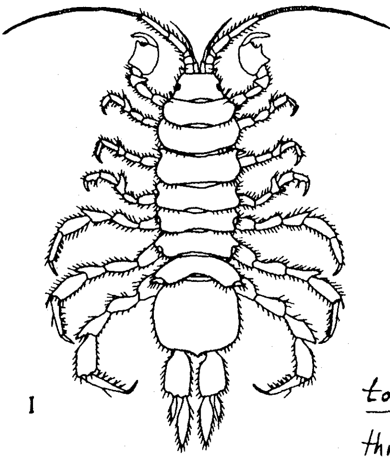


Figure 379. *Asellus* sp.

Fig. 379. *Asellus* sp. (10 to 30 mm)

Range: Much of southern Canada and the United States (Freshwater)

Probably several species. Asellus tomalensis Harford 1877 is common throughout N. Calif.

HAPLOMUNNA CAECA INCERTAE SEDIS

This asellote has never convincingly been placed in a category higher than genus. It appears to be a munnid, but there are some differences which make it impossible to assign it to that family. The species was not well described.

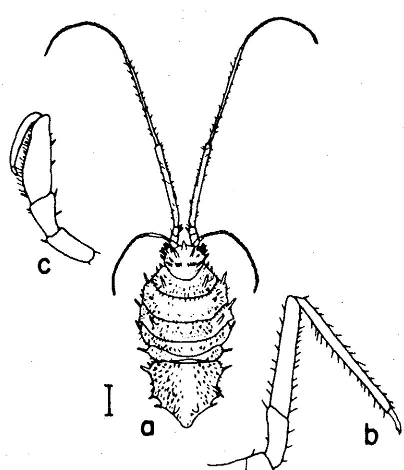


Figure 380. a. *Haplomunna caeca*. b. Peraeopod II. c. Peraeopod I.

Fig. 380. *Haplomunna caeca* (Richardson) (8 mm)

Range: Off Santa Catalina Island, California (3990 m)

This species is only indirectly related to the species of *Munna* that are described in this book. It is not clear whether it would be included in the family Munnidae or not. The species is blind and the type and only one in the genus.

ISCHNOMESIDAE

The species of this family are interesting to see. When viewed alone or drawn without appendages they look like a turned piece of wood—like the rung of the back of an old rocking chair. When grouped together in a bowl awaiting study they look like a bunch of twigs. They are the walking sticks among the isopods. The segments of the elongate body of the ischnomesids are fused in various ways and the appendages are thought to be long, but for most species they have never been seen. The body of the species is generally highly calcareous and they can become very brittle if not preserved properly. The general body configuration, the presence or absence of free or fused segments and the type of uropods are used as criteria to distinguish the different genera. There are eight known genera three of which have been recorded in North American waters. The genus *Ischnomesus*, the largest of the family, contains about 20 species. *Heteromesus* and *Haplomesus* contain 8 and 11 species respectively, but only one species of *Haplomesus* and three species of *Heteromesus* have been recorded from North American waters.

KEY TO THE GENERA OF ISCHNOMESIDAE

1a. Uropod with basis only; pleon with segments completely fused and various numbers of peraeonal segments also fused and many times fused with pleon 2

1b. Uropods with one ramus (uniramus); pleon with one free segment and with little or no indication of other segments .... *Ischnomesus*

Fig. 381. *Ischnomesus profundus* (Hansen) (4 mm)

Range: North Atlantic, southern part of Davis Strait (3521 m)

No long anterolateral projections are present on the peraeonal segments of this species.

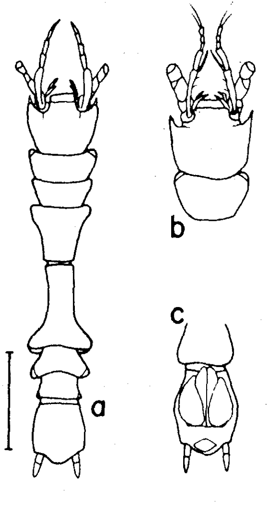


Figure 381. a. *Ischnomesus profundus*. b. Anterior part. c. Posterior part.

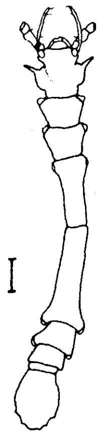


Figure 382. *Ischnomesus caribbicus.*

Fig. 382. *Ischnomesus caribbicus* (Menzies) 7.8 mm)

Range: Caribbean Sea (1714 m)

Only peraeonal segment I which is fused to the cephalon has the anterolateral corners produced.

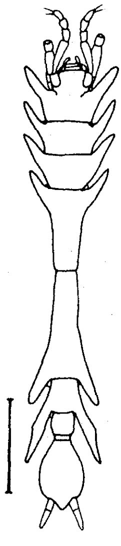


Figure 383 (a) *Ischnomesus armatus.*

Fig. 383(a). *Ischnomesus aramtus* (Hansen) (4.8 mm)

Range: Davis Strait to north of Puerto Rico (2702 to 5494 m)

Peraeonal segments I to VI are armed with large spines.

Fig. 383(b). *Ischnomeus multispinis* (Menzies) (7.4 mm)

Range: Caribbean Sea (975 m)

Many large spines are present on this species.

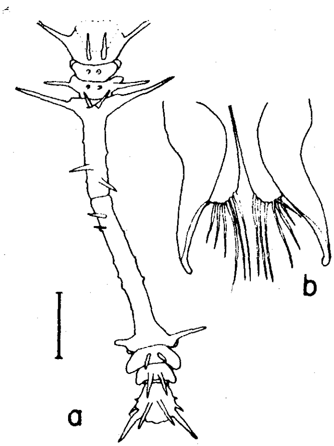


Figure 383(b) a. *'schnomesus multispinis*. b. Apex pleopod 1, male.

2a. Peraeonal segments VI and VII and pleon fused as unit; flagellum of antenna one rudimentary .... *Heteromesus*

Fig. 384. *Heteromesus spinescens* (Richardson)

Range: Georges Bank to Virginia (2155 to 3337 m)

The anterior part of the lateral margins of the pleon are bulged in this species.

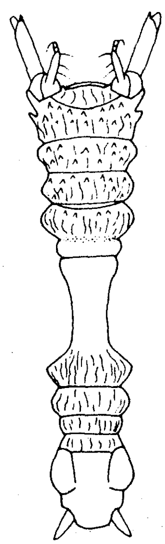


Figure 384. *Heteromesus spinescens.*

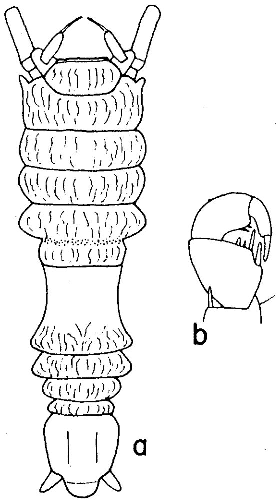


Figure 385. a. *Heteromesus grandulatus*. b. Peraeopod I.

Fig. 385. *Heteromesus granulatus* (Richardson)

Range: South of Martha's Vineyard to Block Island, New York (713 to 3235 m)

The lateral borders of the pleon are regularly convex.

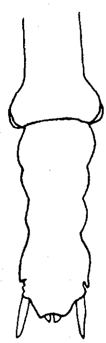


Figure 386. *Heteromesus bifurcatus*.

Fig. 386. *Heteromesus bifurcatus* (Menzies) (3.5 mm)

Range: Caribbean Sea, north of Columbia (4071 m)

This species, known only from the posterior part of the animal, has furrows representing pleonal segments.

2b. Peraeonal segments V to VII and pleon fused; antenna one with flagellum not rudimentary; i. e., normal .... *Haplomesus*

Fig. 387. *Haplomesus tropicalis* (Menzies) (4.1 mm)

Range: Caribbean Sea, north of Columbia (4071 m)

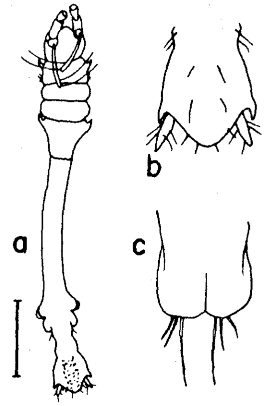


Figure 387. a. *Haplomesus tropicalis*. b. Detail, posterior part. c. Detail, apex male pleopod 1.

Fig. 388. *Haplomesus quadrispinosus* (Sars) (4.5 mm)

Range: Davis Strait (3420 m)

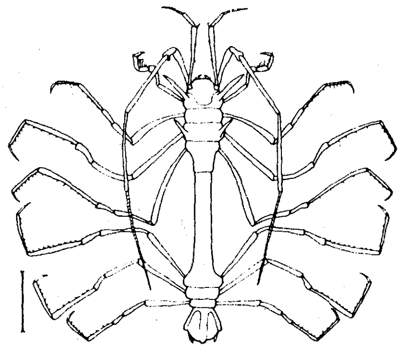


Figure 388. *Haplomesus quadrispinosus*.

ECHINOTHAMBEMATIDAE

This is a good example of a single specimen that is so different from other species that it forms the basis of, not just a new species or genus, but a new family as well. The differences that distinguish the specimen from others are logical differences and are of such a nature as to be considered biologically normal; hence, the specimen is not considered a freak or injured specimen or a specimen that has grown up distorted. There are two spines on peraeonal segment II which probably indicates two lateral lappets. Peraeonal segment VII and peonal segment I each have a single spine and are fused into one large body section. Antenna one has a large flattened basal segment and antenna two is normal.

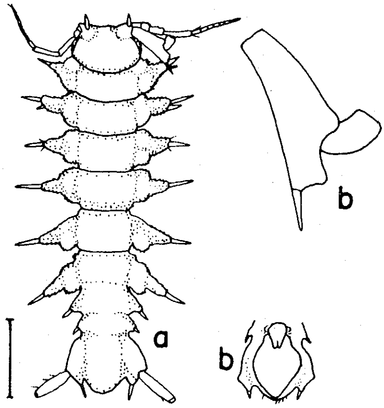


Figure 389. a. *Echinothambema ophiuroides*. b. Antenna one. c. Ventral aspect of pleon, intersex.

Fig. 389. *Echinothambema ophiuroides* (Menzies) (5 mm)

Range: North of Puerto Rico (5104 to 5122 m)

The specimen on which the species is based in an intersex; i. e., it is not a male or female, but rather has some of the external structures of both.

ANTIASIDAE

There are about 12 species in three genera in the family. They are small species and in some ways resemble species of Munnidae. Occasionally species of the family have eyes, but most are blind. There are never more than three articles in the flagellum of antenna one. Peraeopod I is prehensile; the remaining ones are ambulatory with two dactyl claws. Biramus uropods are found and they are inserted dorsally or laterally on the pleotelson. Two genera each with one species are known from North American waters.

KEY TO GENERA OF ANTIASIDAE

1a. Blind; frontal margin of cephalon finely serrated; short uropods inserted dorsally on pleotelson .... *Abyssianira*

Fig. 390. *Abyssianira dentifrons* (Menzies) (2.8 mm)

Range: North of Puerto Rico (5104 to 5122 m)

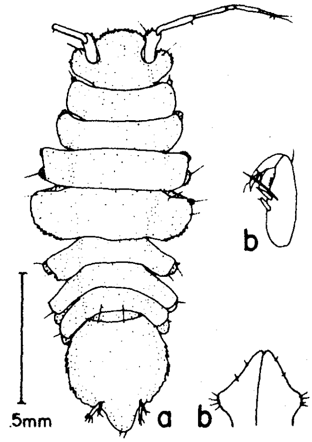


Figure 390. a. *Abyssianira dentifrons*. b. Peraeopod I. c. Detail, apex male pleopod 1.

1b. With eyes; frontal margin smooth or with spines; deep antero-lateral indentations for antennae; uropods inserted laterally or sometimes dorsolaterally .... *Antias*

Fig. 391. *Antias hirsutus* (Menzies) (1.5 mm)

Range: Tomales Bluff, California (Intertidal)

All five articles on the maxillipedal palp are narrow on this species.

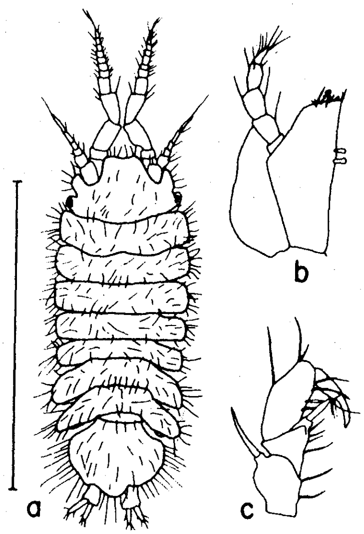


Figure 391. a. *Antias hirsutus*. b. Maxilliped. c. Peraeopod I.

JANIRIDAE

This family is one of the most diverse asellote families and contains common well defined species as well as poorly defined ones. The species have very little in common and yet there are not really well defined differences that separate them; hence, much difficulty is encountered when it comes to putting the species into taxonomic categories within the family. There have been many published attempts to organize the family, either by removing the troublesome species to other facilities or by making a very broad definition of the family to include all of its diverse elements. Neither method has been too successful. Here the genera and species are put together in one broadly defined group which is called the family Janiridae.

Both blind and species with eyes are included and they are from very diverse ecological and geographical regions. There are species from near-shore and species from the deep-sea. The body of the species is usually dorsoventrally compressed. The cephalon, peraeonal segments and anterior one or two pleonal segments are usually free and not fused. Generally there are two free pleonal segments, but they are generally too small and indistinct to be useful as key characters. The pleon, except for the anterior segments, is generally shield shaped. The mouth parts of the animals are normal; i. e., there are no criteria that can be used to set them apart from those of other species. The first peraeopod is for most species gnathal or prehensile, and the next six are ambulatory. There are two or sometimes three claws on the dactyls (Figs. 29d and 369f). The uropods are usually biramus, but there are some species on which they are uniramus. There are about 35 genera in the family and 13 of them have representatives in North American waters.

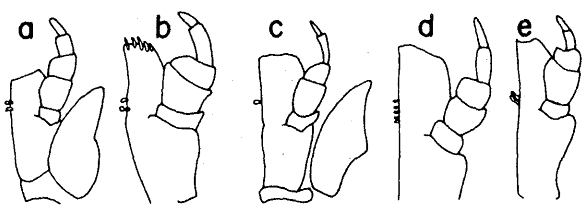


Figure 392. Maxillipeds of some janirid genera. a. *Ianirella*. b. *Ianiropsis*. c. *Janira*. d. *Acanthomunnq*. e. *Rhacura*.

KEY TO GENERA AND SPECIES OF JANIRIDAE

1a. With large spines (lateral lappets and/or dorsal projections) 3

1b. Body smooth (lateral processes if present short) 2

2a. Eyes present 11

2b. Eyes absent 9

3a. Blind; lateral borders of pleotelson with at least three sets of lateral projections; rostrum produced, but not into acute projection 7

3b. With eyes; pleotelson with single large posterolateral angle; single acutely pointed anterolateral lappet on cephalon; rostrum produced into acutely pointed spine .... *Ioella*

KEY TO SPECIES OF IOELLA

4a. Body with dorsal spines 5

4b. Body without dorsal spines 6

5a. Pleotelson with large tubercles .... *I. speciosa*

Fig. 393. *Ioella speciosa* (Bovallius) (21.5 mm)
Range: Baffin Bay, Canada

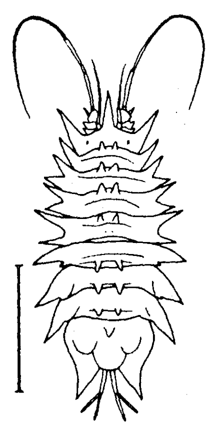


Figure 393. *Ioella speciosa*.

5b. Pleotelson relatively smooth .... *I. spinosa*

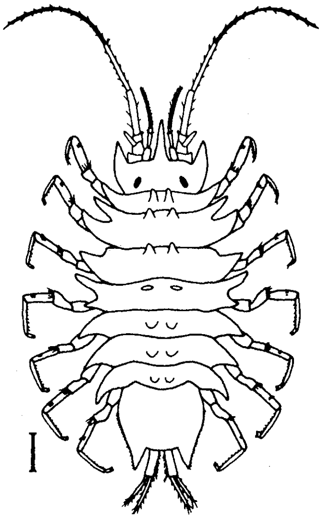


Figure 394. *Ioella spinosa.*

Fig. 394. *Ioella spinosa* (Harger) (8 mm)

Range: Davis Strait (146 to 183 m)

6a. Posterolateral angles of pleotelson short, not much longer than medial margin .... *I. libbeyi*

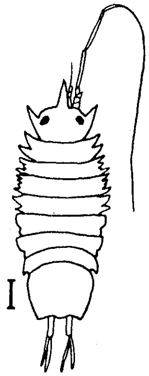


Figure 395. *Ioella libbeyi.*

Fig. 395. *Ioella libbeyi* (Ortmann) (8 mm)

Range: Cape Alexander, North Greenland

6b. Posterolateral angles of pleotelson long, much longer than medial margin .... *I. glabra*

Fig. 396. *Ioella glabra* (Richardson)

Range: Off Cape Hatteras, North Carolina (1624 m)

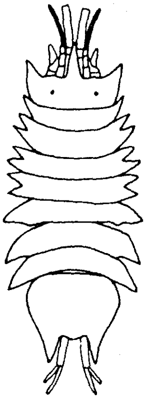


Figure 396. *Ioella glabra.*

7a. Lateral border of cephalon with two lateral projections; lappets on peraeonal segments according to formula—1, 2, 2, 1, 2, 2, 3 .... *Rhacura*

Fig. 397. *Rhacura pulchra* (Richardson)

Range: Georges Bank (3219 m)

Minute eyes are present on this type and only species of the genus. The first pair of peraeopods are prehensile and the other pairs are ambulatory.

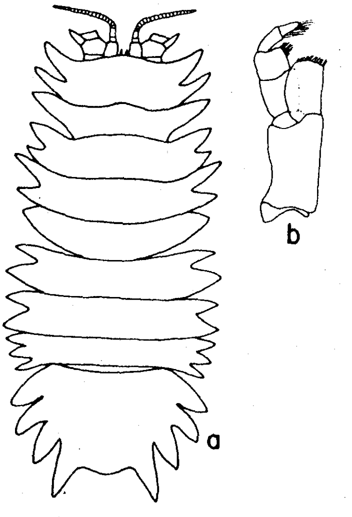


Figure 397. a. *Rhacura pulchra.* b. Maxilliped.

7b. **Lateral border of cephalon with only one prominent spine; lappets on peraeonal segments arranged according to formula –1, 2, 2, 2, 1, 1, 1** 8

8a. **Dorsal spines and strongly produced lateral spines on peraeon and pleon; pleotelson secondarily produced posteriorward with two spines on posterior margin; uropods biramus** .... *Microproctus*

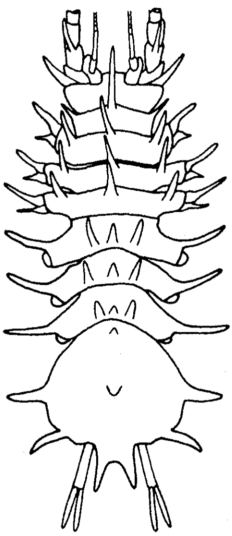


Figure 398. *Microproctus caecus.*

Fig. 398. *Microproctus caecus* (Richardson) (12 mm)

Range: Bering Sea, near Agattu, Aleutian Islands (549 m)

This blind, pigmented species is the type and only species in the genus. The species description is based on one male specimen.

8b. **No dorsal spines, only lateral lappets; pleotelson much narrower than peraeonal segment II; uropods uniramus** .... *Ianirella*

GENUS IANIRELLA

There are eleven species in the genus. All are from the Atlantic Ocean, but only three are from North American waters.

Fig. 399. *Ianirella lobata* (Richardson)

Range: Southeast of Georges Bank (2480 to 3225 m)

This species has parallel rows of mediodorsal spines and lateral lappets that are rounded apically and apparently without spines.

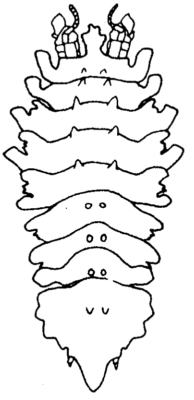


Figure 399. *Ianirella lobata.*

Fig. 400. *Ianirella vemae* (Menzies) (3.3 mm)

Range: North of Puerto Rico (5104 to 5122 m)

No dorsal spines are present on this species. It might perhaps be a juvenile form of the species *I. caribbica.*

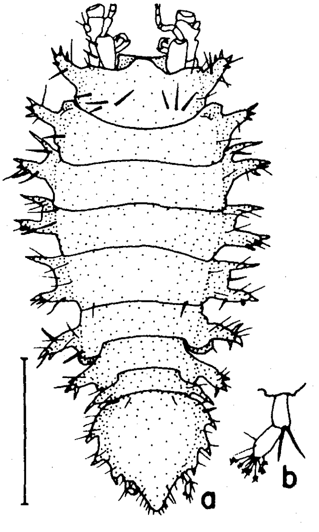


Figure 400. a. *Ianirella vemae.* b. Uropod.

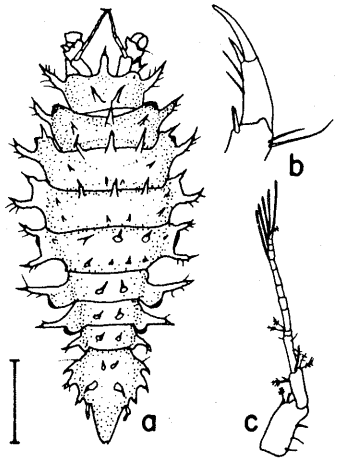


Figure 401. a. *Ianirella caribbica.* b. Peraeopod I. c. Antenna one.

Fig. 401. *Ianirella caribbica* (Menzies) (5.5 mm)

Range: Caribbean Sea, south of Jamaica (1244 m)

The juvenile of this species perhaps is the species *I. vemae* which has no spines. More must be learned to discover if dorsal spines are an adult character.

9a. Body with subparallel lateral borders **10**

9b. Body with peraeonal segment IV widest .... *Abyssijaera*

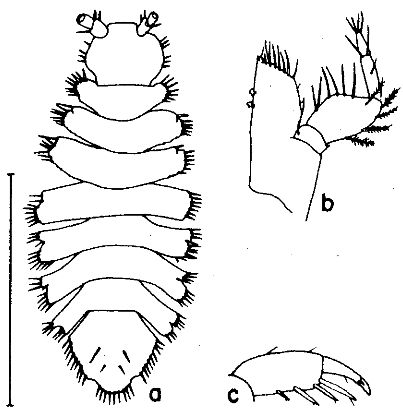


Figure 402. a. *Abyssijaera acarina.* b. Maxilliped. c. Peraeopod I.

Fig. 402. *Abyssijaera acarina* (Menzies) (1.6 mm)

Range: South of Bermuda (5779 m)

This species forms the type of a new genus of which there are now several species known.

10a. Body elongate; antenna one with first basal segment elongate, but not wide; uropod elongate with endopod much longer than exopod .... *Caecianiropsis*

Fig. 403. *Caecianiropsis psammophila* (Menzies and Pettit) (2.2 mm)

Range: Mid-California (Intertidal)

This blind species lives between the sand grains on the intertidal beaches. They live several centimeters below the surface and can be quite abundant. It shares the sand beach habitat with species of *Microcerberus* (p. 216).

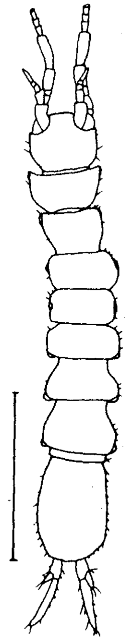


Figure 403. *Caecianiropsis psammophila.*

10b. Body oblong, compact; antenna one with very broad basal segment; uropod short arising from notches in border of pleotelson, both rami short .... *Caecijaera*

Fig. 404. *Caecijaera horvathi* (Menzies) (1.7 mm)

Range: Los Angeles Harbor, California (Intertidal)

This very small, blind species is commensal with the boring isopod *Limnoria*. *Limnoria* specimens, which are about twice as large as *C. horvathi* specimens, burrow into wood and the burrows also serve as the home of *C. horvathi*. *Limnoria* species have been found without the *C. horvathi* species, but *C. horvathi* have never been found without their *Limnoria* host to make the holes.

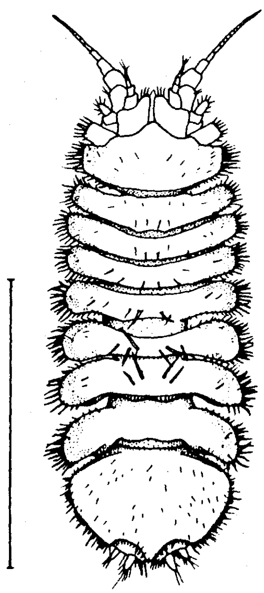


Figure 404. *Caecijaera horvathi.*

11a. Lateral margins of peraeon subparallel 12

11b. Lateral margins of peraeon convex, or at least some of peraeonal segments noticably larger than others 24

12a. Frontal margin of cephalon without medial projection; pleon variously attached to peraeon; anterolateral angles of peraeonal segments II, III and IV produced only slightly or not at all 17

12b. Frontal margin of cephalon with rostral projection; pleon narrowly attached to peraeon; anterolateral angles of peraeons II, III and IV produced .... *Janira*

GENUS JANIRA

The species in this genus, although common, are not known as well as they should be because most of the descriptions of the species are old and too general for critical taxonomic distinctions. The species listed here in the genus most probably represent a heterogeneous assemblage of genera.

KEY TO SPECIES OF JANIRA

13a. Pleotelson with posterolateral angles or crenulations on posterior margin 15

13b. Pleotelson with no posterolateral angles or crenulations on posterior margin .... *J. minuta*

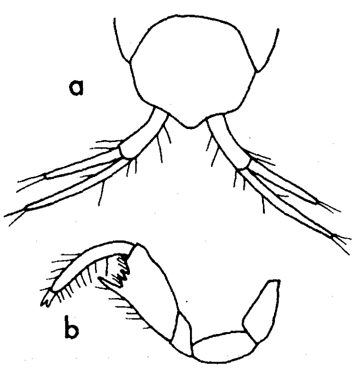


Figure 405. a. *Janira minuta*, posterior part. b. Peraeopod I, male.

Fig. 405. *Janira minuta* (Richardson)

Range: Castle Harbor, Bermuda (In dead coral)

14a. Posterolateral angles present and widely separate .... *J. tricornis*

Fig. 406. *Janira tricornis* (Kroyer)

Range: Greenland (9 to 91 m)

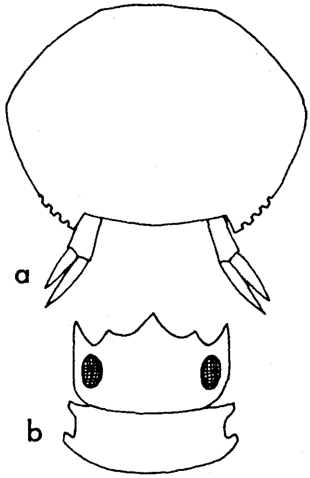


Figure 406. a. *Janira tricornis*, posterior part. b. Anterior part.

14b. Crenulations only present in posterolateral margins 15

15a. Length of one posterolateral crenulated margin longer than small medial crenulated margin .... *J. maculosa*

Fig. 407. *Janira maculosa* (Leach) (10 mm)

Range: Davis Strait (55 to 212 m)

This species has been recorded from the west coast of North America, but the report was probably in error or the specimen was really *J. occidentalis* which has now been placed in *Janiralata* (p. 265)

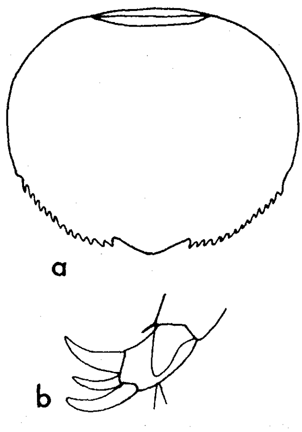


Figure 407. a. *Janira maculosa*, posterior part. b. Peraeopod V.

15b. Length of one posterolateral crenulation equal to or shorter than medial non-crenulated portion of posterior margin of pleotelson .... *J. alta*

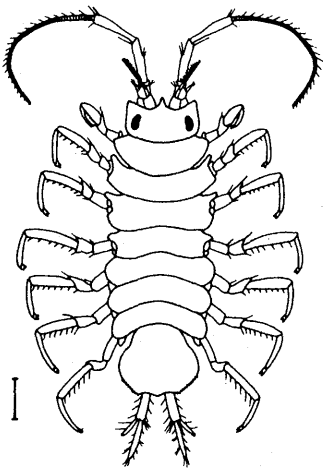


Figure 408. *Janira alta.*

Fig. 408. *Janira alta* (Stimpson) 7 mm)

Range: Nova Scotia to Chesapeake Bay (64 to 891 m)

16a. Cephalon and pleotelson abruptly narrower than peraeon and shorter than two peraeonal segments; peraeopod I subchelate in male, all others ambulatory .... *Carpias*

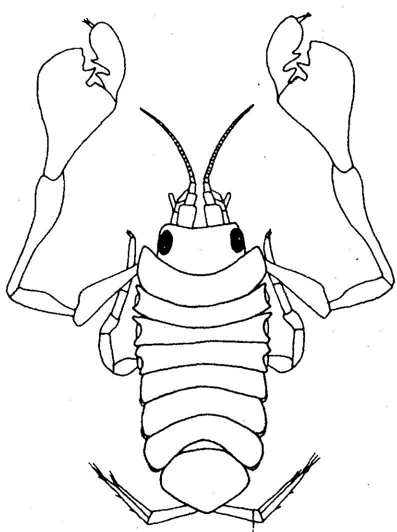


Figure 409. *Carpias bermudensis.*

Fig. 409. *Carpias bermudensis* (Richardson) (2.5 mm)

Range: Bermuda (Shallow water)

In this species the male has a very large subchelate peraeopod I. The female peraeopod I resembles that of the other peraeopods.

16b. Cephalon and pleotelson about as broad as peraeon and about as long as two peraeonal segments; all peraeopods ambulatory .... *Ianiropsis*

GENUS IANIROPSIS

The species of the genus are very common on the sea coasts of the world. There are three claws on the dactyls of peraeopods II to VII; only two are found on peraeopod I. The frontal margin of the cephalon is nearly straight, or only slightly produced, with rounded anterolateral corners in most species.

17a. Lateral borders of pleotelson with small teeth **18**

17b. Lateral borders of pleotelson smooth **20**

18a. Lateral borders of pleotelson with more than four teeth; frontal margin of cephalon rounded with small anterolateral projections .... *I. analoga*

Fig. 410. *Ianiropsis analoga* (Menzies) (3.7 mm)

Range: Northern Washington to Mid-California (Intertidal)

The specimens were taken from under rocks and from under the holdfasts of algae.

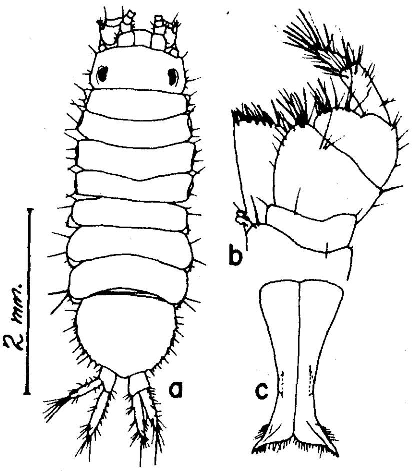


Figure 410. a. *Ianiropsis analoga*. b. Maxilliped. c. Pleopod 1, male.

18b. Lateral borders of pleotelson with less than four teeth; frontal margin of cephalon trisinuate **19**

19a. Peraeonal segment V with anterolateral borders rounded; pleotelson about as long as wide; uropods about as long as pleotelson .... *I. epilittoralis*

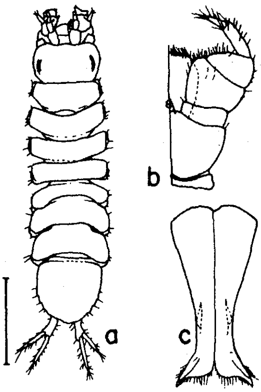


Figure 411. a. *Ianiropsis epilittoralis*. b. Maxilliped. c. Pleopod 1, male.

Fig. 411. *Ianiropsis epilittoralis* (Menzies) (3.8 mm)

Range: Mid-California (Intertidal)
This species was found in tidal pools.
Dillon Beach to San Luis Obispo.

19b. Peraeonal segment V with nearly square anterolateral corners; pleotelson shorter than wide; uropods shorter than pleotelson .... *I. tridens*

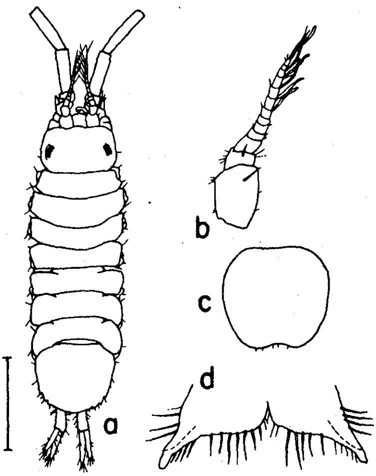


Fig. 412-413. *Ianiropsis tridens* (Menzies) (2.5 mm)

Range: Puget Sound, Washington to northern Chile (Intertidal)

The species is common on algae and is occasionally found in sponges.

Figure 412. a. *Ianiropsis tridens*. b. Antenna one. c. Pleopod 2, female. c. Detail, pleopod 1 male.

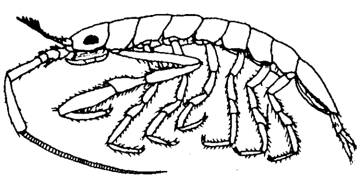


Figure 413. *Ianiropsis tridens*, lateral view.

20a. Frontal margin of cephalon with anterior margin not produced, but trisinuate; no anterolateral corners present 21
20b. Frontal margin of cephalon acutely produced; small anterolateral corners present .... *I. magnocola*

Fig. 414. *Ianiropsis magnocola* (Menzies) (2.2 mm)

Range: Puget Sound, Washington to Mid-California (20 to 57 m)

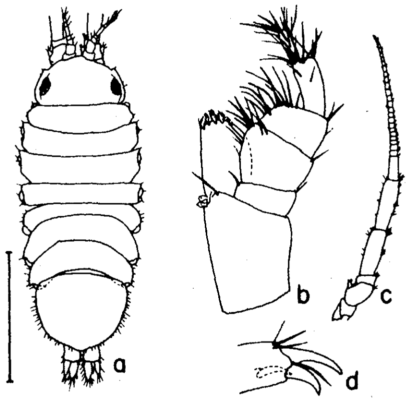


Figure 414. a. *Ianiropsis magnocula*. b. Maxilliped. c. Antenna two. d. Peraeopods II to VII.

21a. Uropods shorter than pleotelson 22
21b. Uropods elongate, much longer than pleotelson .... *I. montereyensis*

Fig. 415. *Ianiropsis montereyensis* (Menzies) (3.6 mm)

Range: Mid-California (Intertidal)

The species was found under rocks on a rocky beach below high tide level.

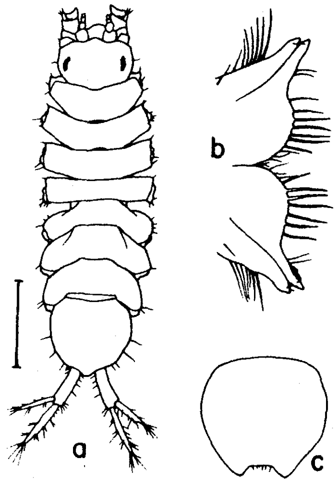


Figure 415. a. *Ianiropsis montereyensis*. b. Detail, pleopod 1, male. c. Pleopod 2, female.

22a. Body with lateral margins parallel and lateral parts of peraeonal segments together; cephalon quadrate, broadly attached to peraeonal segment I .... *I. minuta*

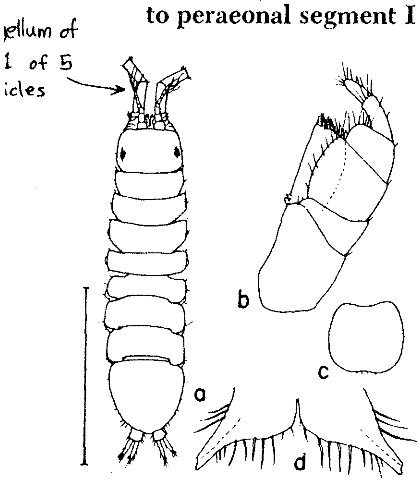


Figure 416. a. *Ianiropsis minuta*. b. Maxilliped. c. Pleopod 2, female. d. Detail pleopod 1 male.

Fig. 416. *Ianiropsis minuta* (Menzies) (1.3 mm)

Range: Mid-California (Intertidal)

The species was collected among rocks and in sand.

22b. Body with lateral margins with cephalon and pleon narrower than peraeon and lateral parts of peraeonal segments separated at ends; cephalon much wider than long and narrowly attached to peraeonal segment I .... *I. kincaidi*

Fig. 417. *Ianiropsis kincaidi kincaidi* (Richardson) (3.8 mm)

Range: Bering Sea to Mid-California (Surface to 69 m)

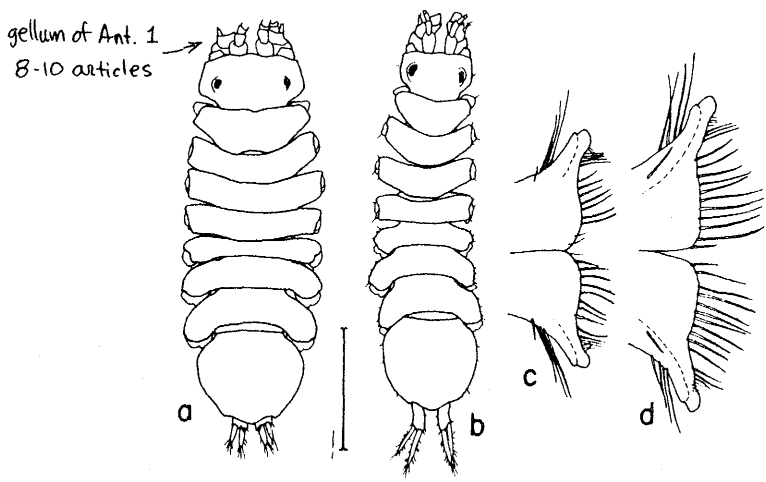


Figure 417. a. *Ianiropsis kincaidi kincaidi*. b. *I. k. derjugini*. c. Detail pleopod 1, male (*I. k. derjugini*). d. Detail pleopod 1, male (*I. k. kincaidi*).

The subspecies *I. kincaidi derjugini* Gurjanova (2.5 m) has been described within the range of the parent species. It (Fig. 417b) is narrow with elongate uropods when compared to the parent species (Fig. 417a).

23a. Cephalon with no medial rostral spine or process, but with acutely produced anterolateral projections; uropods either short or long 30

23b. Cephalon with or without medial rostral spine and acutely produced anterolateral projections; uropods elongate extending well beyond body margin; peraeonal segments II, III and IV with indented lateral margins; peraeonal segments V, VI and VII with indented posterolateral margins .... *Janiralata*

GENUS JANIRALATA

The species of this genus ought to be compared more closely with those of the genus *Janira*. They are very similar in many features. Most of the species of the genus are found in shallow, near shore habitats.

KEY TO SPECIES OF JANIRALATA

24a. Three lobes (posterolateral corners and medial lobe) or five lobes present and prominent on frontal margin of cephalon 25

24b. No anterolateral lobes present; medial margin of cephalon only slightly produced .... *J. rajata*

Fig. 418. *Janiralata rajata* (Menzies) (4 mm)

Range: Monterey Bay, California (37 m)

The specimens were taken from the egg cases of ray fish.

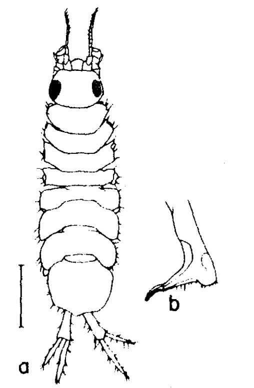


Figure 418. a. *Janiralata rajata*. b. 1/2 of pleopod 1, male.

Janiralata davisi Menzies 1951
intertidal; Monterey, Calif.

on frontal margin of cephalon

25a. Five lobes (posterolateral corners enclose medial lobe and one on each side of it); medial and anterolateral lobes of cephalon greatly produced or not greatly produced 27

25b. Three lobes only present; medial and anterolateral margins of cephalon only slightly produced 26

26a. Cephalon greatly wider than widest part of peraeon .... *J. occidentalis*

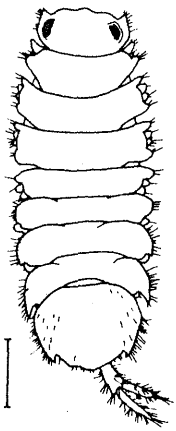


Figure 419. *Janiralata occidentalis.*

Fig. 419. *Janiralata occidentalis* (Walker) (5.5 mm)

Range: Puget Sound, Washington to Laguna Beach, California (18 to 69 m)

26b. Cephalon not greatly wider than widest part of peraeon .... *J. sarsi*

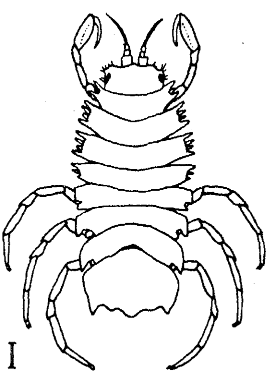


Figure 420. *Janiralata sarsi.*

Fig. 420. *Janiralata sarsi* (Richardson) (10.5 mm)

Range: Amchitka Islands, Alaska (15 m)

27a. Posterolateral corners of pleotelson pointed 28

27b. **Posterolateral corners of pleotelson rounded (the three lobes on the posterior margin are about the same size.) 29**

28a. **Anterolateral corner and one lateral lappet or one bifurcate lateral lappet on cephalon 30**

28b. **Single anterolateral corner, no lateral lappets on cephalon .... *J. solasteri***

Fig. 421. *Janiralata solasteri* (Hatch) (5.7 mm)

Range: Alaska to southern California (Shallow water)

I've seen specimens from Gulf of Alaska soft-bottom subtidal.

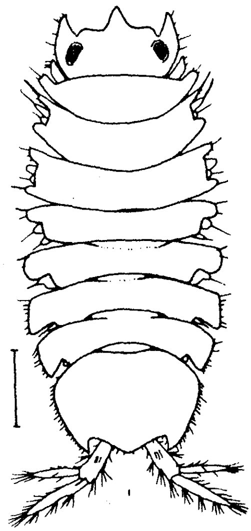


Figure 421. *Janiralata solasteri.*

29a. **Medial margin of cephalon greatly produced ...... *J. triangulata***

Fig. 422. *Janiralata triangulata* (Richardson) (3.8 mm)

Range: Monterey Bay, California (Shallow water)

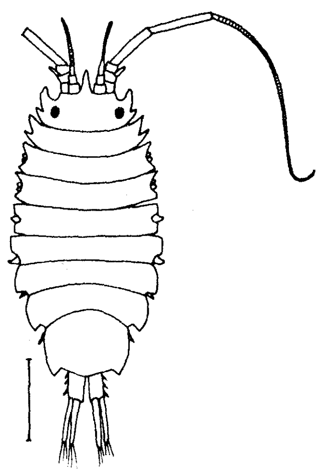


Figure 422. *Janiralata triangulata.*

29b. Medial margin of cephalon not greatly produced .... *J. holmesi*

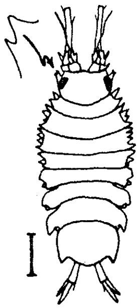


Figure 423. *Janiralata holmsei.*

Fig. 423. *Janiralata holmesi* (Richardson) (5.6 mm)

Range: Stephens Passage and southeastern Alaska (80 to 344 m)

30a. Medial margin of cephalon greatly produced .... *J. alascensis*

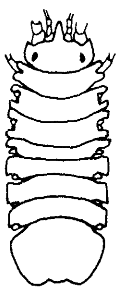


Figure 424. *Janiralata alascensis.*

Fig. 424. *Janiralata alascensis* (Richardson)

Range: Just south of Alaskan Peninsula (35 m)

30b. Medial margin of cephalon not greatly produced .. *J. erostrata*

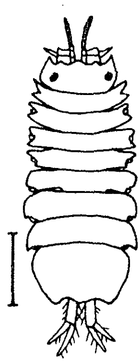


Figure 425. *Janiralata erostrata.*

Fig. 425. *Janiralata erostrata* (Richardson) (3.5 mm)

Range: Attu, Aleutian Islands (Subtidal)

31a. Uropods short with short rami, not extending much if at all beyond posterior margin of pleotelson .... *Jaera*

Fig. 426. *Jaera marina* (Fabricus) (3 mm)

Range: Laborador to New York (Intertidal)

This is one of the most frequently encountered species in the intertidal and slightly below the low tide waters of northeastern North America. It is frequently found in tide pools and other shallow water retreats. Occasionally the species is found in brackish water.

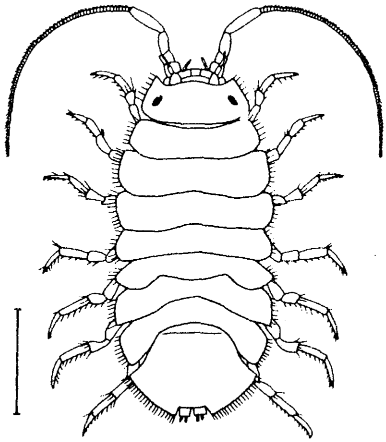


Figure 426. *Jaera marina.*

No. Fig. *Jaera wakishiana* (Spence Bate)
Range: Esquimault Harbor, British Columbia (Intertidal)

The species is named after the tribe of Indians on whose land it was collected. No figure or really good description of the species is to be found.

31b. Uropods with long rami, extending beyond posterior margin of pleotelson .... *Iais*

Fig. 427. *Iais californica* (Richardson) (1.9 mm)

Range: ~~Sausalito,~~ Humboldt Bay to Newport Bay California (Shallow water)

The species is found almost exclusively among the pleopods of the species *Sphaeroma pentodon* (p. 129), an isopod that burrows into soft rock.

Also reported from Australia, New Zealand & Singapore.

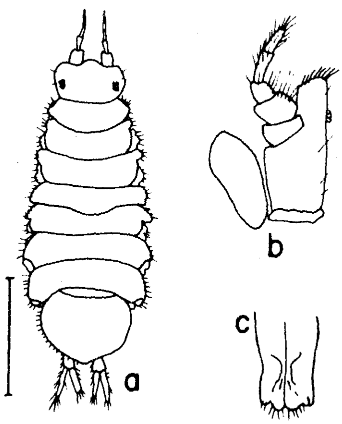


Figure 427. a. *Iais californica.* b. Maxilliped. c. Detail, pleopod 1, male.

HAPLONISCIDAE

"Haplo-" in Greek means plain or without ornamentation and when one first encounters a member of the family Haploniscidae the name seems appropriate. After much study of many specimens, however, certain consistent differences are discovered, and it is soon realized that the animals are not plain at all, but rather are part of a group with a very complex, but very subtle morphological diversity.

The species are almost all from the deep-sea where they are apparently somewhat like terrestrial isopods in their general biology. They are very small and blind and crawl about on short legs on the bottom where they are most probably omnivorous detritus feeders. Their exoskeletons are highly calcified in most species. In addition to male-female differences there are also intersexes with their particular differences. They have a morphology that is intermediate between that of males and females in some ways and it is also like that of juveniles. Confusion then in placing specimens in the correct genus and species can result.

The species of the genus are one of the most frequently encountered groups found in the deep-sea and four genera and eight species are included here. The species of the family are so numerous and so geographically widespread that when more deep-sea regions are explored many more genera and species will be discovered.

A KEY TO THE GENERA OF HAPLONISCIDAE

1a. Uropods shaped like ten-pins (Fig. 428b) .... *Apsidoniscus*

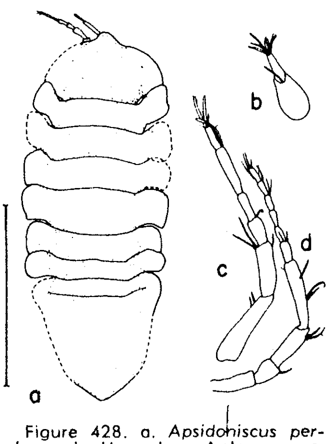


Figure 428. a. *Apsidoniscus perplexus*. b. Uropod. c. Antenna one. d. Antenna two.

Fig. 428. *Apsidoniscus perplexus* (Menzies and Schultz) (2.1 mm)

Range: Caribbean Sea, north of Columbia (3071 m)

This is the type and only species in the genus.

1b. Uropods, if present, with more or less parallel edges 2

2a. Antenna two with fifth and sixth peduncular segments fused (Fig. 35e); subrostral plate quite large .... *Antennuloniscus*

Fig. 429. *Antennuloniscus dimeroceras* (Barnard) (2.2 mm)

Range: North of Puerto Rico (1816 m)

The species is the type-species of the genus.

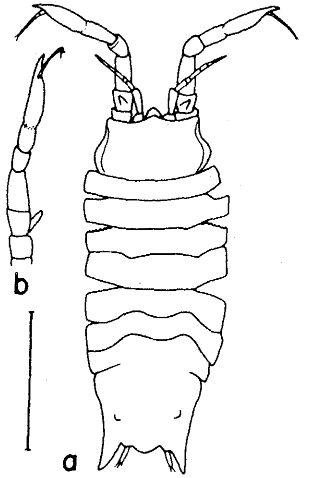


Figure 429. a. *Antennuloniscus dimeroceras*. b. Antenna two.

2b. Antenna two with fifth and sixth peduncular segment not fused (Fig. 35h); subrostral plate somewhat small 3

3a. Antenna two and antenna one with basal segment of peduncle much larger and greater in diameter than other segments (a spine is frequently present on peduncular segment three—Fig. 35h); last three segments of peraeon never abruptly wider than four anterior segments; posterior lateral angles of pleotelson usually developed, sometimes greatly so; frontal margin produced or not produced .... *Haploniscus*

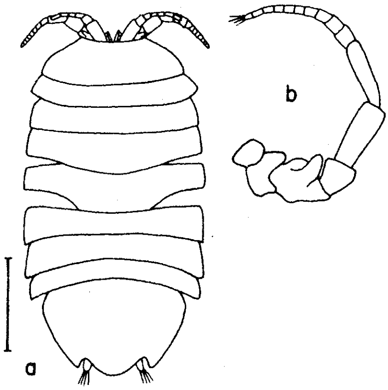


Figure 430. a. *Haploniscus excisus.* b. Antenna two.

Fig. 430. *Haploniscus excisus* (Richardson) (3.5 mm)

Range: Georges Banks and North Atlantic (3235 m)
This species is the type-species of the genus.

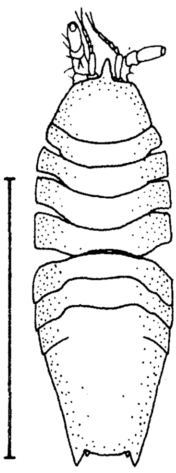


Figure 431. *Haploniscus unicornis.*

Fig. 431. *Haploniscus unicornis* (Menzies) (1.5 mm)

Range: North of Puerto Rico (5104 to 5122 m)

Fig. 432. *Haploniscus tropicalis* (Menzies) (1.5 mm)

Range: Caribbean Sea (1714 m)

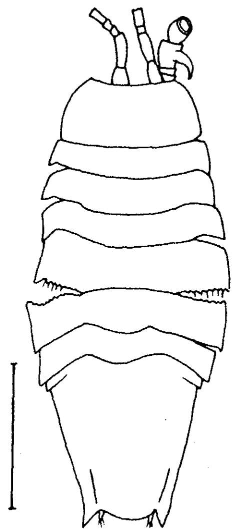


Figure 432. *Haploniscus tropicalis.*

Fig. 433. *Haploniscus retrospinis* (Richardson)

Range: South of Martha's Vineyard (713 m)

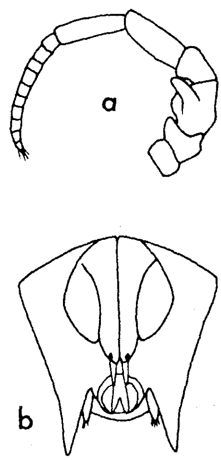


Figure 433. a. *Haploniscus retrospinis*, antenna two. b. Posterior part, ventral view.

3b. Antenna two and antenna one with basal segments of peduncle not easily distinguishable from those of flagellum (a spine is never present on any segment of peduncle of antenna two); last three segments of peraeon fused and abruptly wider than

first four peraeonal segments (frequently it is flared forward into two acute anterolateral angles); posterolateral angles of pleotelson weakly developed if at all, and never visible in dorsal view; frontal margin of cephalon always greatly produced ....*Hydroniscus*

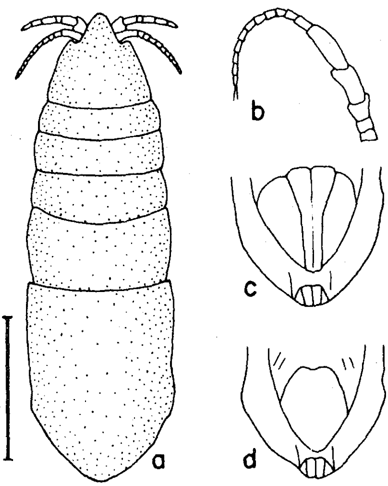


Figure 434. a. *Hydroniscus abyssi*. b. Antenna two. c. Posterior part, male (ventral view). c. Posterior part, female (ventral view).

Fig. 434. *Hydroniscus abyssi* (Hansen) (2.8 mm)

Range: North Atlantic, Davis Strait (3521 m)

This species is the type-species of the genus.

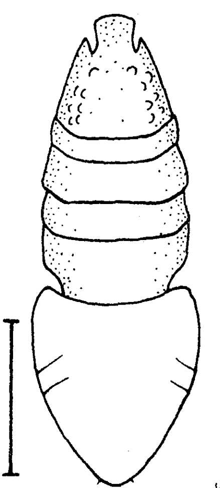


Figure 435. *Hydroniscus quadrifrons*.

Fig. 435. *Hydroniscus quadrifrons* (Menzies) (3.2 mm)

Range: North of Puerto Rico (5163 to 5684 m)

MACROSTYLIDAE

The family contains species in a single genus *Macrostylis* that are very common in the deep-sea. They are small and have long uniramus uropods. All the peraeopods are short and ambulatory. The species are blind and pigmentless and have short antennae. In the more northern part of their range the species are collected in moderately deep water. A species of the genus, *M. galatheae*, was collected frcm the Pacific Ocean near the Philippine Islands from a depth of six miles. The depth exceeded that of any other isopod and is the depth record for all crustacean species.

KEY TO THE SPECIES OF MACROSTYLIS

1a. Posterior margin of pleotelson broadly rounded, produced and rounded or obtusely pointed 2

1b. Posterior margin of pleotelson truncate .... *M. truncatex*

Fig. 436. *Macrostylis truncatex* (Menzies) (3.5 mm)

Range: Off northern Florida (3950 to 3963 m)

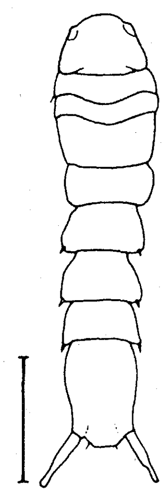


Figure 436. *Macrostylis truncatex.*

2a. Peraeonal segment IV much narrower and shorter than other peraeonal segments .... *M. setifer*

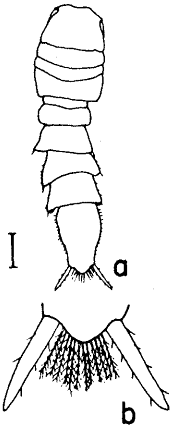


Figure 437. a. *Macrostylis setifera*. b. Detail, posterior border pleotelson.

Fig. 437. *Macrostylis setifer* (Menzies) (6.1 mm)

Range: North of Puerto Rico (5477 to 5484 m)

2b. Peraeonal segment IV slightly narrower and as long or longer than some of other segments 3

3a. Frontal margin of cephalon with three small lobes; posterior margin of pleotelson obtusely pointed .... *M. minutus*

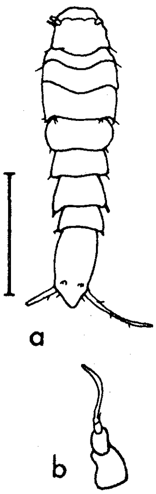


Figure 438. a. *Macrostylis minuta*. b. Antenna one.

Fig. 438. *Macrostylis minutus* (Menzies) (2.5 mm)

Range: North of Puerto Rico (5163 to 5944 m)

3b. Frontal margin of cephalon straight or broadly rounded; posterior margin of pleotelson broadly rounded or produced and broadly rounded 4

4a. Lateral borders of pleotelson parallel for entire length .... *M. abyssicola*

Fig. 439. *Macrostylis abyssicola* (Hansen) (3.1 mm)

Range: Davis Strait (3229 m)

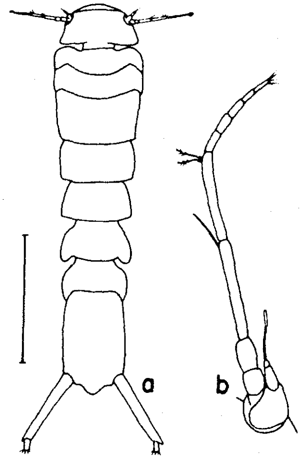


Figure 439. a. *Macrostylis abysicola*. b. Antenna two and one.

4b. Lateral borders of pleotelson indented in posterior 1/3 of length **5**

5a. Posterior margin of pleotelson broadly rounded; peraeonal segment IV slightly wider at widest part than posterior part of segment III .... *M. vemae*

Fig. 440. *Macrostylis vemae* (Menzies) (3.9 mm)

Range: North of Puerto Rico (5440 to 5410 m)

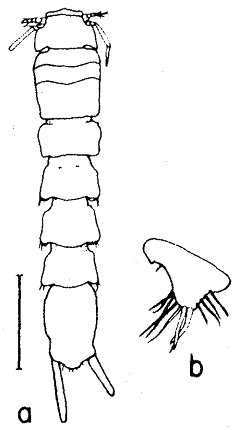


Figure 440. a. *Macrostylis vemae*. b. Peraeopod III.

5b. Posterior margin of pleotelson produced and broadly rounded; peraeonal segment IV at widest part not wider than widest part of peraeonal segment III .... *M. caribbicus*

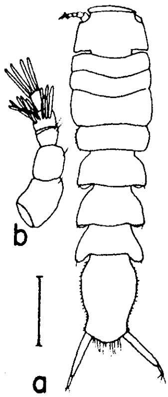


Figure 441. a. *Macrostylis caribbicus*. b. Antenna one.

Fig. 441. *Macrostylis caribbicus* (Menzies) (4.8 mm)

Range: Caribbean Sea, north of Columbia (2875 to 2941 m)

DESMOSOMATIDAE

The species of this family have six natatory peraeopods only peraeopod I being ambulatory. They are occasionally caught in deep plankton tows. Only the genus *Desmosoma* has been collected from North American waters. There are about 27 species widely distributed in the deep seas of the world.

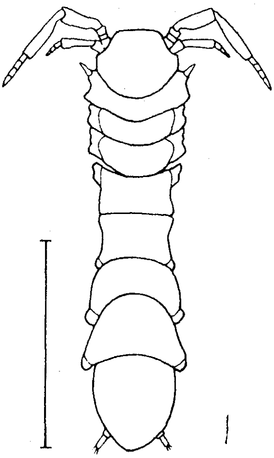


Figure 442. *Desmosma plebejum.*

Fig. 442. *Desmosoma plebejum* (Hansen) (2 mm)

Range: North Atlantic and Arctic Ocean (1040 to 1613 m)

This deep water species was first taken in the North Atlantic off Iceland and then was taken from the water below an ice island station (Station Bravo) in the Arctic Sea northeast of Alaska. The species differs from many members of the genus in that peraeonal somites IV and V are narrower than the other peraeonal segments.

Fig. 443. *Desmosoma symmetric~~um~~a* (Schultz) (3.2 mm)

Range: Tanner Canyon on shelf off southern California (469 m)

The body of this species gradually narrows caudaly.

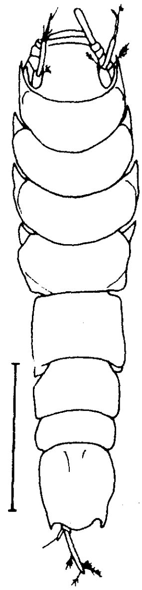


Figure 443. *Desmosoma symmetricum.*

Fig. 444(a). *Desmosoma birsteini* (Menzies) (2.3 mm)

Range: Near Bermuda (5166 m)

The posterior half of the body of this species is abruptly narrower than the anterior half.

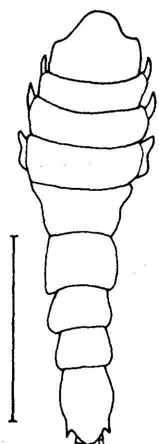


Figure 444(a). *Desmosoma birsteini.*

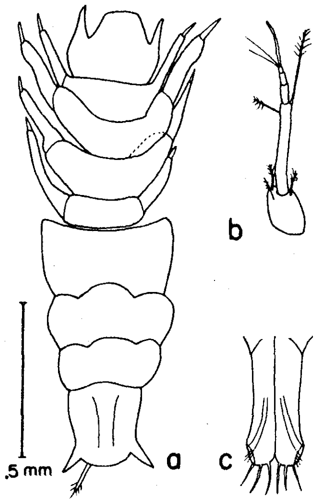


Figure 444(b). a. *Desmosoma magnispinium*. b. Antenna one. c. Apex pleopod 1, male.

Fig. 444(b). *Desmosoma magnispinum* (Menzies) (2.1 mm)

Range: Caribbean Sea near Panama (1906 m)

The lateral lappets on the anterior peraeonal segments are very long.

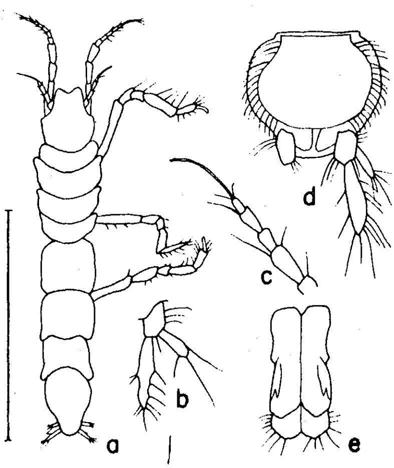


Figure 444(c). a. *Desmosoma lobiceps*.

Fig. 444(c). *Desmosoma lobiceps* (Blake) (2 mm)

Range: Mount Desert Island, Maine (Intertidal)

Fig. 445. *Desmosoma tenuimanum* (Sars) (4 mm)

Range: East Greenland (22 m)

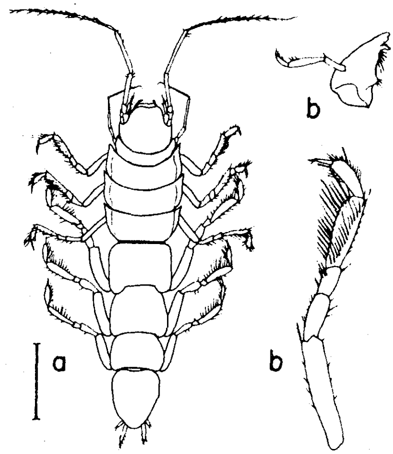


Figure 445. a. *Desmosoma tenuimanum*. b. Mandible. c. Peraeopod II.

Fig. 446. *Desmosoma armatum* (Sars) (2 mm)

Range: East Greenland (350 m)

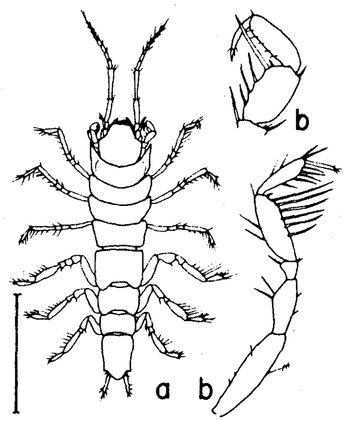


Figure 446. a. *Desmosoma armatum*. b. Peraeopod I. c. Peraeopod V.

NANNONISCIDAE

The species of the family have no peraeopods modified for swimming, so they probably are weak swimmers that live on the bottom. The molar process of the mandible in the animals is reduced to a short setiferous lobe (Fig. 37g). Members of two genera are found in North American waters. They have a bulbous organ on the flagellum of antenna one (Fig. 448b). It is apparently a modified aesthetasc which is a special chemical receptor, but its true function remains unknown. About 17 species are in *Nannoniscus* the nominal genus, the largest one in the family. Four species have been collected in North American waters.

KEY TO THE GENERA OF NANNONISCIDAE

1a. Pleotelson much wider than peraeon or cephalon; no anterolateral lobes present on cephalon .... *Nannonisconus*

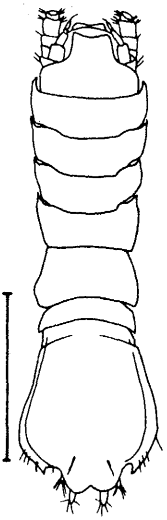


Fig. 447. *Nannonisconus latipleonus* (Schultz) (2.8 mm)

Range: Redondo Canyon on shelf off southern California (465 m)

Figure 447. *Nannonisconus latipleonus.*

1b. Pleotelson not wider than peraeon; anterolateral lobes present on cephalon .... *Nannoniscus*

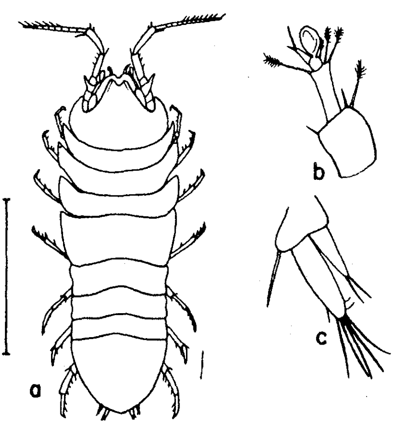


Fig. 448. *Nannoniscus oblongus* (Sars) (2.2 mm)

Range: Davis Strait and west of Iceland (225 to 248 m)

Compared to other species of the genus *N. oblongus* has a very squat body and it is without posterolateral angles on the pleotelson.

Figure 448. a. *Nannoniscus oblongus.* b. Antenna one. c. Uropod.

Fig. 449(a,b). *Nannoniscus camayae* (Menzies) (4.1 mm)

Range: Caribbean Sea, near Cayman Islands (1714 m)

This species is fairly elongate with the anterior part of the body wider than the posterior part. Simple posterolateral angles are present on the pleotelson.

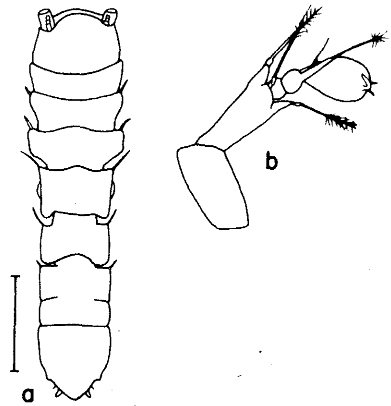


Figure 499(a, b). a. *Nannoniscus camayae.* b. Antenna one.

Fig. 449(c,d). *Nannoniscus primitivus* (Menzies (1.8 mm)

Range: Off Cartagena, Columbia (2868 to 2875 m)

This species has a peculiar bulbous organ. There are two posterolateral corners on the pleotelson.

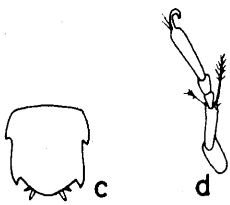


Figure 449(c, d). c. *N. primitivus*, posterior part. d. Antenna one.

Fig. 450. *Nannoniscus arcticus* (Hansen) (2.8 mm)

Range: Just south of Greenland (75 m)

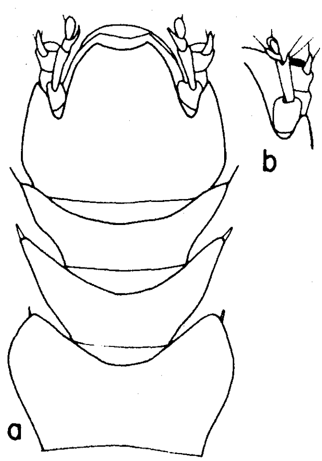


Figure 450. a. *Nannoniscus arcticus*, anterior part. b. Antenna one.

JAEROPSIDAE

The family contains only one genus *Jaeropsis* in which there are about 20 species. They are small, have eyes and are rarely over 5 mm in length. They differ from other asellotes in the presence of very short antennae one and two and in the spiniform molar process on the mandible (Fig. 37e). The species themselves, although they at first seem to be quite similar to one another in morphology, have many distinguishing features. The configuration of the frontal margin of the frontal plate is one of them (Fig. 451). Others include the absence or presence and the number of lateral spines on the cephalon border or the pleotelson border. The configuration of the uropods is also an important feature, but it is not used here because it must be viewed at high magnification. As further more intensive collecting is made in North American tropical waters more species will most probably be found.

KEY TO THE SPECIES OF JAEROPSIDAE

1a. Frontal plate (Fig. 451) of cephalon rounded or obtusely pointed; spines on lateral margins of pleotelson absent or present 2

1b. Frontal plate (Fig. 452) of cephalon indented; no spines on margin of pleotelson .... ***J. coralicola***

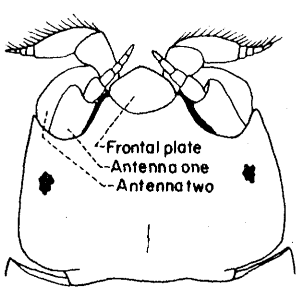


Figure 451. Cephalon of *Jaeropsis* species.

Fig. 452. *Jaeropsis coralicola* (Schultz and McCloskey) (2.8 mm)

Range: Cape Lookout, North Carolina (10 m)

In the deep water off North Carolina large coral heads which are the home of many animals including isopods are found on rock jetties.

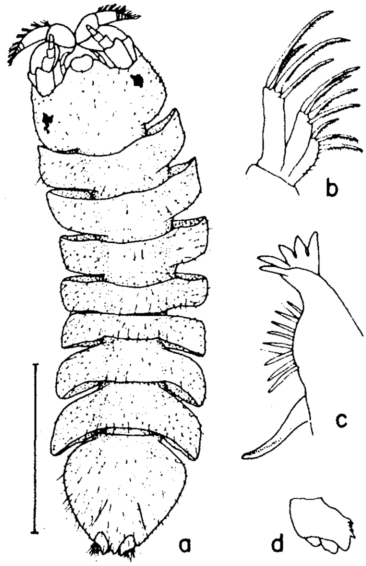


Figure 452. a. *Jaeropsis coralicola.* b. Maxilla two. c. Mandible, left. d. Uropod.

2a. Lateral margin of pleotelson without spines; eyes laterally placed on cephalon .... *J. lobata*

Fig. 453. *Jaeropsis lobata* (Richardson) (3.5 mm)

Range: Monterey Bay, California (Shallow water)

The species is not at all well defined and more specimens must be collected for a more proper definition.

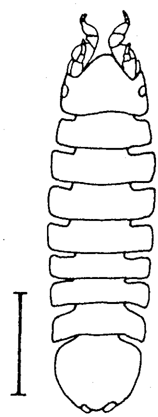


Figure 453. *Jaeropsis lobata.*

2b. Lateral margin of pleotelson with spines; eyes dorsally placed on cephalon 3

3a. Frontal plate with anterior margin obtusely pointed; four spines on lateral edge of pleotelson .... *J. rathbunae*

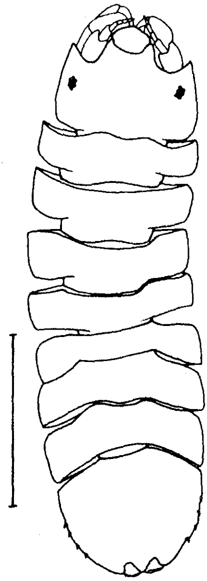


Fig. 454. *Jaeropsis rathbunae* (Richardson) (3.2 mm)

Range: Bermuda (Shallow water)

The original description of this species stated that there were no spines on the lateral borders of the pleotelson. The four shown here were present when the type specimen (the specimen on which the description of Richardson was based) was examined under high magnification.

Figure 454. *Jaeropsis rathbunae.*

3b. Frontal plate rounded; more than four spines on lateral margin of pleotelson 4

4a. Body somewhat elongate; lateral margins of peraeon concave .... *J. concava*

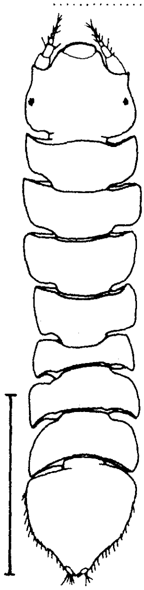


Fig. 455. *Jaeropsis concava* (Schultz) (3.1 mm)

Range: Santa Cruz Canyon on shelf off southern California (221 m)

Figure 455. *Jaeropsis concava.*

4b. Body somewhat squat; lateral margins of peraeon parallel or very nearly parallel 5

5a. Lateral margin of cephalon with indentation in anterior third of length; body without long setae .... *J. dubia*

Fig. 456(a). *Jaeropsis dubia* (Menzies) (1.8 mm)

Range: Mid-California to northern Baja California (18 to 91 m)

This species is usually collected with algae. A subspecies, *J. dubia paucispinis*, has been recorded which differs from the parent species in that there are less spines on the lateral margins of the pleotelson and there is different dorsal color pattern.

Menzies (1951) considered this a "low intertidal" species.
Brazil (Pires, 1981)
Gulf of Calif. (Carvacho, 1983)

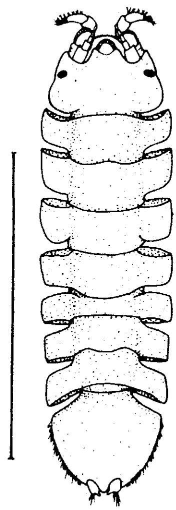


Figure 456(a). *Jaeropsis dubia*.

5b. Lateral margins of cephalon coverage anteriorly with no lateral margin indentations; body covered with long setae .... *J. setosa*

Fig. 456(b). *Jaeropsis setosa* (George and Stromberg) (2.3 mm)

Range: Puget Sound, Washington (50 m)

The species was collected with red and brown algae.

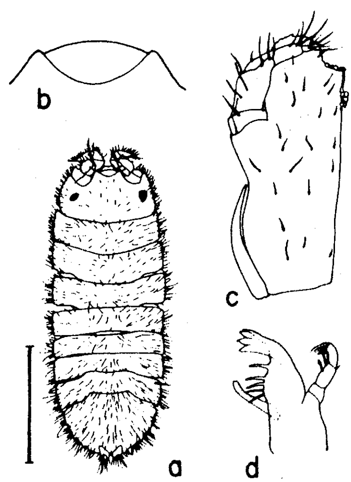


Figure 456(b). a. *Jaeropsis setosa*. b. Frontal plate of cephalon. c. Maxilliped. d. Mandible, right.

MUNNOPSIDAE

Munnopsis is the only genus of the family found in North American waters. Peraeopods I and II are gnathal, and II and IV are extremely long and ambulatory. Peraeopods V, VI and VII are natatory and the dactylus is absent. Antenna two is as long as peraeopods II and III. Antenna one is much shorter and with a broad basis. Most species of the family are truly planktonic or at least able to swim well and found above the bottom of the sea. Two species, one found principally in near-shore and the other in open sea habitats are described here.

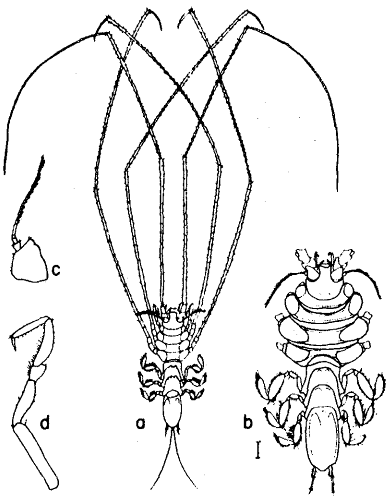


Figure 457(a). a. *Munnopsis typica* (male). b. Female. c. Antenna one. c. Peraeopod I (see also Fig. 372).

Fig. 457(a). *Munnopsis typica* (M. Sars) (13 mm)

Range: East Greenland, Cape Cod to Arctic Sea (9 to 732 m)

This moderately large asellote species with its very long legs swims backward as well as forward. It is able to extend its legs to the side so that it can get its body close to the bottom. The species is found in algae in the near-shore and in some deep-sea locations.

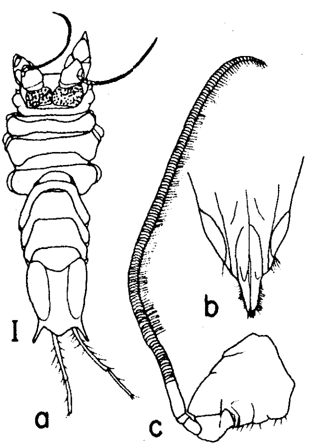


Fig. 457(b). *Munnopsis longiremis* (Richardson) (15 mm)

Range: Pacific Ocean off Costa Rica (Open ocean)

The species is a true planktonic species. It was taken at 1485 m in water that was 3570 m deep.

Figure 457(b). a. *Munnopisis longiremis*. b. Apex pleopod 1, male. c. Antenna one.

MUNNIDAE

The species of the Munnidae, especially those of the genus *Munna*, are the daddy long leg spiders of the isopod world. All have very long spider-like legs and have small bodies. Some species have a compact body and the ends of all peraeonal segments are closely adherent along their entire lengths. Other species are more dorsoventrally flattened and have peraeonal segments on which the ends are separated widely from each other.

Species of the genus *Munna* are common in the near-shore habitat, but species are also present in the deep-sea. Because of their small size, many specimens were poorly observed and described, hence, many apparently widespread species will undoubtedly be divided into several species when specimens are reobserved and redescribed. Species of the other genera mentioned here have been taken in the near-shore and deep-sea habitats and they are abundant at times. Members of the family although small in body are abundant and have a very important role to play in the habitats of which they are a part.

The peraeopods and antenna two of the specimens of the family are usually long. Antenna one and the uropods on the other hand are generally short. The two apical articles of the maxillipedal palp are in most instances much narrower than those of the first three articles.

KEY TO THE GENERA AND SPECIES OF MUNNIDAE

1a. Eyes, absent, or if present, visible in dorsal view **2**
1b. Eyes visible only in ventral view .... *Munnogonium*

Fig. 458(a). *Munnogonium erratum* (Schultz) (1.8 mm)

Range: Santa Barbara Channel, near Gaviota, California 135 m)

This species has eyes that are on stalks which are bent downward so that the eyes are visible only in the ventral or ventrolateral view.

see Bowman & Schultz (1974)

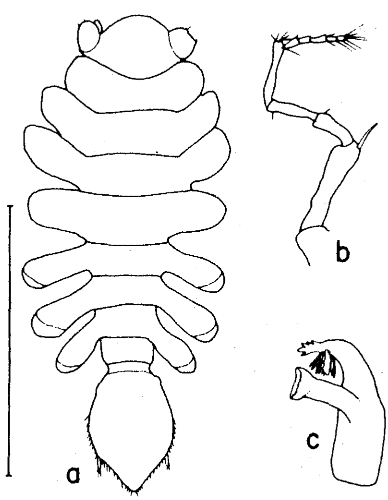


Figure 458(a). a. *Munnogonium erratum*. b. Antenna two. c. Mandible.

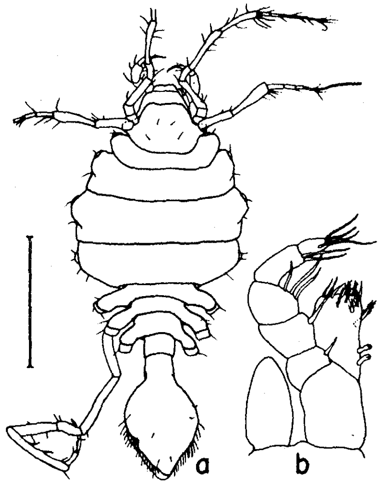


Fig. 458(b). *Munnogonium waldronensis* (George and Stromberg) (1.8 mm)

Range: Washington State (50 m)

Figure 458(b). a. *Munnogonium waldronense.* b. Maxilliped.

2a. Molar process of mandible strong and subcylindrical with distal end truncate (Fig. 37a); cephalon sometimes with eyes stalked; some coxal plates visible in dorsal view 3

2b. Molar process of mandible narrow, with distal and obliquely truncate, rounded or pointed; cephalon without eyes on stalks or bulges .... *Pleurogonium*

GENUS PLEUROGONIUM

This small group of species is blind and lives on muddy bottoms. Four species, three of which have been recorded from both northeastern United States and Norway are found in North American waters.

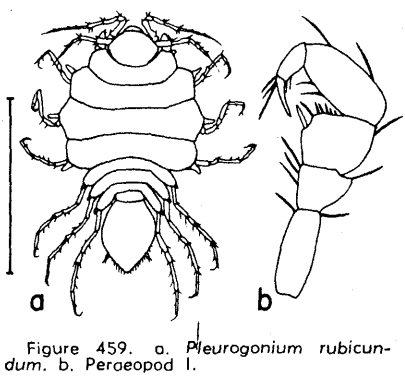


Fig. 459. *Pleurogonium rubicundum* (Sars) (1.5 mm)

Range: Puget Sound, Washington and St. Andrews, New Brunswick, Canada (4 to 9 m)

Figure 459. a. *Pleurogonium rubicundum.* b. Peraeopod I.

Fig. 460. *Pleurogonium inerme* (Sars) (2 mm)

Range: Bay of Funday, Canada (4 to 27 m)

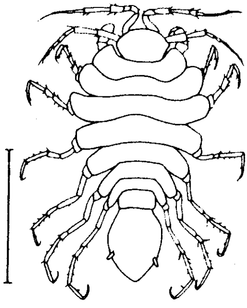


Figure 460. *Pleurogonium inerme.*

Fig. 461. *Pleurogonium spinosissmum* (Sars) (2.3 mm)

Range: Bay of Fundy, Canada (4 to 137 m)

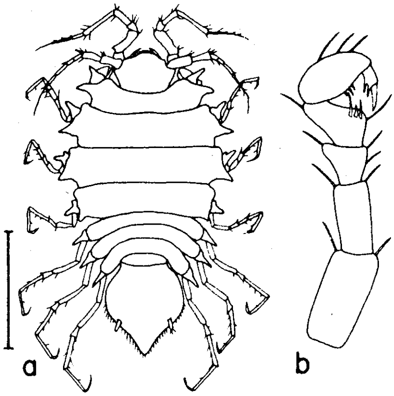


Figure 461. a. *Pleurogonium spinossimum.* b. Peraeopod I.

Fig. 462. *Pleurogonium californiense* Menzies, 1951 (1.4 mm)

Range: Sonoma to Pt. Loma, California (93 to 99 m)

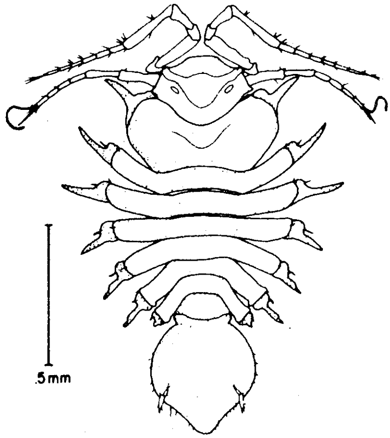


Figure 462. *Pleurogonium californiensis.*

3a. Coxal plates visible on peraeonal segments V to VII .... *Austrosignum*

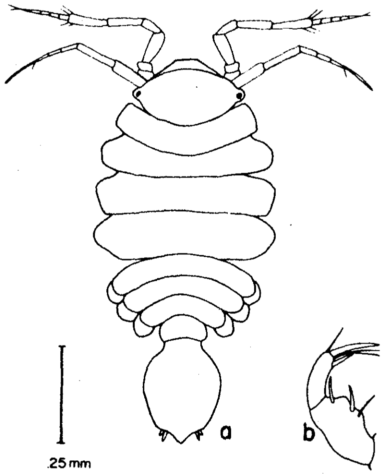


Fig. 463. ~~*Austrosignum*~~ Munnogonium *tillerae* (Menzies) and Barnard) (1 mm)

Range: Pt. Loma, California to Mexican border (18 to 183 m)

The other species of the genus have been taken in the Antarctic Sea.

See Bowman & Schultz, 1974: 266

Figure 463. a. *Austrosignum tillerae*. b. Peraeopod I.

3b. Coxal plates visible on peraeonal segments II to VII .... *Munna*

GENUS MUNNA

The genus *Munna* contains a great many species that are common in the near shore habitats along all continents of the world. Species are also found in moderately deep water and in the deep-sea. The animals are small and difficult to see even with a microscope so that the ones that have been described were described in a very cursory fashion, and it is difficult to make comparisons of them and newly discovered specimens. However, some attempts have been made to assemble all species of the genus and put them into subgroups or subgeneric categories.

KEY TO SPECIES OF MUNNA

4a. Eyes present **5**

4b. Blind .... *M. truncata*

Fig. 464. *Munna truncata* (Richardson) (2 mm)

Range: Nova Scotia to south of Martha's Vineyard (146 to 713 m)

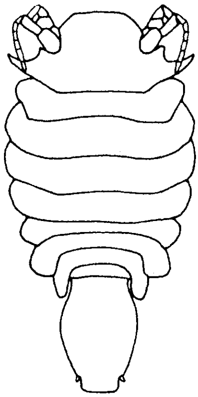


Figure 464. *Munna truncata*.

5a. With few, if any, spines (not setae) or projections on lateral parts of body 6

5b. With many small spines (not setae) or lateral projections on anterior margin of cephalon, on lateral edges of peraeonal segments and on anterior parts of lateral borders of pleotelson .... *M. spinifrons*

Fig. 465. *Munna spinifrons* (Menzies and Barnard) (1.5 mm)

Range: Off Pt. Conception, California (12 m)

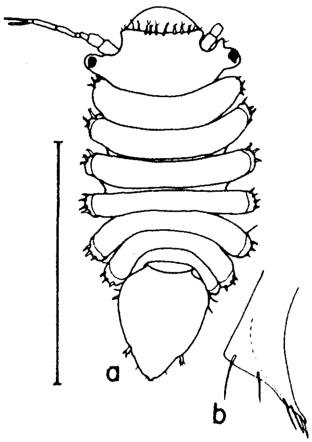


Figure 465. a. *Munna spinifrons*. b. 1/2 pleopod 1, male.

6a. No ventral posteriorly projecting extension of pleotelson visible in dorsal view (not to be confused with projecting pleopods in preserved specimens); frontal margin of cephalon concave or rounded 8

6b. **Pleotelson with ventral posteriorly projecting extension visible in dorsal view (not to be confused with projecting pleopods in preserved specimens); frontal margin concave or truncate** **7**

7a. **With toothed ventral posterior projection** .... *M. halei*

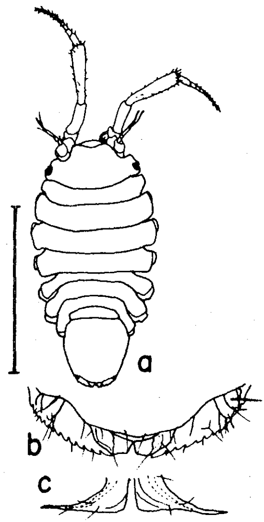


Figure 466(a). a. *Munna halei*. b. Detail, posterior margin pleotelson. c. Apex pleopod 1, male.

Fig. 466(a). *Munna* (*Munna*) *halei* (Menzies) (1.5 mm)

Range: Mid-California (Intertidal) {Tomales Bay to San Luis Obispo.

The species is found under stones and the holdfasts of algae, + in sea urchin spines (Iverson, 1975).

7b. **With no teeth on ventrally projecting pleonal extension** .... *M. fernaldi*

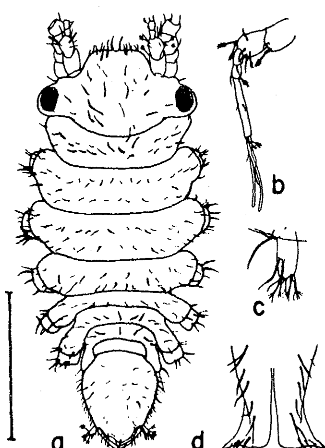


Figure 466(b). a. *Munna fernaldi*. b. Antenna one. c. Uropod. d. Apex pleopod 1, male.

Fig. 466(b). *Munna* (*Munna*) *fernaldi* (George and Stromberg) (1.5 mm)

Range: Friday Harbor, Washington (Intertidal)

The species is from algae among stones.

8a. **Frontal margin of cephalon concave** **10**

8b. **Frontal margin of cephalon broadly rounded or straight** ... **9**

9a. **Frontal margin broadly rounded; peraeonal segment VII as wide as or slightly narrower than pleotelson** **10**

9b. **Frontal margin straight; peraeonal segment VII wider than pleotelson** .... *M. reynoldsi*

Fig. 467. *Munna* (*Uromunna*) *reynoldsi* (Frankenberg and Menzies) (1.5 mm)

Range: Georgia (Coastal swamps)

This species was taken in oak leaves on the bottom of shallow water in the swamps and marshes along the Georgia seacoast. It, like *M. ubiquita* and *M. magnifica,* is in the subgenus *Uromunna.*

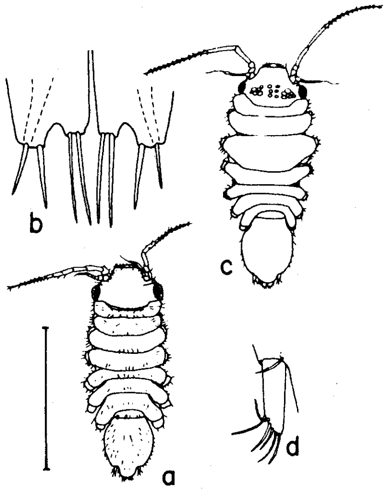


Figure 467. a. *Munna reynoldsi* (male). b. Apex pleopod 1, male. c. Female. d. Uropod.

10a. **Ventral posterior border of pleotelson not crenulated (ventral view)** .... *M. kroyeri*

Fig. 468. *Munna* (*Neomunna*) *kroyeri* (Goodsir) (3 mm)

Range: Greenland (18 to 110 m)

West coast records of this species most always refer to *M. stephenseni* mentioned below. It is found in Norway as well as Greenland.

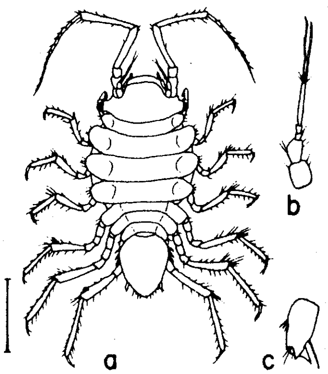


Figure 468. a. *Munna kroyer.* b. Antenna one. c. Uropod.

10b. Ventral border of pleotelson crenulated (ventral view) .... *M. fabricii*

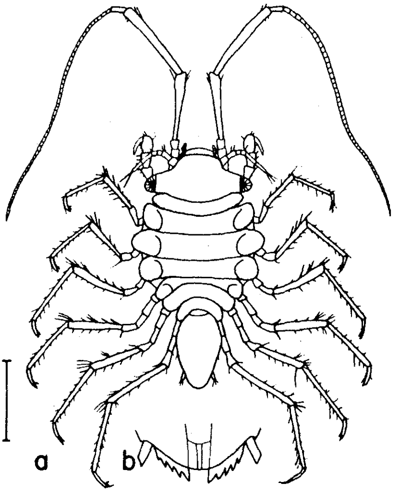


Figure 469. a. *Munna fabricii*. b. Detail, ventral aspect posterior margin of pleotelson.

Fig. 469. *Munna* (*Neomunna*) *fabricii* (Kroyer) (3 mm)

Range: Greenland to Maine (7 to 366 m)

Both this species and *M. halei* have a posteriorly directed projection from the ventral part of the pleotelson. In *M. halei* it is generally apparent in the dorsal view; in *M. fabricii* it is generally hidden in the dorsal view. The frontal margin of the cephalon in *M. halei* is concave; whereas, it is broadly rounded in *M. fabricii.*

11a. Peraeonal segments VI and VII wider than pleotelson 12
11b. Peraeonal segments VI and VII narrower than pleotelson (or about as long–segment VII only) as pleotelson is wide .... *M. magnifica*

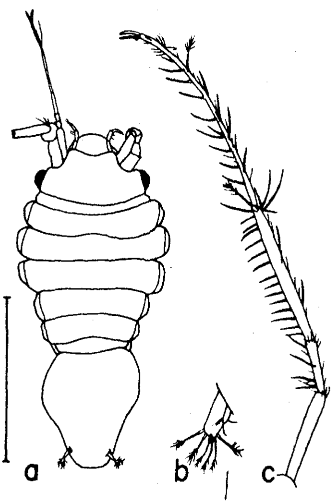


Figure 470. a. *Munna magnifica*. b. Uropod. c. Peraeopod V.

Fig. 470. *Munna* (*Uromunna*) *magnifica* (Schultz) (2 mm)

Range: Near Santa Barbara Island off southern California (500 m)

The species was taken from a bottom with black mud, nodules and flat shaley rocks.

12a. Body with about 1/2 length **13**

12b. Body width about 1/3 length .... *M. chromatocephala*

Fig. 471. *Munna* (*Neomunna*) *chromatocephala* (Menzies) (2.2 mm)

Range: Puget Sound, Washington to mid-California (Intertidal)

This species is found among encrusting organisms on rocks and piles.

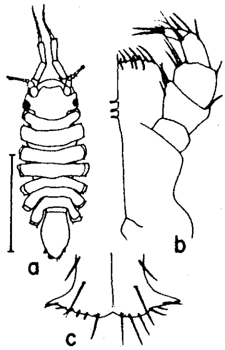


Figure 471. a. *Munna chromatocephala*. b. Maxilliped. c. Apex pleopod 1, male.

13a. Cephalon with anterior projection near eye; apex of eye stalk not completely covered by eye .... *M. stephenseni*

Fig. 472. *Munna* (*Neomunna*) *stephenseni* (Gurjanova) (0.7 mm)

Range: Bering Sea to mid-California (Intertidal to 18 m)

The records of *M. kroyeri* from western North America refer to this species.

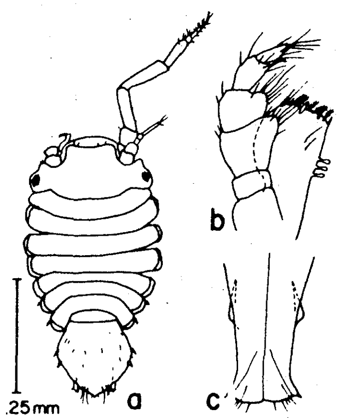


Figure 472. a. *Munna stephenseni*. b. Maxilliped. c. Apex pleopod 1, male.

13b. No anterior projection on cephalon near eye; apex of eye stalk completely covered by eye .... *M. ubiquita*

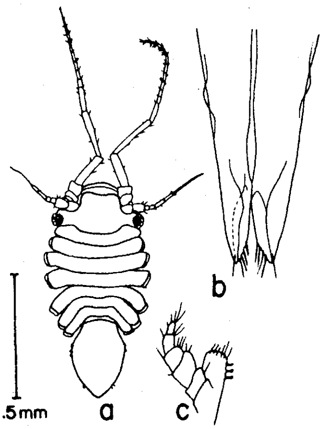


Figure 473. a. *Munna ubiquita*. b. Apex pleopod 1, male. c. Maxilliped.

Fig. 473. ***Munna*** (***Uromunna***) ***ubiquita*** (Menzies) (1.2 mm)

Range: Puget Sound, Washington to northern Baja California (Subtidal to 37 m)

San Quintin Bay (Menzies, 1962)
N.W. Gulf of Calif. (Carvacho, 1983)

MESOSIGNIDAE

The family Mesosignidae is composed of one genus, *Mesosignum*. The species are very small, pigmentless and blind and are found in the deep sea. Peraeonal segment I is short being only slightly broader than the cephalon. Neither the cephalon or peraeonal segment I bear spines or lateral lappets. The palp of the mandible has three articles and the palp of the maxilliped is narrow with four articles. The uropods are uniramus. Two species from the Caribbean Sea are mentioned here.

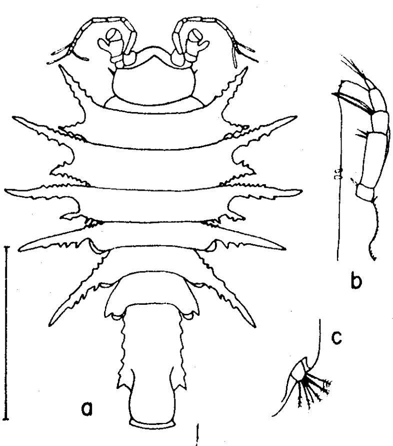


Figure 474. a. *Mesosignum kohleri*. b. Maxilliped. c. Uropod.

Fig. 474. ***Mesosignum kohleri*** (Menzies) (2.5 mm)

Range: Caribbean Sea, north of Columbia (4076 m)

The species has a pleotelson with two short posterolateral spines. The lateral margins of the pleotelson are parallel.