Key to Shrimps and Lobsters

R N Burukovskii

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R.N. BURUKOVSKII

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PREFACE

Decapods constitute the most important group in nonfish catches by commercial fishermen and hence their detailed study is essential to the fishing industry. The available literature provides identification keys mainly for regional decapod fauna: *Key to Shrimps, Crayfishes, and Crabs of the Far East* (Vinogradov, 1950); *Key to the Fauna and Flora of the Northern Seas* (Gaevskaya, 1948); and *Key to the Decapod Fauna of the Black and Azov Seas* (Kobyakova and Dolgopol'skaya, 1969).

The keys included in the present book cover the tropical and subtropical decapods which are currently exploited and potentially important for the fishing industry. Keys translated earlier by the author for several groups of decapods have been incorporated: the classification of the subfamilies of all decapods published by Balss (1957); the key to shrimps compiled by Anderson and Lindner (1945), considered one of the most important publications of the twentieth century (G. Gunter, 1957) even though it covers primarily American fauna, has now become obsolete in certain aspects; and the key to extant genera of caridean and stenopodidean shrimp published by Holthuis (1952).

These publications have been somewhat revised or supplemented in keeping with more recently published data. A number of keys to the regional fauna of different groups of decapods have been incorporated. For one series of the crustacean group (rock lobsters, spiny lobsters, etc.), however, keys had to be formulated on the basis of original descriptions (identifications) of genera and species, since no keys were available for them.

Unfortunately, the present keys cannot be considered comprehensive. A few facts and figures reveal the reasons for this deficiency. The order Decapoda presently comprises 1,001 genera with 8,321 species (Balss, 1957) but these figures have increased significantly with every passing year. Shrimps now include about 230 genera with about 2,000 species. Of these, 33 genera in the tribe Penaeidea alone (excluding fossils) comprise more than 320 species. This in itself indicates that the task of compiling a comprehensive key assumes rather herculean proportions! Hence the format of the classification given here is perforce unique. Keys up to the level of subfamilies and exhaustive keys up to the level of genera have been given for all the known shrimps, spiny lobsters, and rock lobsters. Keys up to the level of species are provided for almost all the genera of shrimp of families Stenopodidea and Penaeidea, as well as families of spiny lobsters and rock lobsters. Despite its lack in species identifications for every genus of decapods, the present classification remains the most comprehensive of all the known keys for this group of crustaceans in existence to date.

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*No author or date given in original—General Editor.

I

PRINCIPAL MORPHOLOGICAL FEATURES OF DECAPOD CRUSTACEANS (CRUSTACEA, DECAPODA)

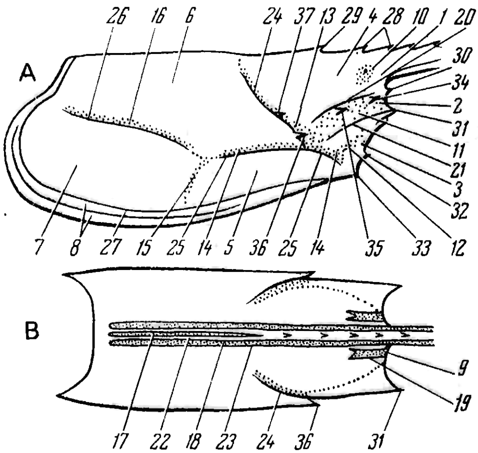
Decapods are higher forms of crustaceans in which one of the most important characters is constancy in number of body segments. The body consists of three sections: head, thorax, and abdomen. In most species the segments of the head and thorax are fused. Only in some fresh-water crayfish and most hermit crabs is the last thoracic somite movable. In some shrimps (for example, *Penaeus*) the anterior part of the head (with the eyes and antennules) is separated from the remaining portion by a joint. The entire body of a decapod consists of 21 segments, the head, thorax, and abdomen comprising 6, 8, and 7 segments respectively.

Through the fusion of the head and thoracic sections the cephalothorax is formed, which is covered laterally and dorsally with a common covering, the carapace.

Carapace. Exoskeletal cover which extends dorsally over the fused segments of the cephalothorax. True, in some cases (*Typlon, Porcellana,* Paguridae, *Homola, Dromia,* etc.) the carapace and the penultimate segment* of the thorax are separated. The lateral parts of the carapace cover the branchial regions and are called the branchiostegites. The structure of the carapace is highly variable and distinctive in different groups of decapods and hence an important taxonomic character. In shrimps it is usually elongated, laterally compressed, and posteriorly rounded, merging into the lateral surfaces with no pronounced curve. The same is true of spiny lobsters, lobsters, crayfishes and some snub-tailed crustaceans. In other groups of Reptantia the carapace is more often dorsoventrally flat, short, and more or less elongated in the direction of the transverse axis of the body. Its contours are extremely
5 variable. The dorsal surface is separated from the lateral surfaces by a distinct margin which is sometimes denticulate. The lateral and dorsal

* Mistake in original. Should read "last segment"—General Editor.

surfaces are divided into a number of regions by grooves. The cervical groove (the place of attachment of the gastric muscles) (Figure 1) is a frequent feature and separates the gastric area of the carapace from the cardiac. The latter is separated from the branchial areas by the branchial grooves. In addition to these more prominent grooves, other grooves, carinae, teeth, and spines occur on the carapace, the presence or absence of which is of taxonomic significance. The branchiostegites are never fused with the thoracic coverings, which are divided into segments (somites); they are fused on the anterior side with the supraoral plate only in true crabs. The true crab differs from other crab-like crustaceans in this character, whereby the anterior margin of the branchial cover hangs freely from the base of the antennae, forming a broad slit for the water passing out of the branchial cavity. In true crabs a more or less broad fusion occurs between the supraoral plate, the branchial cover, the base of the antennae, and the branchial opening.



4 Figure 1. Diagrammatic sketch of carapace of macruran crustaceans (shrimp, spiny lobster, lobster) (from Kubo, 1949).

A—lateral view; *B*—dorsal view; Sections of carapace: *1*—frontal (forehead); *2*—orbital; *3*—antennal; *4*—gastric; *5*—pterygostomian; *6*—cardiac; *7*—branchial gill cover or branchiostegite; *8*—marginal; Grooves: *9*—gastrofrontal; *10*—postocular; *11*—orbitoantennal; *12*—antennal; *13*—cervical; *14*—hepatic; *15*—inferior; *16*—branchiocardiac; *17*—median; *18*—adrostral; Carinae: *19*—gastrofrontal; *20*—gastroorbital; *21*—antennal; *22*—postrostral; *23*—adrostral; *24*—cervical; *25*—hepatic; *26*—branchiocardiac; *27*—pterygostomian; Spines: *28*—postrostral; *29*—epigastric; *30*—supraorbital; *31*—antennal; *32*—branchiostegal. *33*—pterygostomian; *34*—postorbital; *35*—postantennal; *36*—hepatic; *37*.*

*Shown in figure but omitted from legend—General Editor.

The anterior margin of the carapace between the orbits is called the forehead. In swimming forms it very frequently juts out forming a rostrum (Figure 2). Depending on the decapod's mode of life, the structure of the rostrum varies considerably, ranging from a short and simple spine or tip above the eyes to a knife- or saber-shaped structure.

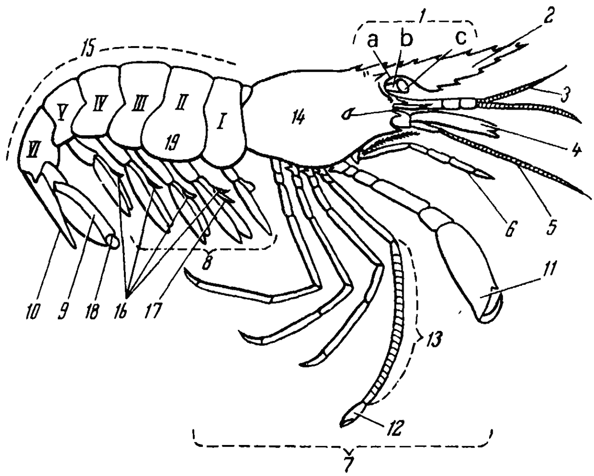


Figure 2. Diagrammatic sketch of macruran crustaceans (shrimp, spiny lobster, lobster) (lateral view) (from Holthuis, 1955).

1—eye (*a*—orbit; *b*—stalk; *c*—cornea); *2*—rostrum; *3*—antennule; *4*—scaphocerite; *5*—antennal flagellum; *6*—maxilliped III; *7*—walking legs (pereopods); *8*—swimming limbs (pleopods); *9*—caudal limbs (uropods); *10*—telson; *11*—false chela; *12*—true chela; *13*—carpus divided into secondary segments; *14*—carapace; *15*—abdomen; *16*—appendix interna; *17*—appendix masculina; *18*—dieresis; *19*—pleuron of abdominal somite (epimeron).

In some cases it articulates with the carapace (shrimps of genera *Pantomus* and *Rhynchocinetus*). On the upper and lower sides, sometimes only on the upper side, the rostrum is armed with movable and fixed teeth. The armature of the rostrum is important in taxonomy and for the sake of the number of teeth on the rostrum is expressed by the following formula (Vinogradov, 1950):

$$a-b+\frac{c-d}{e-f}\ g-h$$

where a = minimum number of teeth on middle crest of carapace (epigastric teeth);

b = maximum number of epigastric teeth;

c = minimum number of teeth on upper margin of rostrum (rostral teeth);

d = maximum number of upper rostral teeth;
e = minimum number of lower rostral teeth;
6 f = maximum number of lower rostral teeth;
g = minimum number of teeth at end of rostrum (terminal teeth of rostrum);
h = maximum number of terminal teeth.

A large number of appendages are attached to the lower side of the cephalothorax. The scutella of the carapace, known as the sterna, are located between them. In most shrimp these are poorly developed because of the fact that the bases of the appendages are very close to each other. In spiny lobster and lobster the shape of the sterna often constitutes an important taxonomic character (Scyllaridae, *Enoplometopus*, Homaridae).

Abdomen. Located behind the cephalothorax. Usually consists of seven abdominal somites (the last one called the telson). The abdomen is well developed in shrimp and highly compressed laterally. The somites of the abdomen articulate freely with each other. Laterally, the margins of the somites hang down freely, forming the pleura (epimera). The abdominal sternal surface is not as well developed as the lateral margins.

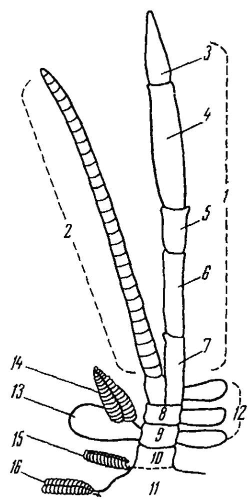


Figure 3. Diagrammatic sketch of a typical appendage of a decapod crustacean (from Holthuis, 1955).

1—endopod; *2*—exopod; *3*—dactyl (finger); *4*—propodus; *5*—carpus; *6*—merus; *7*—ischium; *8*—basis; *9*—coxa; *10*—precoxa; *11*—body; *12*—endites; *13*—epipod; *14*—podobranchia; *15*—arthrobranchia; *16*—pleurobranchia.

There is a characteristic curve in Caridea between the third and fourth somites, and the epimeron of the second somite is better developed than the epimera of the other somites, overlapping the contiguous epimera anteriorly and posteriorly. This overlapping is especially pronounced in the female, sometimes forming a unique oval chamber as, for example, in *Sympasiphaea annectens.* In swimming forms the sixth somite is markedly elongated, being more than twice the length of the fifth. In other groups of decapods the epimera are reduced. In the hermit crab, for example, the abdomen is mostly devoid of appendages and is soft and often spiraled. A more complete reduction of the abdomen is found in members of Galatheidae in which it is tucked under the cephalothorax. This reduction is maximum in crabs. The pleura are totally absent here and the abdomen flat and tucked under the carapace; in the male it is located in a special groove. In the female the abdomen is two to three times broader and protects the abdominal processes involved in egg-laying. In the male some of the modified abdominal processes participate in copulation. The shape of these processes is highly variable. Some of the segments of the abdomen may be fused.

Limbs and other appendages. In decapods only one of the 21 segments of the body—the telson—lacks appendages. Hence a total of 20 pairs of jointed appendages are present, one pair on each segment. Each appendage is initially biramous (Figure 3). The inner ramus of the appendage or endopod carries the major functional load. The outer ramus or exopod is often subject to reduction. The endopod of a typical appendage consists of seven segments labeled (beginning from the distal
7 end): dactyl (finger), propodus (the dactyl and propodus together may form a true or false chela), carpus, merus, ischium, basis (the exopod is attached to the basis), and coxa. The coxa is attached to a small outgrowth on the body, the precoxa. The coxa often has a folded lobe—the epipod (of mastigobranchia) to which the gill—the podobranchia—is attached. One or two gills also occur on the joint between the coxa and the body and are called arthrobranchiae. Finally, one or two pairs of gills are located on the lateral surface of the body and known as pleurobranchiae. Several modifications of a typical appendage are known, which relate to the different functions of the appendages of the different segments of the body. In some species some appendages are entirely or partly reduced. This is especially true of the exopods, particularly those of the walking legs.

Eyes. The stalked eyes of decapod crustaceans are located on the first segment of the body and included in the total number of body appendages. They usually consist of two segments: a basal segment and a terminal one carrying the cornea. The size ratio between these two segments may vary considerably. In most cases the terminal segment is larger, although the contrary is also known (*Podophtalmus,* Brachyura, Portunidae). The cornea is faceted and usually terminally located. It may be black, deep brown, or reddish brown in color. In deep-sea decapods it is reduced to a varying degree and in cavernous decapods almost totally absent.

Antennules. Located on the second segment of the body. In shrimp they are placed right below the eyes. Because of the fact that in crab the eyes are shifted toward the sides, the antennules appear to be located between them, almost along the median line of the body. Each antennule consists of a three-segmented peduncle and two or three (Palaemonidae and some members of Hippolytidae) flagella, which are attached to the last segment of the peduncle. In shrimp the antennular peduncles are freely attached to the body and highly variable in size. In crab with highly reduced antennules the basal segments are contiguous with the margins of the forehead or mouth and thus lose their mobility. The antennular flagella vary considerably in size but are usually shorter than the antennae (see below); in some deep-sea shrimp they may be several times longer than the body.

The proximal part of the basal segment is often flat in shrimp, forming a socket for the eye. The expansion on the outer side of the basal segment is called the stylocerite. The structure at the base of the basal segment of the antennular peduncle is called a statocyst (balancing organ). In some shrimps of family Penaeidae yet another structure occurs on the inner side of this segment. Lanceolate in shape it is known as the prosarthema and its presence or absence is an important taxonomic character.

Exceptionally, in shrimp of the genus *Solenocera* (Penaeidae) and in lower crabs of the genus *Albunea* (Hippidea) the antennular flagella may fuse to form a siphon-tube, which is used for respiration. In male shrimp of family Sergestidae the flagella are modified into an organ for holding the female.

Antennae. Located next to the antennules, the antennae consist of a five-segmented peduncle comprising a two-segmented (second segment called the basicerite) and a three-segmented endopod. The last segment of the endopod (carpocerite) carries a long flagellum. The excretory organ (antennal gland) opens at the back of the first segment of the protopodite. In addition to the endopod, the second segment also has an exopod known as the scaphocerite. This scale-like structure is highly developed in shrimp; together with the rostrum, the scaphocerites constitute a stabilizer—analogous to the tail stabilizer of an airplane. This device is used for maintaining the direction of movement in such situa-
8 tions as backing away from predators. In the case of spiny lobsters, lobsters, hermit crabs, and crabs the scaphocerite has undergone reduction and gradually disappeared in the same way as the rostrum. This change took place in higher crustaceans as a result of a transition from

swimming to crawling as a means of locomotion. The antennal flagella in shrimp are usually very long, sometimes even several times longer than the body. In crab they are reduced, short, or may be totally absent.

The modifications of the antennae in the spiny lobsters of family Scyllaridae are rather interesting. The basal segment of the antenna is fused with the margin of the forehead; of the remaining three movable segments the first and third are very small and the second very broad, dorsoventrally flat, and more or less highly serrate along the outer margin. This segment, together with the terminal one, which is also modified in the same way, forms a unique scapula (squama).

Mandibles. The first pair of oral appendages, the mandibles, are considerably modified and specialized appendages. In the identification of decapods their analysis is mandatory even though they lie much deeper in the body than do the other oral appendages. To remove the mandibles properly, the other oral appendages should either be pushed aside or carefully removed first. The body of the mandible consists of a divided apparatus and the base to which the muscles are attached. The divided apparatus consists of two highly calcified processes—the molar and incisor—located approximately at right angles to each other. In most decapods (Penaeidea, Stenopodidea, and all Reptantia), as well as in primitive types of Eucyphidea (Pasiphaeidae, Stylodactylidae, Oplophoridae), the molar and incisor are separated from each other only by a groove. In other members of Eucyphidea these processes are in sharp apposition to each other. In some families the incisorial process has disappeared completely and only the molar remains.

Moreover, the mandibles usually have a palpus (synaphipod), which primarily consists of three segments. However, the first or second segment of the palpus is frequently reduced and sometimes the entire palpus absent. These features constitute important taxonomic characters. In origin, the mandibles are possibly homologous to the coxae of other appendages or to their several segments. The origin of the palpus is controversial; some researchers hold that it is not homologous to the exopod but rather a new structure.

The mandibles are situated between the upper and lower labia. The palpus, in most cases, is attached to the upper labium. In those forms which have both processes, the incisorial is attached to the upper labium and the molar directed toward the oral opening. The mandibles are the major grinding organs of the oral apparatus and act as the opening and closing forceps. The other oral appendages are located behind the lower labium and cover the mandibles like a fold. The two pairs of maxillae belong to this group.

Maxilla I (or maxillula). This is a bilobate structure in which the lower lobe is slightly weaker than the upper. The upper or stronger lobe is covered with a series of large spines or teeth which, like the mandibular teeth, help to grind food. The two lobes may articulate with each other. The palpus of maxilla I is most often single-, rarely double- (*Homarus*, Thalassinidea, some crabs), and very rarely three- or four-segmented (*Penaeus*). The lobes of maxilla I are also known as endites or laciniae.

Maxilla II. Much larger than maxilla I, also bilobate; but here each lobe may be further divided into two. The palpus is usually single-segmented (in *Nephrops*, double-segmented) and the exopod prominent (also known as the scaphognathite or respiratory lamella). The vibrating movements of the lamella cause water to pass through the gills. Its removal causes death by asphyxiation.

9 The first three pairs of the thoracic limbs are known as maxillipeds.

Maxilliped I. In structure, resembles a maxilla. The coxa and basis are quite broad and look like lobes (the coxal lobe may be bifid) (for example, in Penaeidae). The palpus of the maxilliped (homologous to the exopod) has no more than five segments and usually only one. In crabs it is broad at the end and forms a transverse fold which serves as the closing end of the canal leading into the branchial chamber. The exopod usually consists of an expanded basal part and a terminal flagellum which is sometimes multisegmented. The expanded basal part, a characteristic feature of Eucyphidea, is otherwise known as the eucyphid appendage. In shrimp the endopod on maxilliped I is bilobate; in crab it is a very elongated structure with a broad proximal and a narrow distal part. In Eryonidea the exopod, and in Oxystomata the endopod, are modified into respiratory tubes.

Maxilliped II. In structure, resembles a pereopod due to the presence of a five-segmented endopod (the number of segments may be reduced due to the fusion of the basis with the ischium or the fusion of the ischium and merus). In higher members of Eucyphidea the dactyl of maxilliped II is situated not at the end of the propodus, but on its broad lateral side. A segmented or unsegmented exopod is commonly present in maxilliped II. In some groups of decapods, however, the exopod may be totally reduced. An epipod and gill (podobranchia) may also be present.

Maxilliped III. Usually consists of the same elements described for maxilliped II. In shrimp it is long and resembles a pereopod. In many cases (for example, Eucyphidea) the individual segments have fused (for example, the ischium and merus, or the propodus and dactyl, or the basis and ischiomerus), thereby reducing the number of segments. The ischium in Astacura, Palinura, Galatheidea and other primitive Reptantia is armed with a series of teeth used in crushing. In the primitive hermit crab the propodus and dectylus form a small chela. In higher crabs the ischium and merus of maxilliped III are expanded and form an opercular cover for the oral opening. The last three segments of the appendage are reducd in this process into a palpus, which is often hidden behind the merus.

As in maxilliped II the exopod in maxilliped III is highly variable. It is more frequently joined with the coxa than with the basis. Sometimes (in Sergestidae, Eryonidea, etc.) it may be totally absent. In crabs of family Leucosiidae (Oxystomata) it is broad and forms an operculum for the branchial canal. The epipod, on which a podobranchia is often present, is well developed in crabs.

The oral appendages serve the following functions: grinding of food, passage of fresh water into the gills (scaphognathite), and cleansing of the eyes and antennules (especially the last segment of maxilliped III).

Behind the oral appendages five pairs of pereopods (walking legs) are found—the very feature for which the order Decapoda was established.

Pereopods. In structure, resemble the typical seven-segmented appendage of shrimp. In Reptantia some of the segments or podomeres have fused. In Astacura only the basis and ischium of the chelipeds are fused. In other members of Reptantia (except Eryonidea) the same is true of all the pereopods. Hence these limbs generally appear to be six-segmented. The site of the rupturing which occurred during the autotomy (shedding) of the appendages is evident in the center of these segments. The main bend in the pereopod (knee) occurs in the joint between the merus and carpus. Exopods are present on the pereopods of only some decapods, primarily pelagic shrimp (Oplophoridae, Pasiphaeidae, some members of Atyidae, etc.). They are usually rudimentary (for example, in Penaeidea) or present only in the larvae (mysid stage of Natantia, Astacura, etc.).

10 The epipods (or mastigobranchiae) are located on the coxae and directed backward. They consist of a narrow proximal part (pedicel) and a distal widened and often bifid lamella. The gills are cleansed with their help. They may be present on all the appendages from maxilliped I to pereopod IV (sometimes V). They are particularly well developed in shrimp and Anomura, but in crab (except for lower Dromiacea) are present only on the maxillipeds.

Since pereopods differ somewhat in function, certain differences are naturally evident in their structure. The first two or three pairs participate in catching prey or in self-defense against predators. Large chelae of variable size are usually present on the first and rarely on the second pereopods (in Penaeidea, Stenopodidea, and Astacura chelae are present on the first three pairs of pereopods). Depending on their structure these chelae are either true or false (see Figure 2) and exhibit a number of modifications. Even within one species the anterior chelae may differ from the posterior, or those on the right legs differ from those on the left.

Generally speaking, the last two or three pairs of pereopods are locomotory and serve no other function than the animal's movement over ground. In shrimp and lower Reptantia (Palinura, Astacura) these pereopods are very similar in structure. True, in female spiny lobsters small false chelae are evident on the fifth pair of pereopods. In some decapods the last pair of pereopods is reduced (the reduction varying, for example, in pelagic shrimp such as Pasiphaeidae, etc. and hermit crabs) or specialized to perform other functions (for example, the swimming legs of crabs of family Portunidae).

The abdomen has six pairs of appendages; the first five pairs are known as pleopods.

Pleopods (in shrimp). Usually used for swimming by both sexes. They have a typical biramous structure and consist of a very short coxa and a fairly long basis; exo- and endopods are also present. The latter are flagellar or lamellar in structure. A small appendix armed with hooks is usually found on the endopod (appendix interna or stylamblys—in Eucyphidea, Palinura, and Axiidae); it is absent in Penaeidea and Astacura. These appendices link the pleopods of both sides of the body during movement.

In all decapods one or more pairs of pleopods serve as copulatory organs or are adapted for egg-laying. In Penaeidea the endopods of the first pair of pleopods of the male are modified in the form of petasma (see below) which are generally symmetrical but sometimes (*Metapenaeopsis*) asymmetrical. In the male of Eucyphidea, in addition to the appendix interna, another appendix—appendix masculina—occurs on the second pleopods. In Stenopodidea and Scyllaridea appendages with sexual modifications are absent in the male. In Eryonidae, the first pair, and in Nephropidae and Potamobiidae, the first two pairs are modified into copulatory organs in the male. A somewhat similar feature is also observed in several members of Anomura. In primitive forms of Paguridae the first two pairs of pleopods in the male and sometimes the first pair in the female are modified, while the others on both sides of the body remain typical. In higher hermit crabs appendages with special sexual modifications and the pleopods adjoining the columella (the central column) are absent on the right side of the body; both are present on the left side, however (in *Paguropsis* the reverse has been observed). In crabs, pleopods I and II in the male are modified into unique rod-like structures; the other pleopods are totally absent. In the female, except for the first pair, as in other decapods (except Penaeidea), they are adapted for egg-laying.

Uropods. Appendages of the sixth abdominal somite (pleopods VI). In all shrimp and primitive Reptantia these appendages together with the telson form the tail fan. A protopodite with foliate outer and inner
1 rami characterizes most uropods. In Scyllaridea only the proximal half

of the rami is hard and calcified, while the distal part is leathery and elastic. In Astacura the exopod is divided into two parts by a transverse suture (dieresis). In typical hermit crabs the uropods are reduced; their outer surfaces are extremely rough and used for attachment of the body to the shell. Uropods are totally absent in Lithodidae and Brachyura and rudimentary in Dromiidae.

Gills. Contained in a branchial chamber in decapods and externally covered by the branchiostegite. Considered lateral cuticular outgrowths they differ in structure and have been divided into three types: (1) phyllobranchiae consisting of a stalk with two series of flat foliate structures; (2) trichobranchiae consisting of a stalk with numerous long and thin tubules; and (3) dendrobranchiae consisting of a stalk on which the tubules are arranged in two rows but are so densely branched that they appear dendroid (Figure 4). Phyllobranchiae are typical of Eucyphidea, most Paguridea and Galatheidea, all Hippidea, and the majority of Brachyura. Trichobranchiae are typical of Eryonidea, Scyllaridea, Astacura, Stenopodidea, Thalassinidea, lower Paguridea, Galatheidea, and Dromiacea. Dendrobranchiae are found only in Penaeidea.

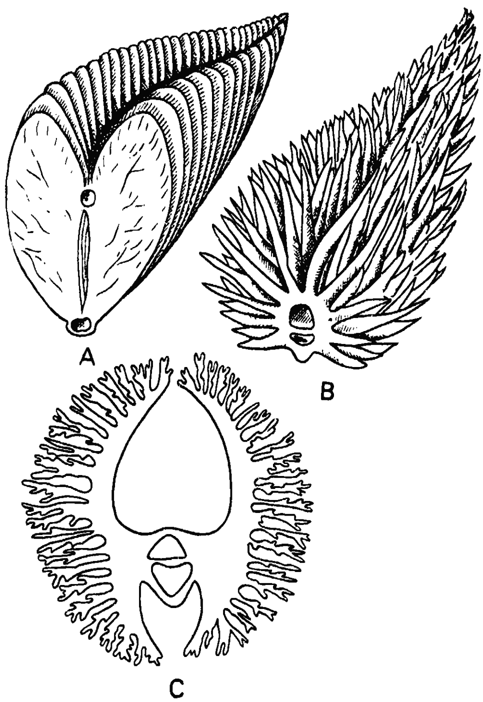


Figure 4. Types of gills found in decapod crustaceans.

A—phyllobranchia (general view); *B*—trichobranchia (general view) (from Vinogradov, 1950); *C*—dendrobranchia (cross section) (from Balss, 1926)

The podobranchiae are located on the coxae of the maxillipeds and pleopods*; the arthrobranchiae are attached to the segment between the body and the coxa; the pleurobranchiae are located on the lateral wall of the body. A segment may have one podobranchia, two arthrobranchiae, and one pleurobranchia. However, this arrangement is found only in some of the pereopodal somites in some shrimp; in other shrimp the number of gills may be more or less or even absent on individual somites. For example, pleurobranchiae are absent on maxillipeds I, while podobranchiae and arthrobranchiae are generally absent on pereopods V. The gills and epipods constitute an important taxonomic character which has been expressed in a branchial formula (see Table).

Stridulatory organ. Present in many members of Decapoda. The presence of this organ as well as the peculiarities of its structure are taxonomically important features. In some spiny lobsters of the family Palinuridae the stridulatory organ is situated between the place of attachment of the antennae and the antennules. Unique sounds are produced when these two parts rub against each other. On the basis of
12 this organ all the spiny lobsters of the family have been classified as Silentia (silent) and Stridulentia (shrilling).

Branchial formula for some decapods

	Maxillipeds			Pereopods				
	I	II	III	I	II	III	IV	V
Benthesy- *cymus*	Ep 1A	Ep, 1Po 1A, 1Ple	Ep, 1Po 2A, 1Ple	Ep, 1Po 2A, 1Ple	Ep, 1Po 2A, 1Ple	Ep, 1Po 2A, 1Ple	Ep 2A, 1Ple	— 1Ple
Pasiphaea				1A, 1Ple	1A, 1Ple	1A, 1Ple	1Ple	1 Ple
Eupagurus			2A	2A	2A	2A	2A, 1Ple	
Cancer	Ep	Ep, 1Po 2A	Ep, 1Po 2A	2A	1Ple	1Ple		

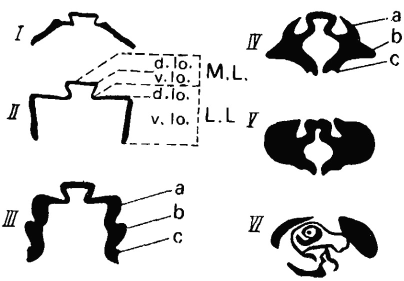
Key: Ep—epipod; Po—podobranchia; A—arthrobranchia; Ple—pleurobranchia.

The stridulatory organ is present in a number of crabs and, for the most part, is quite similar in structure and seldom single. A small ridge occurs on the ischium of each cheliped which the crab seesaws against a group of tubercles or a group of small ridges located either on the inner side of the palm of the chela of the same cheliped or on the lower side of the body. In shrimp of the genus *Metapenaeopsis* the sound-producing mechanism is located on the posterior half of the branchiostegite. The shape and arrangement of the ridges in the stridulatory organ of this genus are of considerable importance in species identifications (see Figure 35).

* Mistake in original. Should read "pereopods"—Technical Editor.

Copulatory organs of Penaeidea. In shrimp belonging to Penaeidea the copulatory organs—the petasma and thelycum—are so significant in species identification that they merit special attention (Kubo, 1949).

Petasma. Formed by the fusion of the endopods of pleopods I along their inner margin. As can be seen from Figure 5, the petasmal endopod consists of a median or inner lobe (*M.L.*) and a lateral lobe (*L.L.*). Each lobe is divided by a fold into two parts: a dorsal or anterior (*d.lo.*) and a ventral or posterior (*v. lo.*) lobule respectively. The ventral lobule of the lateral lobe has three longitudinal ridges on its outer side: *a, b,* and *c.* Ridge *a* is located near the boundary between the dorsal and ventral lobules; ridge *b* near the middle line of the outer surface of the ventral lobule; and ridge *c,* usually smaller than the other two, on the outer surface near the ventral margin of the lobule.

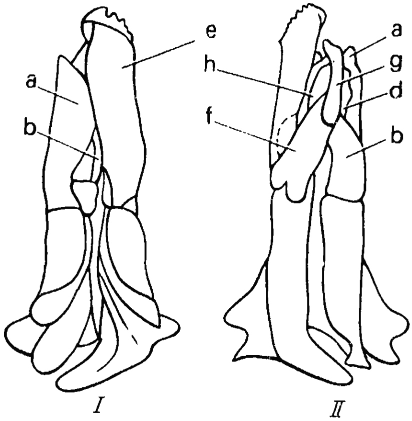


13 Figure 5. Main structural features of different types of petasma.

I to *V*—Cross sections at about midpoint level of petasma of adult specimens. Gradual complexities in petasma depicted (from Kubo, 1949); *M.L.*—median lobe; *L.L.*—lateral lobe; *d.lo.*—dorsal lobule; *v.lo.*—ventral lobule; *a, b,* and *c*—dorsal, median, and ventral ridges respectively of ventral lobule of lateral lobe; *I—Aristaeus, Aristeomorpha, Penaeopsis; II—Penaeus, Solenocera, Hymenopenaeus; III—Parapenaeus, Trachypenaeus; IV—Metapenaeus, Parapenaeopsis, Eusicyonia; V—Metapenaeopsis* (section through middle of petasma); *VI—Metapenaeopsis* (section through distal part of petasma, about middle of inner intermediate plane).

In addition to this lobular division, the petasma is characterized by a series of projections or spines peculiar to different genera or species of Penaeidae. The symmetrical structure of the petasma in most shrimp makes it easy to locate these unique ornamentations and use them in species identification. In shrimp of the genus *Metapenaeopsis,* however, the petasma has lost its typical structure and become highly asymmetrical. To facilitate the identification of shrimp belonging to this genus therefore, the petasmal structure has been detailed in Figure 6.

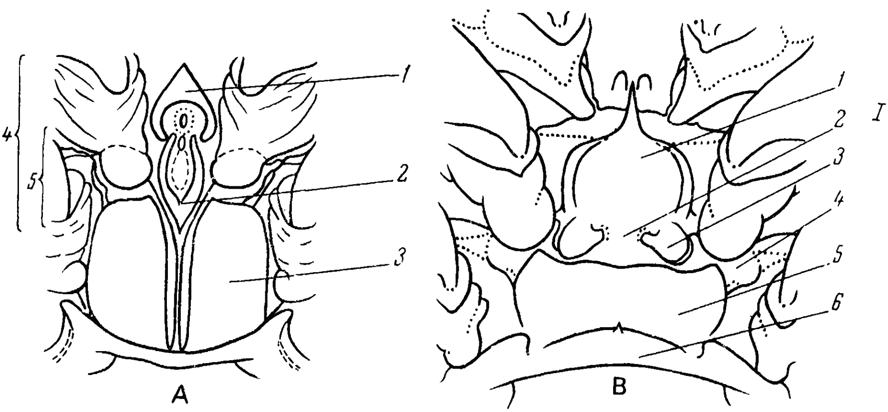
In shrimp of the genus *Metapenaeopsis* both the petasmal endopods are divided transversely into approximately equal proximal and distal parts.



13 Figure 6. Diagrammatic sketch of petasma in shrimp of the genus *Metapenaeopsis* (Racek and Dall, 1965).

I—ventral view; *II*—dorsal view; *a*—right distoventral projection; *b*—right distodorsal lobule; *c*—distoventral flap; *d*—distomedian lobule; *e*—left distoventral projection; *f*—left distodorsal lobule; *g*—inner intermediate strip; *h*—outer intermediate strip.

The distal part of the right endopod consists of four elements: (*a*) right distoventral projection, (*b*) right distodorsal lobule, (*c*) distoventral flap,
14 and (*d*) distomedian lobule. The right distoventral projection lies on the distoventral margin of the proximal part. The right distodorsal lobule arises from the distodorsal margin of the proximal part. The distoventral flap is situated on the ventromedian margin of the proximal part of the



13 Figure 7. Diagrammatic sketch of the thelycum.

A—closed type (Perez Farfante, 1969): *1*—anterior process; *2*—middle ridge; *3*—lateral plate (flap); *4*—posterior process; *5*—middle projection; *B*—open type (Perez Farfante, 1971): *I*—median plate; *1*—anterior part; *2*—middle bridge; *3*—knob; *4*—projection; *5*—transverse plate; *6*—posterior crest.

endopod, and is partially covered by the distoventral projection and distodorsal lobule.

The distomedian lobule is situated on the basal lateral margin of the distoventral flap and is masked by the right distoventral projection.

The distal part of the left petasmal endopod also consists of four elements: (*e*) left distoventral projection, (*f*) left distodorsal lobule, (*g*) inner intermediate strip, and (*h*) outer intermediate strip. The distoventral projection is located on the distoventral margin of the proximal part and the distodorsal lobe on the distodorsal margin. The inner and outer intermediate strips are small appendages situated on the distal inner and outer margins of the distodorsal lobule.

Thelycum. Located on the thoracic sterna between pereopods IV and V. It consists of a series of outgrowths, depressions or grooves, plates and flaps. It is meant for the attachment of spermatophores.

Two types of thelycums have been distinguished: the open type (majority of the members of Penaeidae) and the closed type (in most of the shrimps of the genus *Penaeus*). The latter consists of two lateral plates and a median projection (Figure 7).

II

TAXONOMY OF ORDER DECAPODA LATREILLE

KEY TO SUBORDERS (FROM BALSS, 1957)

15 1. Carpo-propodal articulation of pereopods only at one fixed point. Pleopods well developed, modified for swimming ....Suborder NATANTIA.

— Carpo-propodal articulation of pereopods at two opposite points. Pleopods, if present, highly reduced and not modified for swimming ....Suborder REPTANTIA.

SUBORDER NATANTIA BOAS, 1880

KEY TO TRIBES (FROM BALSS, 1957)

1. Pereopods III chelate. Pleura of first abdominal segment not overlapped by those of second segment. Abdomen without a sharp curve ....2.

— Pereopods III never chelate. Pleura of second abdominal segment noticeably overlap those of first segment. Abdomen usually sharply curved ....Tribe **Caridea** (Eucyphidea).

2. Pereopods III not stouter than II and I. Males with petasma ....Tribe **Penaeidea.**

— Pereopods III (either on both or on one side only) much more robust than II and I. Males without petasma ...Tribe **Stenopodidea.**

Tribe Penaeidea de Haan, 1849

KEY TO FAMILIES

1. Pereopods IV and V well developed. Gills numerous ....Family **Penaeidae.**

— Pereopods IV and V reduced or absent. Gills few (up to 8) or absent ....Family **Sergestidae.**

FAMILY PENAEIDAE DANA,

KEY TO SUBFAMILIES (FROM ANDERSON AND LINDNER, 1945)

1. Prosarthema present .... 2.
— Prosarthema absent .... 3.
2. Postorbital spine absent. Cervical groove short .... Subfamily **Penaeinae.**
— Postorbital spine present. Cervical groove long, either reaching or almost reaching dorsal side of carapace .... Subfamily **Solenocerinae.**
3. Carapace without median dentate crest extending to posterior margin.* .... 4.
— Carapace with median dentate crest extending dorsally to posterior margin .... Subfamily **Sicyoninae.**
4. Upper antennular flagellum very short, several times shorter than lower one .... Subfamily **Aristeinae.**
— Upper antennular flagellum almost as long as lower one .... Subfamily **Benthesicyminae.**

16 FAMILY SERGESTIDAE DANA, 1852

KEY TO SUBFAMILIES

1. Carapace moderately compressed laterally. Lower antennular flagellum and gills present .... Subfamily **Sergestinae.**
— Carapace highly compressed laterally. Lower antennular flagellum and gills absent .... Subfamily **Leuciferinae.**

Subfamily PENAEINAE Dana, 1852

KEY TO GENERA (FROM DALL, 1957, WITH EMENDATIONS AND ADDITIONS)

1. Pleurobranchia on last thoracic somite and epipod on maxilliped III present. Ventral rostral teeth usually present .... 2.
— Pleurobranchia on last thoracic somite and epipod on maxilliped III absent. Ventral rostral teeth absent .... 3.
2. Incisorial process of mandible short, almost rectangular. Body smooth. Pterygostomian angle obtuse. Telson without spines or with three pairs of movable spines .... *Penaeus* Fabricius.
— Incisorial process of mandible elongated and saber-shaped. Body densely pubescent. Telson with three pairs of immovable spines .... *Funchalia* Johnson.

*Error in original. Should read "Carapace with dentate crest extending only to its center"—Technical Editor.

3. Petasma symmetrical. Maxilliped III usually without basial spine . . . . .4.
— Petasma asymmetrical. Maxilliped III with basial spine. . . . . *Metapenaeopsis* Bouvier.
4. Telson with pair of large immovable subapical spines. First segment of antennular peduncle with spine (sometimes very small) on ventral distomedian margin . . . . .5.
— Telson without pair of large immovable subapical spines, but often with lateral immovable spines (except in *Parapenaeopsis stylifera* Milne-Edwards). First segment of antennular peduncle without spine on ventral distomedian margin . . . . .8.
5. Telson with less than four pairs of immovable spines. Basis and ischium of pereopod I with one spine each . . . . .6.
— Telson with four pairs of immovable spines. Basis and ischium of pereopod I without spines . . . . *Artemesia* Bate (one species: *A. longinaris* Bate, 1888).
6. Carapace with longitudinal sutures . . . . *Parapenaeus* Smith.
— Carapace without longitudinal sutures . . . . .7.
7. Branchiostegal spine present. Petasma with pair of large spiny distolateral projections . . . . *Penaeopsis* Bate.
— Branchiostegal spine absent. Petasma with pair of tubular distolateral projections . . . . *Trachypenaeopsis* Burkenroad.
8. Exopods present on pereopods II to IV . . . . .9.
— Exopods absent on pereopods II to IV . . . . *Macropetasma* Stebbing (one species: *M. africanum* Stebbing, 1914).
9. Pleurobranchia present on thoracic somite VII. Exopod absent on pereopod V. . . . . *Metapenaeus* Wood-Mason and Alcock.
— Pleurobranchia absent on thoracic somite VII. Exopod present on pereopod V. . . . . .10.
10. Maxilliped II with well-developed exopod. Chela typical in structure . . . . .11.
— Maxilliped II without exopod. Chela with short finger and elongated palm . . . . *Protrachypene* Burkenroad (one species: *P. precipua* Burkenroad, 1934).
11. Dactyl of pereopods IV and V typical in structure, not divided into secondary segments. Usually not more than distal half of rostrum edentate . . . . .12.
— Dactyl of pereopods IV and V markedly elongated, filiform, and divided into secondary segments. Distal two-thirds of rostrum edentate . . . . *Xiphopenaeus* Smith.
12. Carapace with longitudinal sutures. Thelycum with broadly concave anterior plate, rounded anterior margin, and a transverse posterior plate. Ischium of pereopod II without spine . . . . .13.
— Carapace without longitudinal sutures. Thelycum with narrow

plate, partly bordered by two narrow posterolateral elevations. Ischial spine present on pereopod II ....*Atypopenaeus* (Alcock).

13. Epipod present on pereopod III ....14.
— Epipod absent on pereopod III. ....*Parapenaeopsis* (Alcock).

14. Rostrum long and slender, reaching far beyond distal margin of scaphocerite. Antennular flagella unequal in length and longer than carapace. Pereopods IV and V slender, much longer than the rest. Exopod of pereopod V extremely reduced ....*Tanypenaeus* Perez Farfante (one species: *T. caribeus* Perez Farfante, 1972).
— Rostrum short, in length approximately equal to that of scaphocerite. Antennular flagella almost equal in length and shorter than carapace. Only pereopod V slightly longer than the rest. Exopod of pereopod V slightly smaller than those of the rest ....*Trachypenaeus* (Alcock).

17 **Genus Penaeus Fabricius, 1798**

KEY TO SPECIES

1. Adrostral grooves reach epigastric tooth or extend slightly beyond it. Gastrofrontal grooves absent ....2.
— Adrostral grooves almost reach posterior margin of carapace. Gastrofrontal grooves present ....13.

2. Subhepatic crest well developed. Thelycum in female, open type. Shrimps inhabit Pacific and Atlantic coasts of North, Central, and South America ....3.
— Subhepatic crest poorly developed or absent. Thelycum in female, closed type. Shrimps inhabit coasts of Australia, Asia, and East Africa (as well as eastern part of Mediterranean Sea)...........7.

3 Shrimps inhabit Atlantic coast of North, Central, and South America ....4.
— Shrimps inhabit Pacific coast of North, Central, and South America ....5.

4. Petasma with diagonal crest on inner surface of distal part of lateral lobe; distal ventromedian angle rounded. Thelycum with anterolateral crests facing each other. Pair of fleshy projections on sterna of pereopod (Figure 8) ....*P. setiferus* (L.), 1761.
— Petasma without diagonal crest on inner surface of distal part of lateral lobe; distal ventromedian angle almost forms a right-angle
18 projection. Thelycum with almost parallel anterolateral crests, sometimes not bent toward each other. Pair of rounded hard outgrowths on sterna of pereopod V (Figure 9). ....*P. schmitti* Burkenroad, 1934.

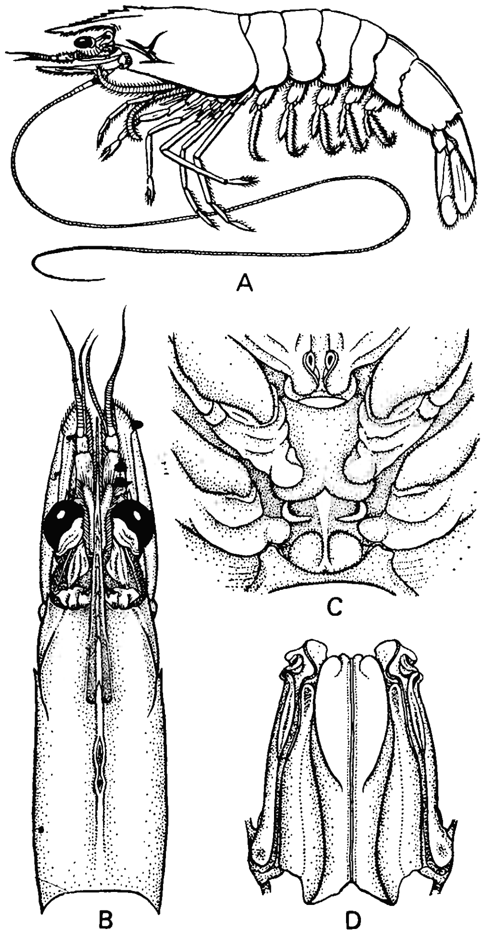


Figure 8. *Penaeus setiferus* (L.) (from Perez Farfante, 1969).

A—lateral view; *B*—cephalothorax, dorsal view; *C*—thelycum, *D*—petasma.

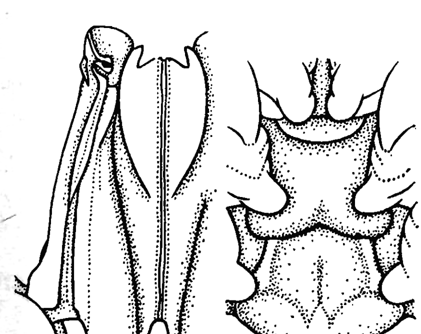


Figure 9. *Penaeus schmitti* Burkenroad.

A—petasma; *B*—thelycum.

5. Posterior ventral tooth of rostrum situated directly under or ahead of anterior or distal dorsal tooth. Adrostral carinae do not extend beyond epigastric spine. Rostral formula usually 9/2. Thelycum without dense pubescence. Sterna of pereopod V with two ventrally raised even areas in anterior part (Figure 10) .... *P. vannamei* Boone, 1931.

— One or more ventral teeth of rostrum situated beyond distal dorsal tooth. Adrostral carinae extend beyond epigastric spine. Rostral formula usually 8-11/4-5. Thelycum without two ventrally raised areas on anterior part of sterna of pereopod V .... 6.

6. Rostral formula usually 8/4-5. Antennular flagellum longer than peduncle. Male with widely spaced spines on middorsal surface of lower (inner) antennular flagellum. Female with distinctly raised triangular area in middle of sterna of pereopod V. Coxa of III, IV, and V pereopods in female with large outgrowths directed toward median line. Thelycum slightly pubescent (Figure 11) .... *P. stylirostris* Stimpson, 1871.

— Rostral formula 10-11/3-5. Antennular flagellum either as long as or
19 shorter than peduncle. Male with closely set spines on outer lateral margin of lower antennular flagellum. Female without triangular outgrowth in middle of sterna of pereopod V. Coxa of III, IV, and V pereopods without outgrowths. Thelycum often pubescent (Figure 12) .... *P. occidentalis* Streets, 1871.

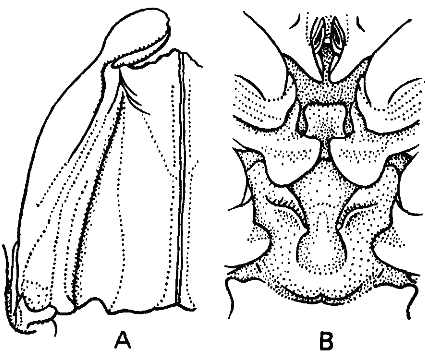


Figure 10. *Penaeus vannamei* Boone. *A*—petasma; *B*—thelycum.

7. Carapace with well-defined subhepatic carina .... 8.

— Carapace without subhepatic carina .... 10.

8. Pereopod V without exopod (Figure 13) .... *P. monodon* Fabricius, 1798.

— Pereopod V with a small but distinct exopod .... 9.

9. Postrostal carina with a groove (Figure 14) .... *P. semisulcatus* de Haan, 1844.

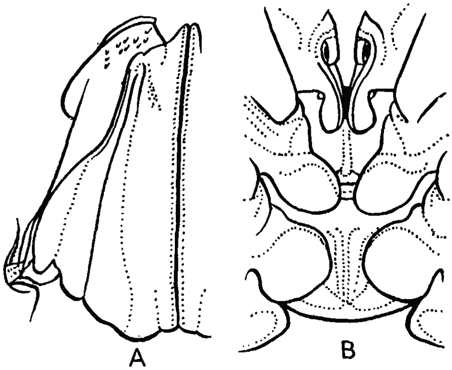


Figure 11. *Penaeus stylirostris* Stimpson.

A—petasma; *B*—thelycum.

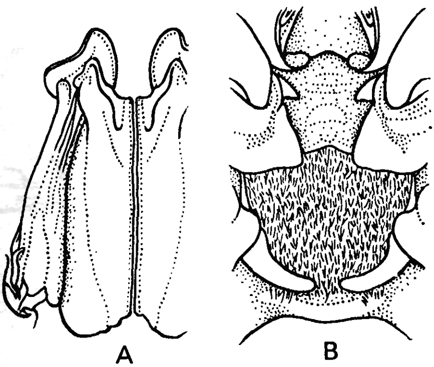
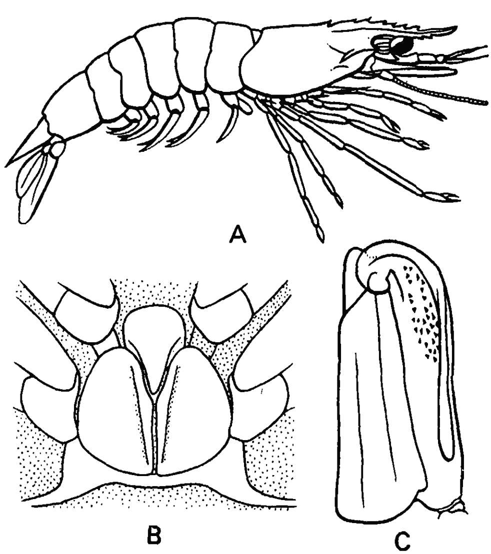


Figure 12. *Penaeus occidentalis* Streets (from Perez Farfante, 1970).

A—petasma; *B*—thelycum.



20 Figure 13. *Penaeus monodon* Fabricius (from Dall, 1957).

A—lateral view; *B*—thelycum; *C*—petasma.

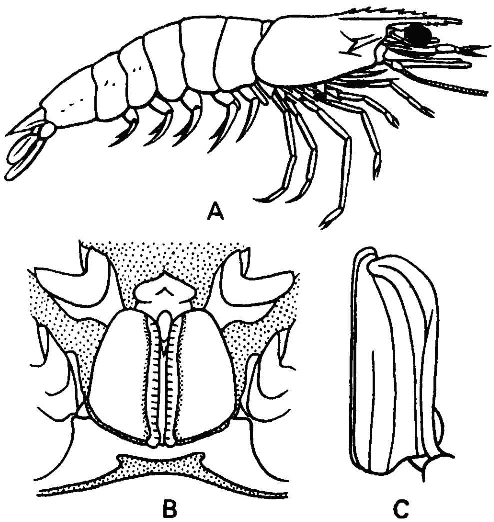


Figure 14. *Penaeus semisulcatus* de Haan (from Dall, 1957).

A—lateral view; *B*—thelycum; *C*—petasma.

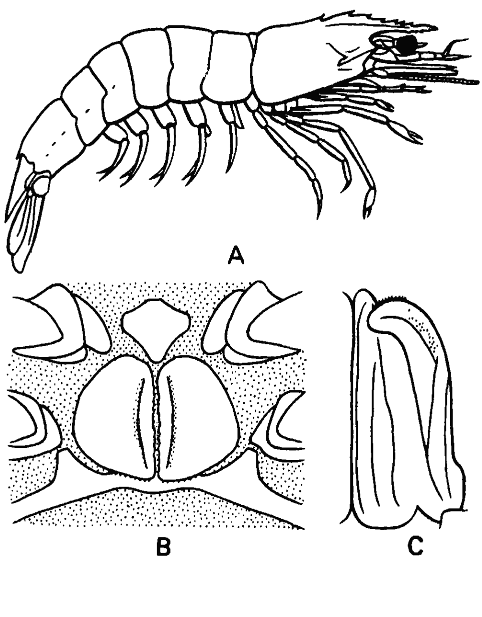


Figure 15. *Penaeus esculentus* Haswell (from Dall, 1957).

A—lateral view; *B*—thelycum; *C*—petasma.

— Postrostral carina without a groove (Figure 15) .... *P. esculentus* Haswell, 1879.

10. Pereopod III extends beyond distal margin of scaphocerite by at least one finger length .... 11.

— Pereopod III does not extend up to distal margin of scaphocerite .. .. *P. orientalis* Kishinouye, 1896.

11. Gastroorbital carina occupies posterior two-thirds of distance be-

tween hepatic spine and orbital angle. Rostral crest moderately high .... *P. indicus* Milne-Edwards, 1837.

— Gastroorbital carina absent or extends medially only up to one-third of distance between hepatic spine and orbital angle. Rostral crest high .... 12.

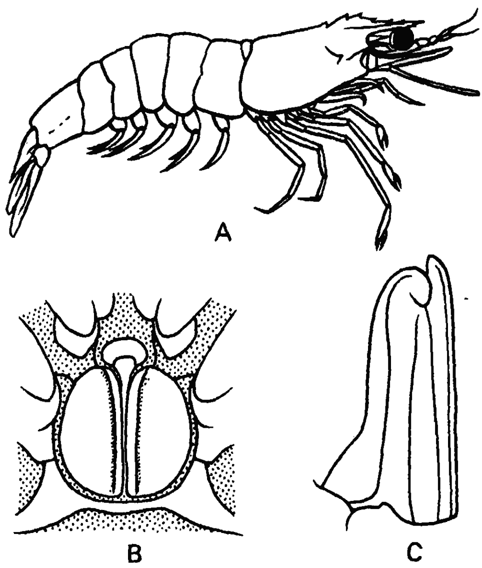


Figure 16. *Penaeus merguiensis* de Man (from Dall, 1957).
A—lateral view; *B*—thelycum; *C*—petasma.

12. Rostral crest triangular; adrostral carina does not extend to epigastric tooth (Figure 16) .... *P. merguiensis* de Man, 1888.

21 — Rostral crest convex and not triangular; adrostral carina extends just beyond epigastric tooth .... *P. penicillatus* Alcock, 1905.

13. Gastrofrontal grooves form a loop; dorsolateral grooves absent on sixth abdominal somite .... 21.

— Gastrofrontal grooves simple, do not loop; dorsolateral grooves present on sixth abdominal somite .... 14.

14. Shrimps inhabit Atlantic coast of Africa and North, Central, and South America .... 15.

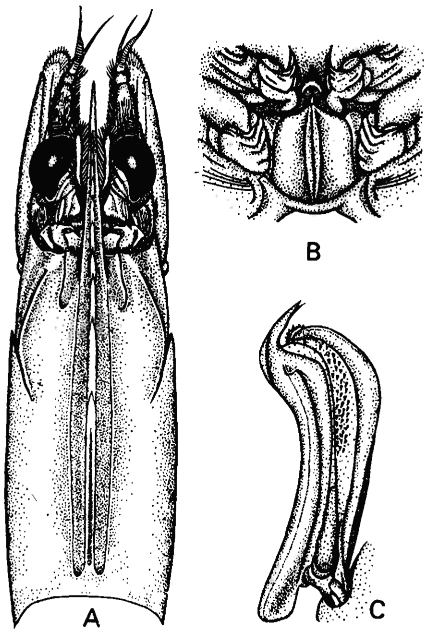
— Shrimps inhabit Pacific coast of North, Central, and South America .... 20.

15. Petasma with long distomedian projections with distal folds, which penetrate deeply into petasma and form large "auricles". Anteromedian corners of lateral plates of thelycum project forward and cover posterior process of median plate (Figure 17) .... *P. brasiliensis* Latreille, 1817.

— Petasma with relatively short distomedian projections with distal folds and do not form "auricles"; height of ventral crest that of adjacent membranous part. Anteromedian corners of lateral plates of thelycum do not project. Posterior process open. . . . . .16.

16. Distal part of ventral crest of petasma with small spines along free margin, broad, and proximally sharply curved. Anteromedian corners of lateral plates of thelycum mildly divergent. Posterior
22 process of median plate with simple median carina . . . . .17.

— Distal part of ventral crest of petasma unarmed along free margin, almost straight or somewhat arced, broadens gradually, and pooximally curved. Anteromedian corners of lateral plates of thelycum widely divergent. Posterior process with a median, anteriorly bifurcated carina . . . . .18.



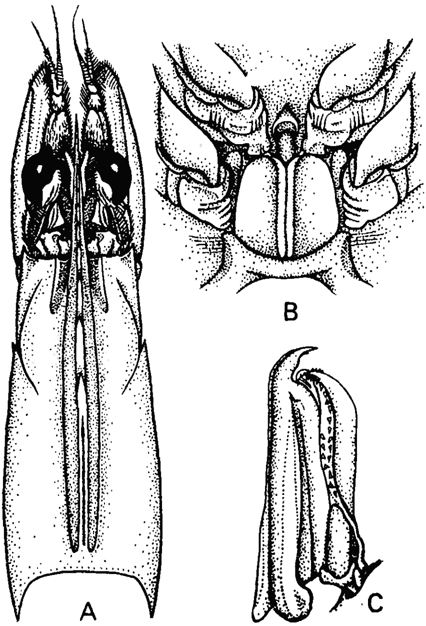
21 Figure 17. *Penaeus brasiliensis* Latreille (from Perez Farfante, 1969).

A—cephalothorax (dorsal view); *B*—thelycum; *C*—petasma.

17. Dorsolateral gooves of sixth abdominal somite narrow; ratio between height of carina of sixth somite and width of groove (measured approximately at a distance of one-third the length of somite from its posterior margin) usually greater than three; grooves often almost entirely closed (Figure 18) . . . .*P. duorarum* Burkenroad, 1939.

— Dorsolateral grooves broad; ratio between carina height and groove width usually less than three . . . .*P. duorarum notialis* Perez Farfante, 1967.

18. Adrostral grooves long, almost reaching posterior margin of carapace, posteriorly deep and broad, and width four-fifths to two times greater than width of postrostral carina (measured at



21 Figure 18. *Penaeus duorarum* Burkenroad (from Perez Farfante, 1969).
A—cephalothorax (dorsal view); *B*—thelycum; *C*—petasma.

posterior one-eighth distance between posterior ends of adrostral grooves up to epigastric tooth) ....19.

— Adrostral grooves relatively short, never close to posterior margin of carapace, posteriorly small and tapering, and width one-fifth to three-fourths of width of postrostral carina .... *P. aztecus subtilis* Perez Farfante, 1967.

19. Median groove of postrostral carina long and deep throughout its length. Dorsolateral grooves broad; ratio between keel height and groove width usually less than three. Distal part of ventral crest of petasma narrows to a cusp, arced, and armed with an outwardly stretched group of closely set teeth on the attached margin. Anterior and posterior processes of median plate of thelycum broad (Figure 19) ....*P. aztecus* Ives, 1891.

23 — Median groove short, shallow, and frequently interrupted. Dorsolateral grooves narrow; ratio between keel height and groove width greater than three; grooves often almost closed. Distal part of ventral crest of petasma obtuse, almost straight, and armed with irregularly arranged teeth. Anterior and posterior processes of median plate of thelycum narrow (Figure 20) ....*P. paulensis* Perez Farfante, 1967.

20. Thelycum with a longitudinal carina in middle of sternite of pereopod V. Ventral surface of lateral plates of spermatheca not pubescent ....*P. californiensis* (Holmes), 1900.

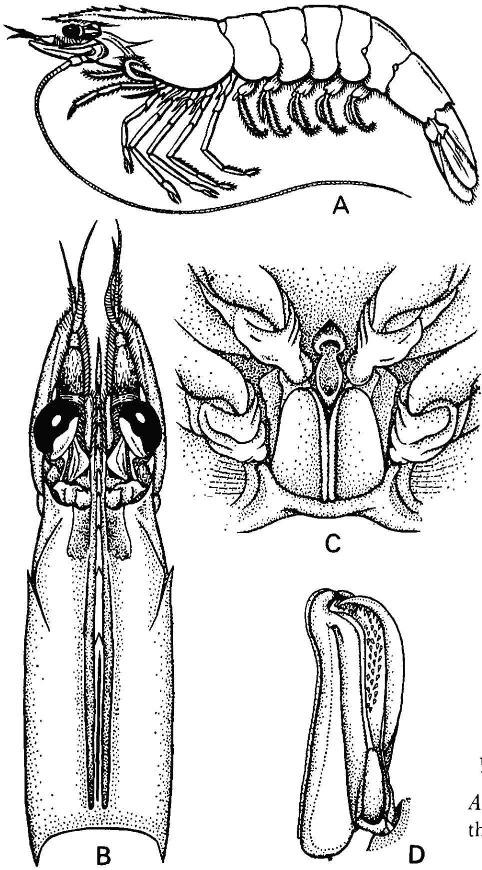


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Figure 19. *Penaeus aztecus* Ives. *A*—lateral view; *B*—cephalothorax (dorsal view); *C*—thelycum; *D*—petasma.

— Thelycum without longitudinal carina in middle of sterna of pereopod V. Ventral surface of lateral plates of spermatheca pubescent .... *P. brevirostris* Kingsley, 1878.

21. Coxa of pereopods I, II, and III armed with spines .... *P. kerathurus* (Forskal), 1775.

— Coxa of first three pereopods without spines .... 22.

22. Ischium and basis of pereopod I armed with spines .... 23.

— Spines present only on basis of pereopod I. Exceptionally small rounded outgrowth replaces spine on ischium .... 24.

23. Antennular flagella equal in length to peduncle. Median groove absent on postrostral carina .... *P. marginatus* Randall, 1840 (*P. teraoi* Kubo, 1949).

— Antennular flagella no more than half length of peduncle. Median groove present on postrostral carina (Figure 21) .... *P. longistylus* Kubo, 1943.

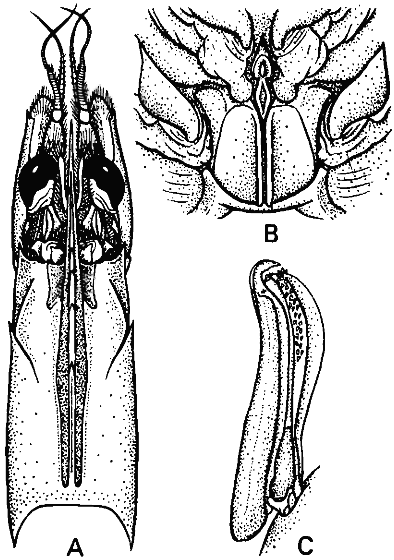


Figure 20. *Penaeus paulensis* Perez Farfante (from Perez Farfante, 1969).

A—cephalothorax (dorsal view); *B*—thelycum; *C*—petasma.

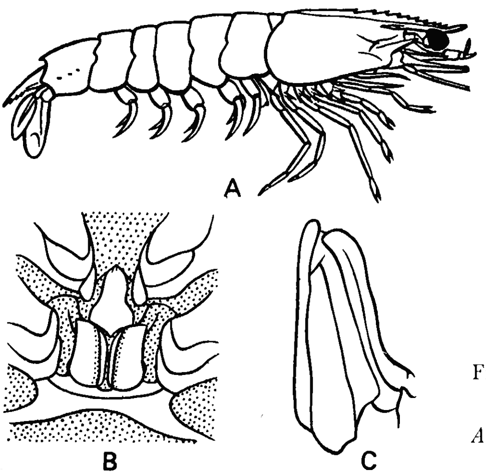


Figure 21. *Penaeus longistylus* Kubo (from Dall, 1957).

A—lateral view; *B*—thelycum; *C*—petasma.

24. Telson with dorsolateral spine .... .25.
— Telson without dorsolateral spine ....
.... *P. canaliculatus* (Olivier), 1811.

24 25. Pair of additional carinae on rostral blade; loop of gastrofrontal grooves trifurcate (Figure 22) .... *P. plebejus* Hess, 1865.
— Rostrum without additional carinae; loop of gastrofrontal grooves bifurcate .... .26.

26. Apex of median plate of thelycum rounded; spermatheca cylindrical and not composed of two lateral plates. Adrostral grooves narrower

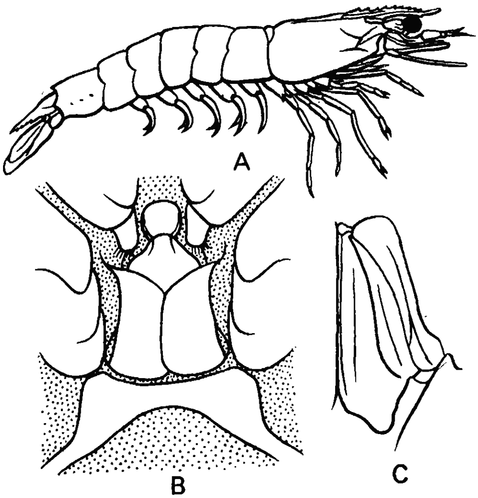


Figure 22. *Penaeus plebejus* Hess (from Dall, 1957).
A—lateral view; *B*—thelycum; *C*—petasma.

than postrostral carina . . . . *P. japonicus* Bate, 1888.
Apex of median plate of thelycum bifurcate; spermatheca consists of two lateral plates. Adrostral grooves equal in width to postrostral carina (Figure 23) . . . . *P. latisulcatus* Kishinouye, 1896.

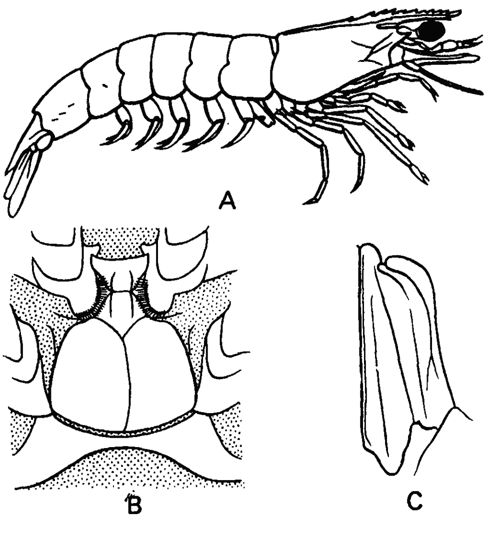


Figure 23. *Penaeus latisulcatus* Kishinouye (from Dall, 1957).
A—lateral view; *B*—thelycum; *C*—petasma.

Genus Funchalia Johnson, 1867

KEY TO SPECIES (FROM DALL, 1957)

1. Rostrum with ventral teeth. Antennal spine absent . . . .

. . . . *F. balboae* (Faxon), 1893.

— Rostrum without ventral teeth. Antennal spine present . . . . .2.

2. Hepatic spine present in adult specimens. More than 10 rostral teeth present . . . . .3.

— Hepatic spine absent in adult specimens. Rostral teeth less than 10. . . . . .4.

3. Abdominal somite VI with a short carina located below and parallel to the long midlateral carina. Spermatheca open. . . . . *F. woodwardi* Johnson, 1867.

— Abdominal somite VI with only a long midlateral carina. Spermatheca consists of a pair of flaps . . . . *F. danae* Burkenroad, 1940.

25 4. Petasma with a small triangular projection on ventral surface of free distal part of larger endopod. Thelycum with very small median crest behind spermatheca (Figure 24) . . .*F. villosa* (Bouvier, 1905).

— Petasma without projection on ventral surface of distal part of larger endopod. Thelycum with large median dentate tubercle behind spermatheca . . . . *F. taaningi* Burkenroad, 1940.

Genus Xiphopenaeus Smith, 1869

KEY TO SPECIES

1. Shrimps inhabit Atlantic coast of America (Figure 25) . . . . *X. kroyeri* (Heller, 1862).

— Shrimps inhabit Pacific coast of America . . . . *X. riveti* (Bouvier), 1907.

Genus Parapenaeus Smith, 1885

KEY TO SPECIES (FROM DALL, 1957)

1. Branchiostegal spine present. Pereopod V does not reach end of scaphocerite . . . . .2.

— Branchiostegal spine absent. Pereopod V exceeds scaphocerite by length of dactyl . . . . *P. longipes* Alcock, 1905.

2. Branchiostegal spine on anterior margin of carapace . . . . .3.

— Branchiostegal spine slightly behind anterior margin of carapace . . . . .7.

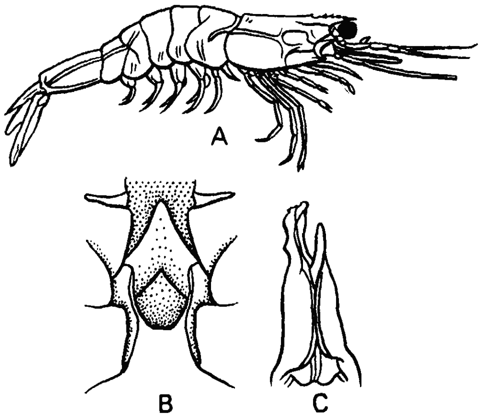
3. Abdominal somite VI less than twice length of somite V. . . . . . . .4.

— Abdominal somite VI a little more than twice length of somite V. . . . . *P. americanus* Rathbun, 1901.

4. Process "a" of petasma bifurcate and directed laterally . . . . .5.

26 — Process "a" simple and pointed and directed distally . . . . .6.

5. Process "b" of petasma long and sharply pointed. Process "d"

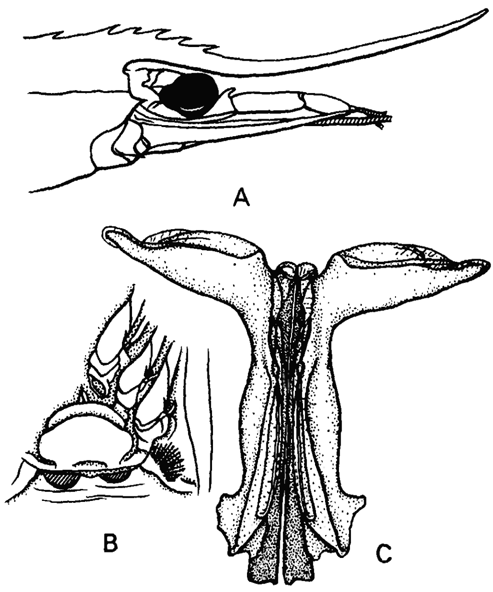


25 Figure 24. *Funchalia villosa* (Bouvier). *A*—lateral view; *B*—thelycum; *C*—petasma.

present. Thelycum consists of anterior intermediate and posterior plates . . . . *P. fissurus* (Bate), 1888.

— Process "b" short and obtuse; process "d" absent. Thelycum consists of anterior and posterior median bosses and two pairs of anterior and posterior lateral bosses . . . . *P. sextuberculatus* Kubo, 1949.

6. Process "d" of petasma well developed. Adrostral carina terminates



25 Figure 25. *Xiphopenaeus kroyeri* (Heller, 1862) (from Williams, 1965). *A*—frontal part of cephalothorax (lateral view); *B*—thelycum; *C*—petasma.

behind rostral teeth. Longer antennular flagellum shorter than antennular peduncle (Figure 26) .... *P. australiensis* Dall, 1958.

— Process "d" small and dentiform. Adrostral carina almost reaches epigastric tooth. Longer antennular flagellum longer than antennular peduncle .... *P. lanceolatus* Kubo, 1949.

7. Rostrum reaches distal end of first segment of antennular peduncle. Abdominal somite VI more than twice length of somite V .... *P. investigatoris* Alcock and Anderson, 1899.

8. Rostrum reaches rostral* distal end of second segment of antennular peduncle. Abdominal somite VI slightly less than twice length of somite V (Figure 27) .... *P. longirostris* (Lucas, 1849).

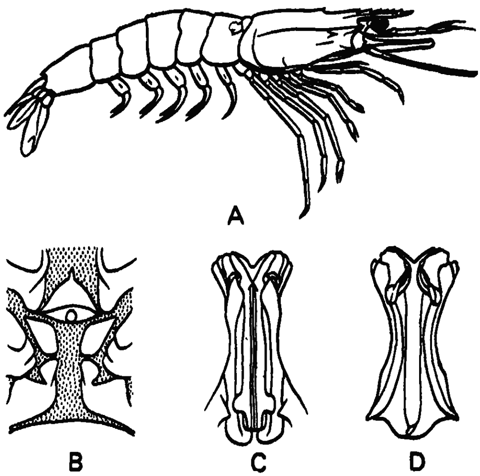


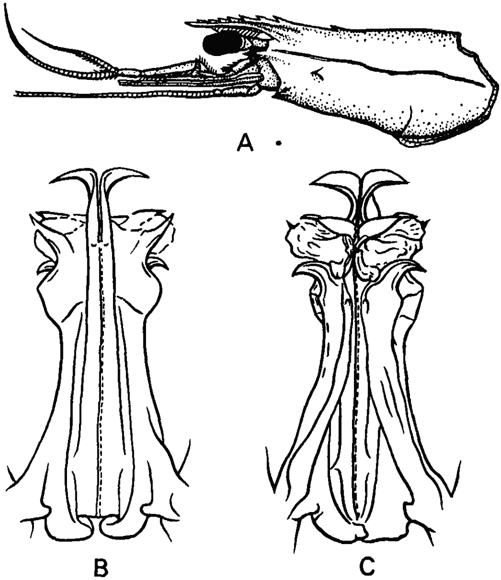
Figure 26. *Parapenaeus australiensis* Dall (from Dall, 1957).
A—lateral view; *B*—thelycum; *C*—petasma (dorsal view); *D*—petasma (ventral view).

Genus Parapenaeopsis (Alcock), 1901

KEY TO SPECIES

1. Shrimps inhabit shelf of Western Africa .... *P. atlantica* Balss, 1926.
— Shrimps inhabit Indian and Pacific Oceans .... 2.
2. Mastigobranchiae present on pereopods I and II .... 8.
27 — Mastigobranchiae absent on pereopods I and II .... 11.
3. Pereopod I with basial spines .... 4.
— Pereopod I without basial spines .... 10.
4. Pereopod II with basial spines .... 5.
— Pereopod II without basial spines .... *P. uncta* (Alcock), 1905.

*Error in original. Should simply read "distal end"—Technical Editor.



26 Figure 27. *Parapenaeus longirastris* (Lucas) (from Williams, 1965).
A—cephalothorax (lateral view); *B*—petasma (dorsal view); *C*—petasma (ventral view).

5. Telson with pair of immovable subapical spines. At least distal half of free portion of rostrum unarmed .... *P. stylifera* (Milne-Edwards), 1837.
— Telson without subapical spines and with or without movable lateral spines. One-third or less of free portion of rostrum unarmed .... 6.
6. Petasma with pair of long, slender, caliper-like distolateral projections directed forward. Thelycum with median tuft of long setae behind posterior edge of last thoracic sternite .... 7.
— Petasma with pair of distolateral projections directed laterally or distolaterally, usually short and spout-like. .... 8.
7. Pereopod III of female with basial spine. Rostrum with 9 to 11 teeth. Postrostral carina convex and extends to posterior margin of carapace .... *P. maxillipedo* (Alcock), 1905.
— Pereopod III of female without basial spine. Rostrum with 7 to 8 teeth. Postrostral carina straight and does not extend to posterior margin of carapace (Figure 28) ..... *P. cornuta* (Kishinouye), 1900.
8. Postrostral carina almost reaches posterior margin of carapace. Petasma with pair of short, spout-like distolateral projections and pair of cap-like distal projections. .... 9.
— Postrostral carina occupies three-fourths length of carapace. Petasma with pair of distolateral projections directed laterally. Cap-

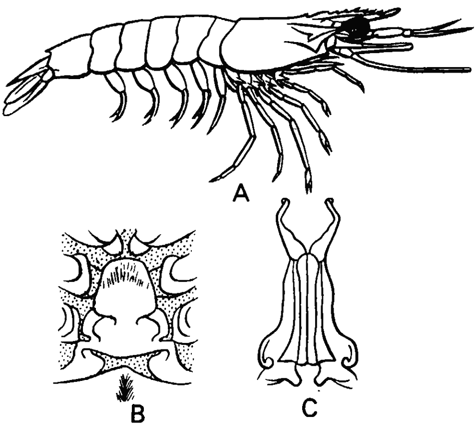


Figure 28. *Parapenaeopsis cornuta* (Kishinouye) (from Dall, 1957).
A—lateral view; *B*—thelycum; *C*—petasma.

like distal projections absent. . . . .*P. nana* (Alcock), 1905.

9. Antennular flagella equal to 0.5 to 0.6 of carapace length. Thelycum with median tuft of setae on posterior plate (Figure 29) . . . .*P. sculptilis* (Heller), 1862.

— Antennular flagella equal to 0.7 or more of carapace length. Thelycum without median tuft of setae on posterior plate . . . .*P. hardwickii* (Miers), 1878.

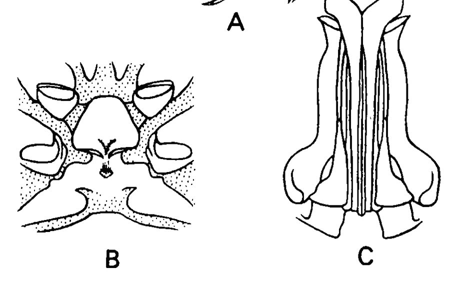
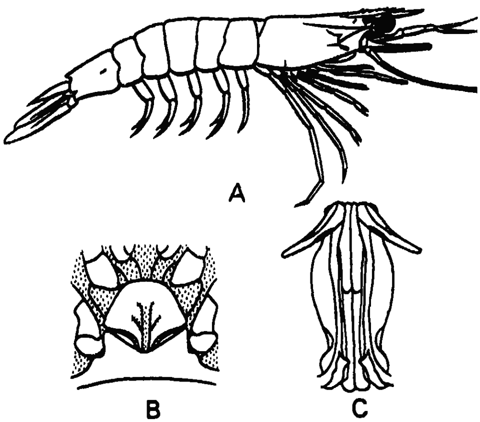


Figure 29. *Parapenaeopsis sculptilis* (Heller) (from Dall, 1957).
A—lateral view; *B*—thelycum; *C*—petasma.

10. Epigastric spine present (species restricted to Pacific coast of America) .... *P. balli* Burkenroad.
— Epigastric spine absent .... *P. gracillima* Nobili, 1903.
11. Epigastric spine present ....12.
— Epigastric spine absent ....13.
12. Rostrum extends somewhat beyond tip of antennular peduncle.
29 Longitudinal suture about 0.9 carapace length from anterior margin .... *P. hungerfordi* (Alcock), 1905.
— Rostrum short, reaching tip of first segment of antennular peduncle. Longitudinal suture extends to hepatic spine. .... *P. venusta* de Man, 1907.
13. Anterior plate of thelycum with Z-shaped posterior edge. Two accessory crests on anterior edge of posterior plate. Rostrum with proximal one-third raised from carapace and remaining portion more or less horizontal. Antennular flagella equal in length to pedunclc (Figure 30) .... *P. tenella* (Bate), 1888.
— Anterior plate of thelycum with more or less straight transverse posterior edge. No accessory crests on anterior edge of posterior plate. Rostrum inclined at an angle to carapace throughout its length. Antennular flagella half as long as peduncle .... *P. acclivirostris* Alcock, 1905.



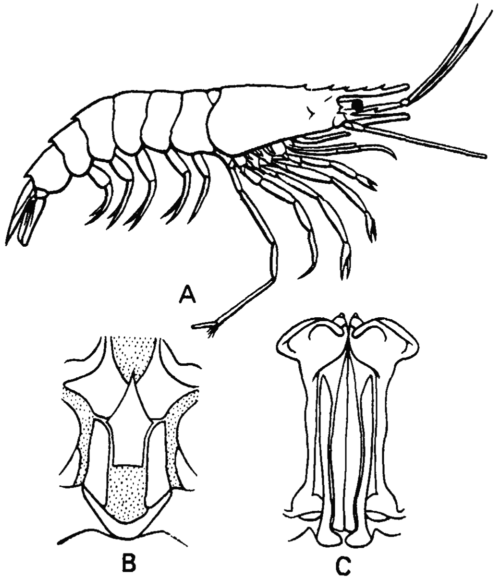
28 Figure 30. *Parapenaeopsis tenella* (Bate) (from Dall, 1957).
A—lateral view; *B*—thelycum; *C*—petasma.

Genus Atypopenaeus Alcock, 1906

KEY TO SPECIES (FROM STAROBOGATOV, 1972)

1. Hepatic groove present ....2.

— Hepatic groove absent (Figure 31) . . . .*A. formosus* Dall, 1957.
2. Hepatic spine present . . . .*A. stenodactylus* (Stimpson), 1860.
— Hepatic spine absent . . . .*A. dearmatus* de Man, 1907.



28 Figure 31. *Atypopenaeus formosus* Dall (from Dall, 1957).
A—lateral view; *B*—thelycum; *C*—petasma (dorsal view).

Genus Trachypenaeopsis Burkenroad, 1934

KEY TO SPECIES (FROM ANDERSON AND LINDNER, 1945)

1. Species inhabits Atlantic coast of America . . . .
. . . .*T. mobilispinis* (Rathbun).
— Species inhabits Indo-Pacific region . . . .
. . . .*T. richtersii* (Miers), 1884.

Genus Trachypenaeus Alcock, 1901

KEY TO SPECIES (FROM DALL, 1957, WITH ADDITIONS)

1. Epipods (mastigobranchiae) present on pereopods I and II . . . . .2.
— Epipods absent on pereopods I and II . . . . .8.
2. Small spine present on ischium of pereopod I. No basial spine on maxilliped III. Carapace with longitudinal suture which does not surpass hepatic spine . . . . .3.

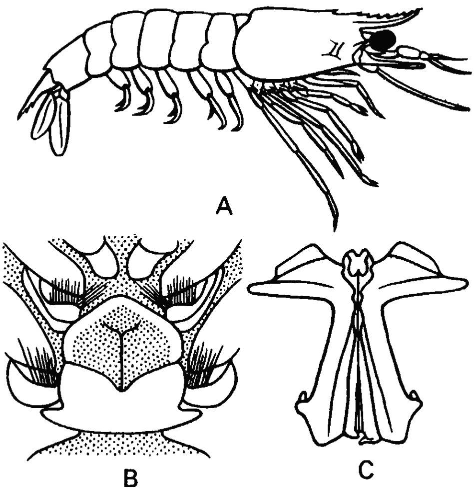
— Ischium of pereopod I without spine. Maxilliped III with basial spine. Carapace with longitudinal suture which surpasses hepatic spine . . . . .4.

3. Rostrum does not extend beyond distal margin of eyes. Telson with four pairs of lateral spines (species inhabits Pacific coast of America) . . . . *T. brevisuture* Burkenroad, 1934.

— Rostrum extends beyond distal margin of eyes. Telson with three or four pairs of lateral spines (species inhabits Indo-Pacific region) (Figure 32) . . . . *T. curvirostris* (Stimpson), 1860.

4. Telson without spines* (Pacific coast of America) . . . . *T. byrdi* Burkenroad, 1934.

— Telson with spines* . . . . .5.



28 Figure 32. *Trachypenaeus curvirostris* (Stimpson) (from Dall, 1957).
A—lateral view; *B*—thelycum; *C*—petasma (ventral view).

5. Rostrum with 7 to 10 teeth, usually 8 or more . . . . .6.

— Rostrum with 6 or 7 teeth . . . . .7.

6. Exopod of pereopod V does not reach distal end of its basis. Telson tapers gradually to a point but with feeble proximal shoulder. Color orange or red . . . . *T. similis* (Smith, 1885).

30 — Exopod of pereopod V reaches distal end of its basis or extends beyond it. Telson with distinct subapical shoulder. Color pale lilac or chocolate (Figure 33) . . . . *T. constrictus* (Stimpson), 1871.

7. Posteriormost pair of lateral spines on telson immovable. . . . .

*Omission in original. Should read "lateral spines"—Technical Editor.

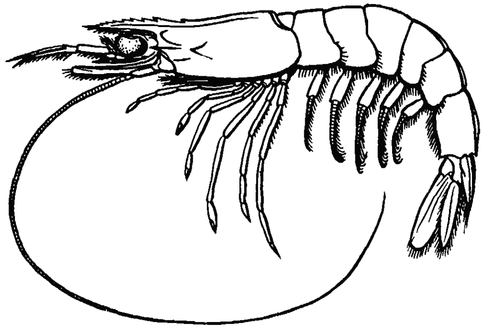


Figure 33. *Trachypenaeus constrictus* (Stimpson) (from Williams, 1965).

Lateral view.

............................*T. fuscina* Perez Farfante, 1971.

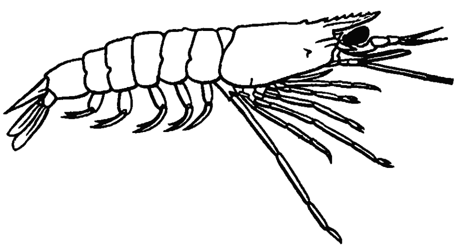
— Posteriormost pair of lateral spines on telson movable ....
............................*T. faoea* Loesch and Avila, 1964.

8. Anterior plate of thelycum with prominent longitudinal crest (male not known) ....*T. pescadoreensis* Schmitt, 1926.

— Anterior plate of thelycum flat or concave (except for posterior margin) ....9.

31 9. Distolateral projections of petasma anteriorly directed ....10.

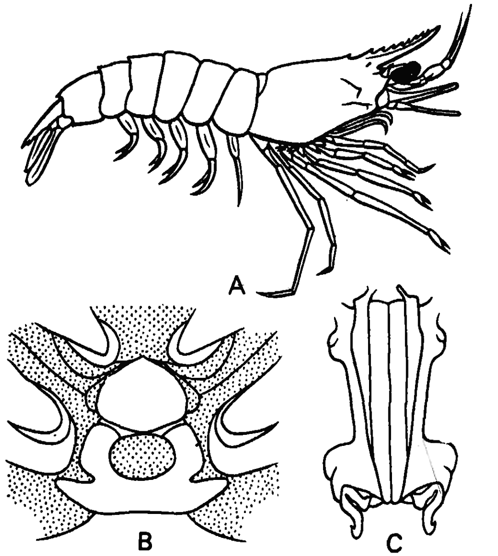
— Distolateral projections of petasma laterally directed (Figure 34) ..
....................................*T. fulvus* Dall, 1957.



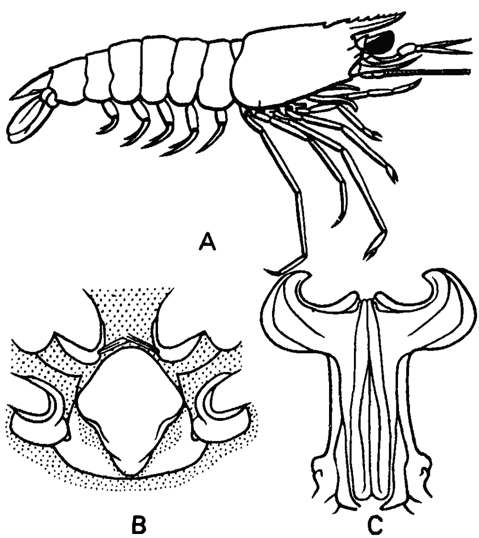
30 Figure 34. *Trachypenaeus fulvus* Dall. Lateral view.

10. Distolateral projections of petasma with blunt ends; extend to coxa of pereopod III. Posterior plate of thelycum Z-shaped and envelops an open oval depression (Figure 35) .....*T. anchoralis* (Bate), 1888.

— Distolateral projections of petasma with sharp ends; extend to coxa of pereopod IV. Anterior plate of thelycum with ligulata protuberance which extends to posterior plate (Figure 36) ....
............................*T. granulosus* (Haswell), 1879.



30 Figure 35. *Trachypenaeus anchoralis* (Bate) (from Dall, 1957).
A—lateral view; *B*—thelycum; *C*—petasma (dorsal view).



30 Figure 36. *Trachypenaeus granulosus* (Haswell) (from Dall, 1957).
A—lateral view; *B*—thelycum; *C*—petasma.

Genus Penaeopsis (Bate, 1881)

KEY TO SPECIES

1. No more than 14 rostral teeth (excluding epigastric); none situated on carapace .... 2.
— Usually 18 rostral teeth; one located on carapace .... *P. megalops* Smith, 1885.
2. Rostrum slightly decurved; teeth 10 to 14. Hepatic spine at level of antennal one. Pterygostomian spine located just above anterolateral corner of carapace (Figure 37) .... *P. rectacuta* (Bate, 1888).
— Rostrum slightly upcurved; teeth 9 to 10. Hepatic spine below antennal one, situated midway between antennal and pterygostomian spines. Pterygostomian spine situated at farthest anterolateral corner of carapace .... *P. serrata* Bate, 1888.

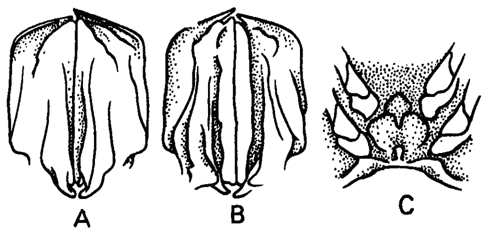
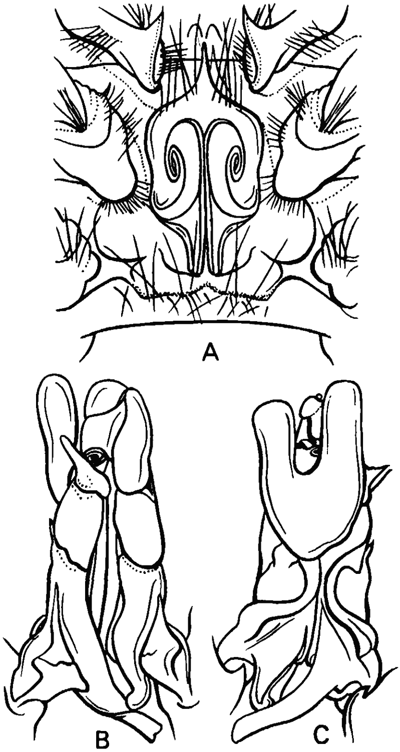


Figure 37. *Penaeopsis rectacuta* Bate (from Kubo, 1949).
A—petasma (dorsal view); *B*—petasma (ventral view); *C*—thelycum.

32 **Genus Metapenaeopsis Bouvier, 1905**
(from Anderson and Lindner, 1945; Racek and Dall, 1965; and Perez Farfante, 1971)

KEY TO SPECIES

1. Shrimps inhabit Pacific coast of America and Atlantic Ocean ... 2.
— Shrimps inhabit Indo-West-Pacific region .... 10.
2. Shrimps inhabit Atlantic Ocean .... 3.
— Shrimps inhabit Pacific coast of America .... 8.
3. Shrimps inhabit Atlantic coast of Africa .... *M. miersi* Holthuis, 1952.
— Shrimps inhabit Atlantic coast of America .... 4.
4. Thelycum with median plate with U-shaped marginal strip and coiled lateral strips. Petasma with distoventral lobe deeply cleft into
33 two long, subequal lobules (Figure 38) .... *M. smithi* (Schmitt), 1924.



31 Figure 38. *Metapenaeopsis smithi* (Schmitt).

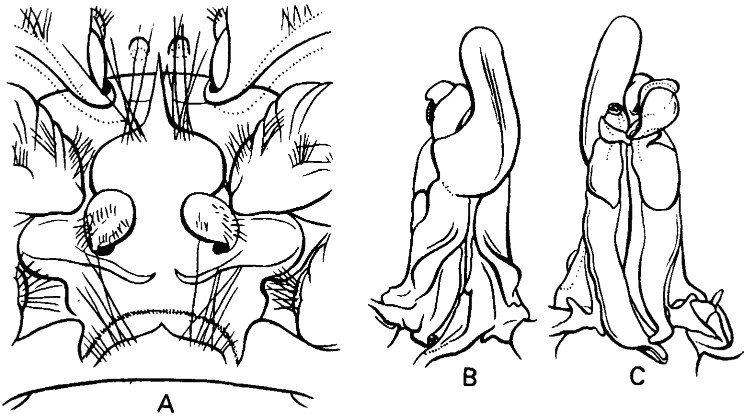
A—thelycum; *B*—petasma (ventral view); *C*—petasma (dorsal view).

— Thelycum with median plate without U-shaped marginal strip and coiled lateral strips. Petasma with simple distoventral lobe forming single lobule, or divided by shallow sinus into two subequal or unequal lobules. . . . . .5.

5. Thelycum with anteromedian part of transverse plate highly depressed; median plate with prominent bosses with posterolateral angles produced. Petasma with projection forms one lobe (Figure 39). . . . . *M. hobbsi* Perez Farfante, 1971.

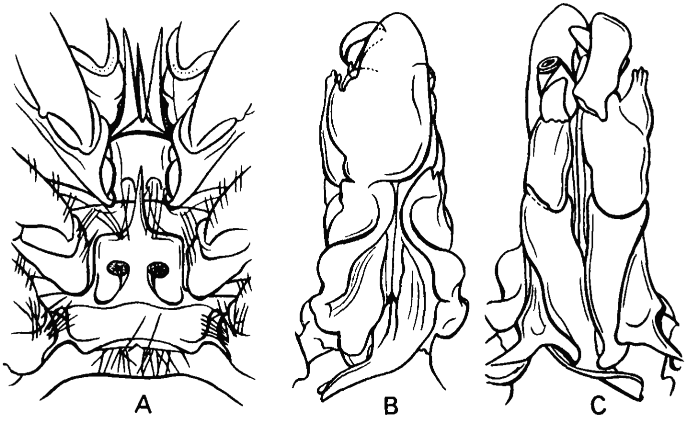
— Thelycum with anteromedian part of transverse plate raised; median plate with bosses with posterolateral angles not produced. Distoventral projection of petasma divided by a shallow sinus into two lobules . . . . .6.

6. Thelycum with anterior part of median plate convex, with two large bosses. Distoventral projection of petasma mitten-shaped; large left lobule extends far beyond small right lobule (Figure 40). . . . . *M. gerardoi* Perez Farfante, 1971.



32 Figure 39. *Metapenaeopsis hobbsi* Perez Farfante.

A—thelycum; *B*—petasma (ventral view); *C*—petasma (dorsal view).



32 Figure 40. *Metapenaeopsis gerardoi* Perez Farfante.

A—thelycum; *B*—petasma (ventral view); *C*—petasma (dorsal view).

— Thelycum with anterior part of median plate concave, with two small bosses. Distoventral projection of petasma distally divided into two subequal or equal lobules; if unequal, larger lobule does not extend distally much beyond smaller one .7.

7. Thelycum with anterior part of median plate long, constituting at least half length of plate. Distoventral projection of petasma divided into two unequal lobules; right lobule much larger than left (Figure 41) . . . .*M. goodei* (Smith), 1885.

— Thelycum with anterior part of median plate short, less than half length of plate. Distoventral projection of petasma divided into two subequal lobules; left lobule slightly larger than right (Figure 42) . . . . *M. martinella* Perez Farfante, 1971.

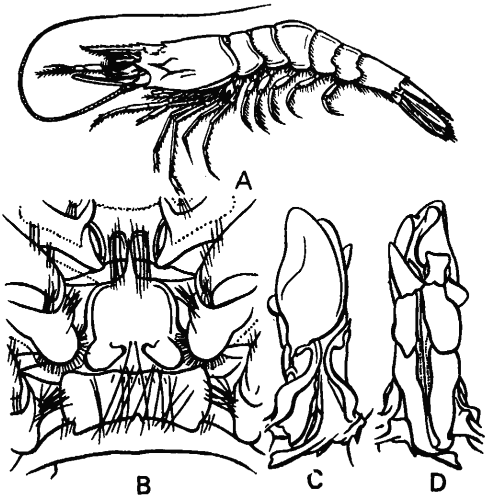
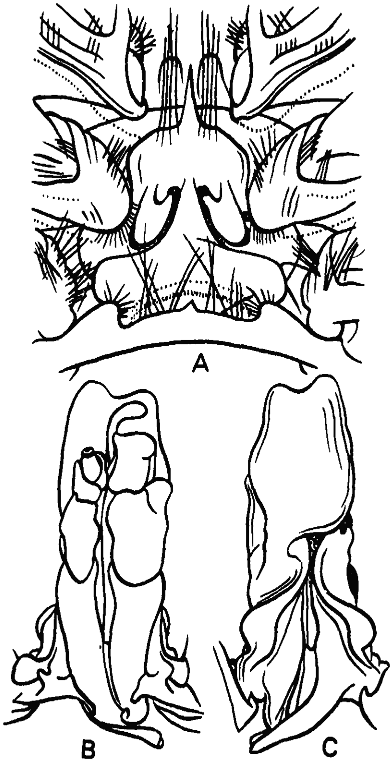


Figure 41. *Metapenaeopsis goodei* (Smith) (from Perez Farfante, 1971). *A*—general view; *B*—thelycum; *C*—petasma (ventral view); *D*—petasma (dorsal view).

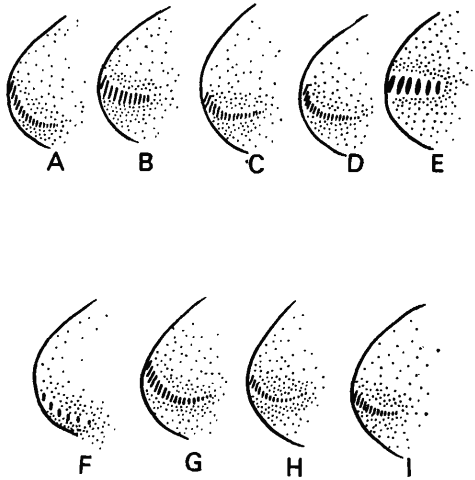
8. Basis of pereopod II unarmed . . . . *M. kishinouye* (Rathbun).
— Basis of pereopod II armed . . . . .9.
9. Rostrum with 9 to 10 teeth (together with epigastric one). . . . . *M. beebei* Burkenroad.
— Rostrum with 11 to 12 teeth . . . . *M. mineri* Burkenroad.
10. Anteromedian spine on basal segment of antennule small and barely noticeable. Thelycal plate without posterior processes (platelets) . . . . .11.
34 — Anteromedian spine on basal segment of antennule well developed. Thelycal plate with posterior processes. . . . . .32.
11. Stridulatory organ present on posterior margin of branchiostegite . . . . .12.
— Stridulatory organ absent on posterior margin of branchiostegite . . . . .21.
12. Rostrum distinctly sinuate. Length of abdominal somite VI more than twice its height near posterior end. Right lobe of petasma slightly longer than left (Figures 43 and 44). . . . . *M. sinuosa* Dall, 1957.
35 — Rostrum slightly sinuate, straight, or upcurved. Length of abdominal somite VI less than twice its height near posterior end. Left lobe



34 Figure 42. *Metapenaeopsis martinella* Perez Farfante.

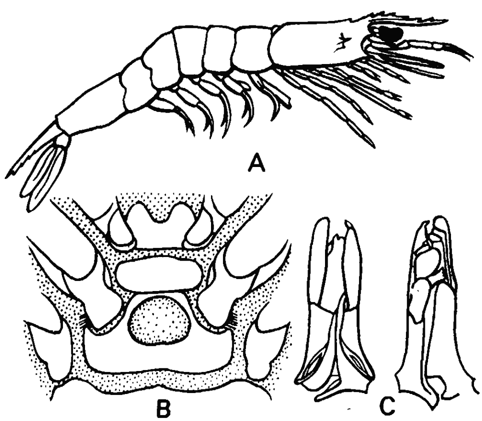
A—thelycum; *B*—petasma (ventral view); *C*—petasma (dorsal view).

of petasma much longer than right . . . . .13.
13. Dorsal carina of abdominal somite III grooved . . . . .14.
— Dorsal carina of abdominal somite III raised or flat . . . . .19.
14. Groove narrow and deep. Stridulatory organ low and highly curved; anterior ridge small and indistinct in front. Intermediate plate of thelycum with a deep transverse groove in posterior part . . . . . .15.
— Groove broad and small. Stridulatory organ high and moderately curved or almost straight, anterior ridge broad. Intermediate plate of thelycum with broad but shallow depression . . . . .18.
15. Pterygostomian spine very large (see Figure 43, *C*) . . . .*M. crassissima* Racek and Dall, 1965.
— Pterygostomian spine small or medium in size . . . . .16.
16. Left lobe of petasma with radial processes originating from U-shaped distal part (Figure 45) . . .*M. rosea* Racek and Dall, 1965.
— Left lobe of petasma with radial processes originating from conical or pyriform part . . . . .17.



34 Figure 43. Arrangement and shape of stridulatory organ in some species of *Metapenaeopsis* (from Racek and Dall, 1965).

A—M. novaeguineae; B—M palmensis; C—M. crassissima; D—M. rosea; E—M. stridulans; F—M. sinuosa; G—M. barbata; H—M. dura; I—M. acclivis.



34 Figure 44. *Metapenaeopsis sinuosa* Dall (from Dall, 1957).

A—dorsal view; *B*—thelycum; *C*—petasma.

17. Apical processes irregularly scattered along tip of pyriform base. Rostrum moderately upcurved. Stridulatory organ consists of 15 to 20 ridges. Species found off Malaysia ...... *M. toloensis* Hall, 1962.

— Apical processes originate radially from conical base. Rostrum highly upcurved. Stridulatory organ consists of 28 to 35 ridges. Species found off Japan (see Figures 43 and 46) .... *M. dura* Kubo, 1949.

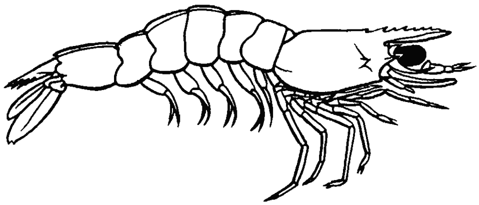


Figure 45. *Metapenaeopsis rosea* Racek and Dall (from Racek and Dall, 1965). Lateral view.

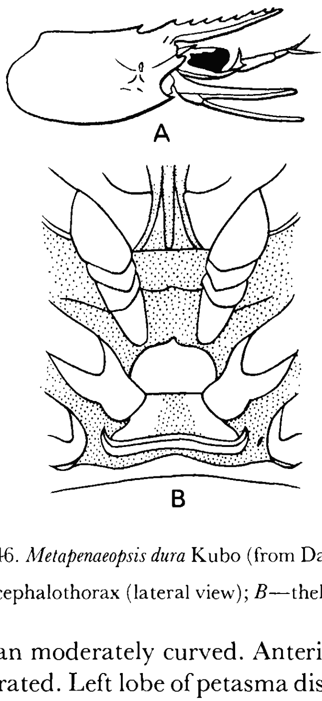


Figure 46. *Metapenaeopsis dura* Kubo (from Dall, 1957). *A*—cephalothorax (lateral view); *B*—thelycum.

18. Stridulatory organ moderately curved. Anterior margin of thelycal plate slightly serrated. Left lobe of petasma distally broad. Rostrum
36 slightly raised and straight, with teeth closely set (see Figure 43, *B*) . . . . *M. palmensis* (Haswell), 1879—*M. velutina* (Bate)—*M. barbeensis* (Hall).

— Stridulatory organ almost straight. Anterior margin of thelycal plate entire. Left petasmal lobe sharply pointed and triangular. Rostrum low and horizontal, with teeth widely scattered (Figure 47) . . . . *M. stridulans* (Alcock), 1905.

19. In female coxal plates of pereopod V separated by a narrow space which is much larger than thelycal plate (see Figure 43, *I*) . . . . *M. acclivis* (Rathbun, 1902).

— In female coxal plates of pereopod V separated by a broad space

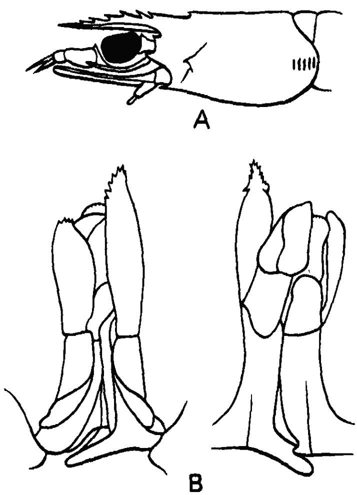


Figure 47. *Metapenaeopsis stridulans* (Alcock) (from Racek and Dall, 1965). *A*—cephalothorax (lateral view); *B*—petasma.

which is smaller than thelycal plate ....20.

20. Thelycal plate larger in width than in length. Left petasmal lobe with processes arranged in a circle. Inner intermediate strip of same length as outer (see Figure 43, *A* and Figure 48) ....*M. novaeguineae* (Haswell), 1879.

— Thelycal plate with equal width and length. Left petasmal lobe with processes arranged in a semicircle. Inner intermediate strip much longer than outer (see Figure 43, *G*). ....

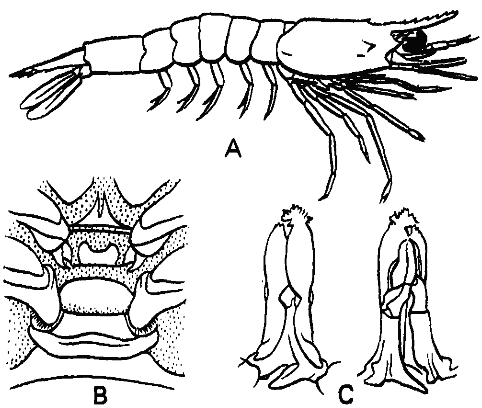


Figure 48. *Metapenaeopsis novaeguineae* (Haswell) (from Dall, 1957). *A*—lateral view; *B*—thelycum; *C*—petasma.

. . . . *M. barbata* (de Haan), 1850—*M. akayebi* Rathbun.

21\. Epigastric tooth situated a little posterior to middle of carapace. Scaphocerite twice as long as wide . . . *M. lamellata* (de Haan), 1850.

— Epigastric tooth situated at one-fourth length of carapace from its anterior margin. Scaphocerite much more than twice as long as wide . . . . .22.

22\. Female with two median spines, one behind the other, on sternum between pereopods IV and V . . . . *M. evermani* (Rathbun), 1906.

— In female sternum between pereopods IV and V merely a transverse plate . . . . .23.

23\. In female no spiny processes on sternum of pereopod II . . . . *M. velutina* (Dana), 1902.

37 — In female two long spiny processes present on sternum of pereopod II . . . . .24.

24\. Hepatic groove descends almost vertically toward ventral margin of branchiostegite (Figure 49) . . . . *M. borradaili* (de Man), 1910.

— Hepatic groove absent or does not reach branchiostegite . . . . . .25.

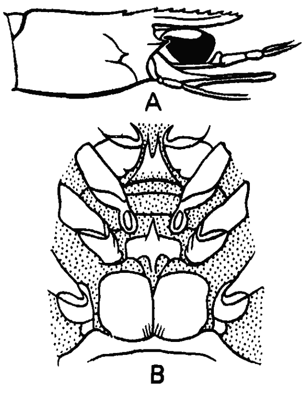


Figure 49. *Metapenaeopsis borradaili* (de Man) (from Dall, 1957). *A*—cephalothorax (lateral view); *B*—thelycum.

25\. One or two pairs of dentiform projections situated immediately behind thelycal plate . . . . .26.

— Dentiform projections situated immediately behind thelycal plate absent . . . . .27.

26\. Pair of small sharp projections behind thelycal plate have a pair of sharp tubercles on the posterior margin of their base (Figure 50) . . . . *M. distincta* (de Man), 1907.

— Pair of dentiform projections behind thelycal plate without posterior tubercles (Figure 51) . . . . *M. mogiensis* (Rathbun) 1902—(*M. hilarula*) (de Man).

27. In female pair of spiny anterolateral processes absent on anterior sternal plate between pereopod V; triangular plate present on sternum between pereopod III . . . . .28.

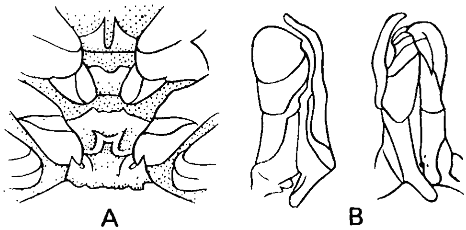


Figure 50. *Metapenaeopsis distincta* (de Man) (from Racek and Dall, 1965).

A—lateral view; *B*—thelycum.

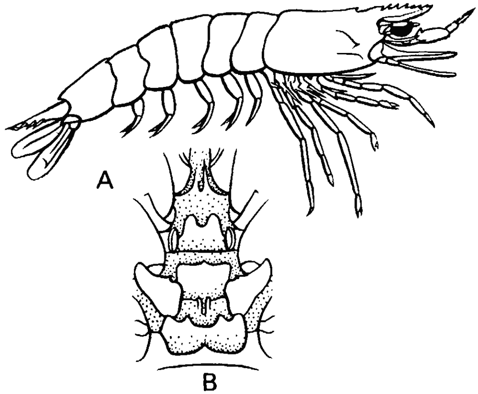


Figure 51. *Metapenaeopsis mogiensis* (Rathbun) (from Dall, 1957).

A—lateral view; *B*—thelycum.

— In female pair of spiny anterolateral processes present on anterior sternal plate between pereopod V; triangular plate absent on sternum between pereopod III . . . . .29.

28. In female triangular plate on sternum between pereopod III sharply pointed toward anterior end; in male sternum between pereopod II with pair of long spiny processes. Upper margin of rostrum distinctly convex (Figure 52) . . . . . .*M. quinquedentata* (de Man), 1907.

— Triangular plate rounded anteriorly. In male sternum between
38 pereopod II without spiny processes. Upper margin of rostrum slightly concave (Figure 53) . . . . . .*M. insona* Racek and Dall, 1965.

29. In female sternum between pereopod III without processes. Anterior sternal plate between pereopod V with large triangular

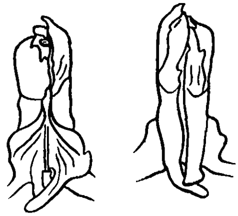


Figure 52. *Metapenaeopsis quinquedentata* (de Man) (from Racek and Dall, 1965).

Petasma.

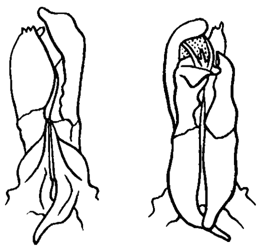


Figure 53. *Metapenaeopsis insona* Racek and Dall (from Racek and Dall, 1965).

Petasma.

process in center . . . .*M. dalei* (Rathbun), 1902.

— In female sternum between pereopod III with one or two processes. Anterior sternal plate between pereopod V without large triangular process in center . . . . .30.

30. Sternum between pereopod III with a concave trapezoid plate which narrows posteriorly. Rostrum short and distinctly raised (Figure 54) . . . .*M. tarawensis* Racek and Dall, 1965.

— Sternum between pereopod III with pair of obtuse processes. Rostrum sharply pointed and not raised. . .*M. incompta* Kubo, 1949.

31. Posterior margin of posterior process of thelycal plate bifurcate . . . . .32.

— Posterior margin of posterior process of thelycal plate simple and pointed . . . . .36.

32. Rostrum equal in length or longer than antennular peduncle . . .33.

— Rostrum does not reach distal end of antennular peduncle . . . . .35.

33. Right petasmal lobe slightly larger than left . . . .*M. sibogae* (de Man), 1907.

— Left petasmal lobe slightly larger than right . . . . .34.

34. Posterior process of thelycal plate with indistinct median groove and sharp posterolateral corners . . . .*M. andamanesis* (Wood-Mason and Alcock), 1891.

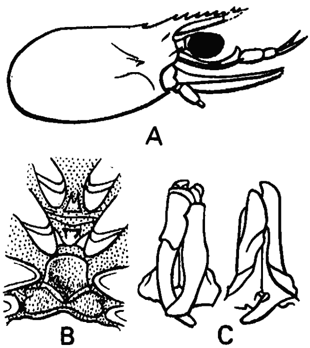


Figure 54. *Metapenaeopsis tarawensis* Racek and Dall (from Racek and Dall, 1965). *A*—cephalothorax (lateral view); *B*—thelycum; *C*—petasma.

— Posterior process of thelycal plate with distinct median groove and rounded posterolateral corners ....*M. philippi* (Bate) 1881—(*M. philippinensis* [Bate]).

35. Rostrum reaches posterior one-third of second antennular segment.
39 Center of thelycal plate with pair of short parallel ridges, forming a short median groove (Figure 55) ....*M. provocatoria* Racek and Dall, 1965.

— Rostrum reaches anterior one-third of third antennular segment. No grooves in center of thelycal plate ....*M. coniger* (Wood-Mason), 1891.

36. Abdomen dorsally carinate posterior to first somite ....

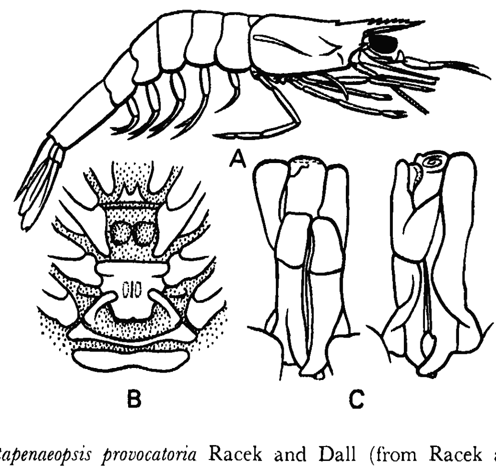


Figure 55. *Metapenaeopsis provocatoria* Racek and Dall (from Racek and Dall, 1965). *A*—lateral view; *B*—thelycum; *C*—petasma.

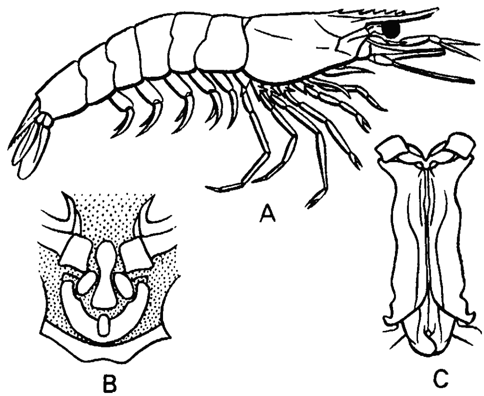


Figure 56. *Metapenaeus macleayi* (Haswell) (from Dall, 1957).
A—lateral view; *B*—thelycum; *C*—petasma.

.... *M. lata* Kubo, 1949.
— Abdomen dorsally carinate posterior to second somite .... *M. kyushuensis* (Yokoya), 1933.

Genus Metapenaeus Wood-Mason and Alcock, 1891

KEY TO SPECIES (FROM RACEK AND DALL, 1965)

1. Telson armed with three or four pairs of well-defined movable spines .... 2.
— Telson with solitary row of very small movable spines, and with or without one to two pairs of fairly large distal spines .... 3.*
2. Telson with three pairs of almost identical spines. Rostrum straight and dentate up to tip .... 3.
— Telson with four pairs of spines which gradually increase in size posteriorly. Rostrum sigmoid; anterior half edentate and acicular (Figure 56) .... *M. macleayi* (Haswell).
3. Branchial part of carapace with small depressed areas. Long and dagger-shaped projections on coxa of pereopod IV.** Thelycum with rounded median boss posterior to lateral plates. Distomedian projections of petasma without anterolateral spiny processes .... *M. intermedius* (Kishinouye), 1900.
— Branchial part of carapace with two large depressed areas. Female with straight conical spines on coxa of pereopod IV. Thelycum without rounded boss posterior to lateral plates. Distomedian projections of petasma with distinct anterolateral spiny processes (Figure 58) .... *M. endeavouri* (Schmitt), 1926.
4. Distomedian projection of petasma with well-developed or reduced

*Error in original. Should be "4"—Technical Editor.
**Omission in original. Should read "Pereopod IV in female"—Technical Editor.

apical filament. Thelycum of impregnated female usually with white conjoined pads . . . . .5.
— Distomedian projection of petasma without apical filament. Thelycum of impregnated female without white conjoined pads . . . . .9.

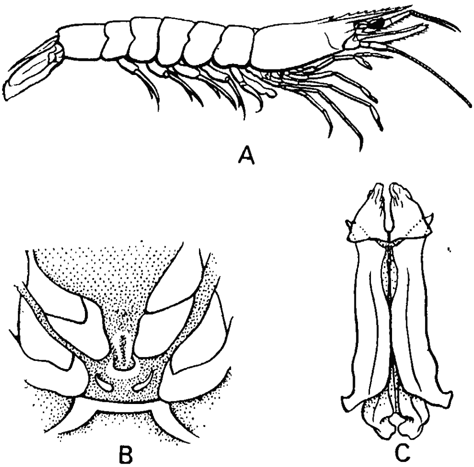


Figure 57. *Metapenaeus ensis* (de Haan) (from Kubo, 1949).
A—lateral view; *B*—thelycum; *C*—petasma.

5. Rostrum broad and short; does not reach distal end of basal antennular segment. Thelycum with ovate anterior and lateral plates of subequal size; conjoined pads usually set askew. Apical filaments of petasma reduced and represented by pair of rounded bosses . . . .*M. lysianassa* (de Man), 1888.
— Rostrum projects beyond basal antennular segment; distal part edentate . . . . .6.
6. Posterior part of rostrum with fairly distinct carina. Basial spine on pereopod III of male simple . . . . .7.
— Posterior part of rostrum without distinct carina. Basial spine on pereopod III of male long and sharp . . . . .8.
7. Basial and ischial spines on pereopod I subequal. Telson usually with pair of distal spinules. Distolateral projections of petasma directed outward; apical filaments of distomedian projection slender and slightly convergent. Thelycum with a large anterior and small lateral plates . . . . . .*M. brevicornis* (H. Milne-Edwards), 1837.
— Ischial spine of pereopod I slightly smaller than basial spine. Telson usually with two pairs of distal spinules. Distolateral projections of petasma directed forward; apical filaments of distomedian projection spatulate. Thelycum with a small anterior and very large lateral plates . . . .*M. tenuipes* Kubo, 1949—(*M. spinulatus* Kubo).
8. Apical filaments of petasma indistinct. Anterior thelycal plate ligu-

late .... *M. dobsoni* (Miers), 1878.

— Apical filaments of petasma large, spatulate, and dorsally curved. Anterior thelycal plate with sharp point .... *M. joyneri* (Miers), 1880.

9. Branchiocardiac groove distinct in at least posterior third of carapace. Distomedian projections of petasma flap-like .... 10.

— Branchiocardiac groove almost completely absent. Distomedian
41 projections of petasma anteriorly filiform and with serrate ventral margin .... *M. stebbingi* (Nobili), 1904.

10. Ischial spine of pereopod I distinct .... 11.

— Ischial spine of pereopod I small or absent .... 13.

11. Ischial and basial spines of pereopod I subequal. Tips of petasma curved at a 30° angle in relation to median line and semicircular. Anterior plate of thelycum in the form of a depression. Lateral plates with raised ventral carinae with anterolateral and posteromedian spiny processes .... *M. suluensis* Racek and Dall, 1965.

— Ischial spine much smaller than basial spine. Anterior thelycal plate ligulate .... 12.

12. Distomedian projections of petasma directed anteriorly. Lateral thelycal plates with raised lateral carinae, each with a posterior incurved triangular plate. Species found eastward of the Strait of Malacca (Figure 57) ...... *M. ensis* (de Haan) 1850—(*M. mastersii* [Haswell])—*M. incisipes* (Bate).

— Distomedian projections of petasma directed anterolaterally. Lateral thelycal plates with only raised and parallel lateral carinae. Species found westward of the Strait of Malacca .... *M. monoceros* (Fabricius), 1798.

13. Ischial spine of pereopod I small and obtuse .... 14.

— Ischial spine absent .... 17.

14. Teeth on rostrum arranged more or less uniformly. Thelycum open at posterior end .... 15.

— Rostral teeth random in arrangement: first two teeth separated from each other and from rostral tip by a greater distance. Thelycum closed at posterior end .... *M. demani* (Roux), 1922.

15. Distomedian projections of petasma divided into two lobes which almost completely cover distolateral projections from above. Lateral thelycal plates reniform with highly raised ventrolateral ridges .... *M. conjunctus* Racek and Dall, 1965.

— Distomedian projections of petasma more or less superficially divided into two lobes which do not cover distolateral projections from above. Lateral thelycal plates in the form of a small arc with raised lateral ridges .... 16.

16. Distomedian projections of petasma directed anteriorly. Parallel
42 longitudinal grooves indistinct. Posterior end of raised ridges on

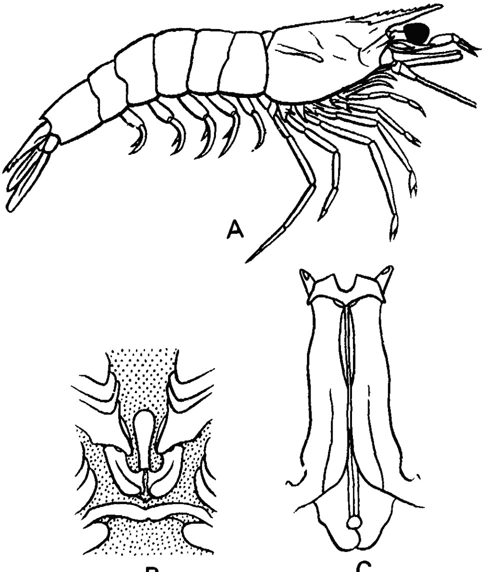


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Figure 58. *Metapenaeus endeavouri* (Schmitt) (from Dall, 1957).
A—lateral view; *B*—thelycum; *C*—petasma.

lateral plates of thelycum curves outward. Spine on merus of pereopod V slants inward slightly in male ....*M. papuensis* Racek and Dall, 1965.

— Distomedian projections of petasma directed anterolaterally and divergent. Longitudinal grooves distinct. Posterior end of ridges on lateral plates of thelycum incurved. Spine on merus of pereopod V slants outward slightly in male ....*M. elegans* (de Man) 1907—(*M. singaporensis* Hall).

17. Distal part of rostrum edentate. Anterior thelycal plate blunt. Lateral plates large and separated by narrow suture (Figure 59) ....*M. eboracensis* Dall, 1957.

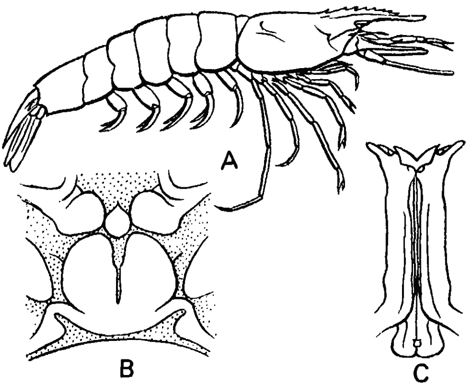


Figure 59. *Metapenaeus eboracensis* Dall (from Dall, 1957).
A —lateral view; *B*—thelycum; *C*—petasma.

— Distal part of rostrum dentate . . . . .18.

18. Branchiocardiac carina distinct, extending from posterior margin of carapace almost up to hepatic spine. Anterior plate of thelycum longitudinally grooved, broader posteriorly than anteriorly. Distomedian projection of petasma sigmoid . . . . *M. affinis* (H. Milne-Edwards), 1837—(*M. mutatus* Lanchester)— *M. necopinans* Hall.

— Branchiocardiac carina faint or poorly defined; anterior end does not extend beyond posterior third of carapace . . . . .19.

19. Anterior thelycal plate ligulate with a pair of anterolateral rounded tubercles. Lateral plates with characteristic patches of dense setae. Distomedian projections of petasma highly divergent, each in the form of a broad and outwardly curved tooth (Figure 60) . . . . *M. insolitus* Racek and Dall, 1965.

— Anterior thelycal plate ampullar with longitudinal ridges in the center. Distomedian projections of petasma digitiform . . . . .20.

20. Anterior margin of anterior thelycal plate with three tubercles . .21.

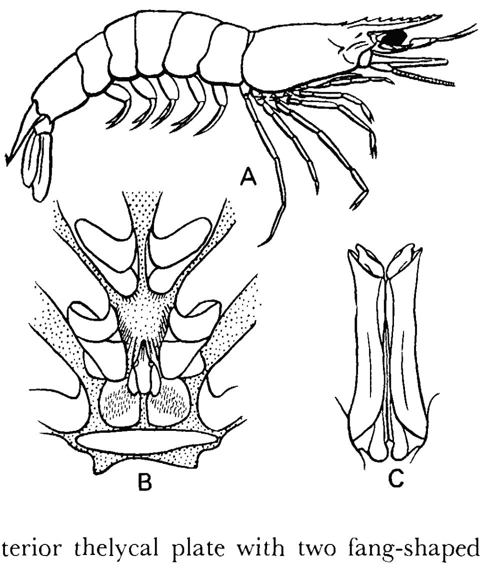


Figure 60. *Metapenaeus insolitus* Racek and Dall (from Racek and Dall, 1965).

A—lateral view; *B*—thelycum; *C*—petasma.

— Anterior margin of anterior thelycal plate with two fang-shaped teeth and an indistinct tubercle. Petasma with slightly divergent
43 tubercular distomedian projections . . . . *M. dalli* Racek, 1957.

21. Median tubercle more raised than marginate ones. Distal margin of anterior thelycal plate distinctly triangular. Petasma with almost parallel distomedian projections; distal half of latter dorsoventrally sinuate (Figure 61) . . . . *M. bennettae* Racek and Dall, 1965.

— All tubercles identical in size. Distal margin of anterior thelycal plate convex to indistinctly triangular. Petasma with laminose and

highly divergent distomedian projections ....
..............................*M. burkenroadi* Kubo, 1954.

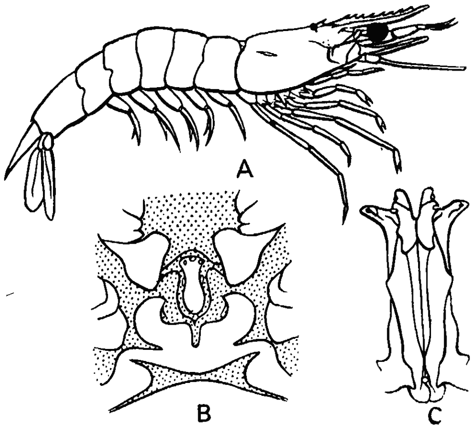


Figure 61. *Metapenaeus bennettae* Racek and Dall (from Kirkegor and Welker, 1970).
A—lateral view; *B*—thelycum; *C*—petasma.

Subfamily SOLENOCERINAE Wood-Mason, 1891

KEY TO GENERA (ANDERSON AND LINDNER, 1945)

1. Antennular flagella foliate and together form a tube which acts as a siphon .... *Solenocera* Lucas.
— Antennular flagella round in cross section and filiform ....2.
2. Podobranchiae present on maxilliped III and all pereopods. Telson with several pairs of movable lateral spines anterior to distal pair of immovable teeth. Prosarthema in the form of a short, rough outgrowth .... *Haliporus* Bate.
— Podobranchiae absent on maxilliped III and all pereopods. Telson with only one pair of lateral spines. Prosarthema in the form of a long elastic scale .... *Hymenopenaeus* Smith.

Genus Solenocera Lucas, 1849

KEY TO SPECIES FROM ATLANTIC OCEAN AND PACIFIC COAST OF AMERICA[1] (FROM LINDNER AND ANDERSON, WITH ADDITIONS)

1. Shrimps inhabit Atlantic and Pacific coasts of America ....2.
— Shrimps inhabit Mediterranean Sea and waters near western and southern coasts of Africa (Figure 62) ....
... *S. membranacea* (H. Milne-Edwards), 1837—(*S. africana* Stebbing).

[1]The geographic distribution of shrimps of this genus outside the stated limits has been assessed by Ya. I. Starobogatov (1972).

2. Shrimps inhabit Atlantic coast of America .... 3.
— Shrimps inhabit Pacific coast of America .... 6.
3. Number of rostral teeth vary from 8 to 10, usually 9. Postrostral
44 carina high and sharp with a deep notch at level of cervical groove . ... *S. vioscai* Burkenroad.
— Number of rostral teeth vary from 5 to 7, usually 6. Postrostral carina absent or low, with a slight notch at level of cervical groove . ... 4.

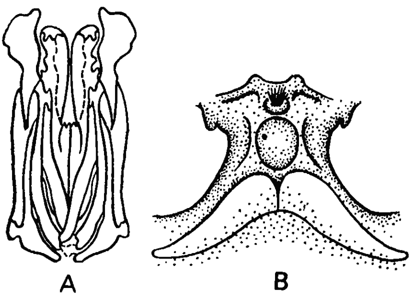


Figure 62. *Solenocera membranacea* (H. Milne-Edwards), 1837.
A—petasma; *B*—thelycum (drawn by Yu. M. Froermana).

4. Scaphocerites long, extending beyond end of antennular peduncle by at least 13% of their length. Feeble tooth located on orbital corner. Pterygostomian spine long and with a broad base .... *S. necopina* Burkenroad.
— Scaphocerites short, shorter than antennular peduncle. Antennules longer than scaphocerites by about 8% of their length. Well-developed tooth located on orbital corner. Pterygostomian spine small and with a narrow base .... 5.
5. Chela of pereopod I significantly shorter than carpus; finger almost twice length of palm. End of distolateral petasmal lobe directed distally. Projections of thelycum located between bases of last pair of pereopods and smoothly rounded . . . *S. atlantidis* Burkenroad, 1939.
— Chela of pereopod I barely shorter than propodus; finger 2.0 to 2.5 times longer than palm. End of distolateral petasmal lobe inwardly directed toward median line. Projections of thelycum located between bases of last pair of pereopods and with distinct tubercles at apex. .... *S. geijskesi* Holthuis, 1959.
6. Number of teeth on rostrum varies from 8 to 10, usually 9. Base of pterygostomian spine merges into margin of carapace with a smooth curve .... *S. agassizii* Faxon, 1893.
— Number of teeth on rostrum varies from 6 to 8, usually 7. Base of

pterygostomian spine merges into margin of carapace at a right angle . . . . .7.

7. Sternum of pereopod IV in female sharply incurved along posterior margin. Median lobules of distolateral lobe of petasma almost rectangular . . . . *S. florea* Burkenroad.

— Sternum of pereopod IV in female rounded at posterior margin. Median lobules of distolateral lobe almost triangular . . . . *S. mutator* Burkenroad.

Genus Haliporus Bate, 1881

KEY TO SPECIES (FROM LINDNER AND ANDERSON, 1945)

1. Spine present on inner margin of basal segment of antennular peduncle. Merus of pereopod I with a strong spine. . . . . *H. thetis* Faxon, 1893.

— Spine absent on inner margin of basal segment of antennular peduncle. Merus of pereopod I without spine . . . *H. curvirostris* Bate, 1881.

45 ## Genus Hymenopenaeus Smith, 1882

KEY TO SPECIES (FROM ANDERSON AND LINDNER, 1945, WITH ADDITIONS)

1. No postrostral teeth separated from rostral teeth by some distance . . . . .2.

— One or two postrostral teeth separated from group of rostral teeth by some distance . . . . .8.

2. Neither branchiostegal nor pterygostomian spine present . . . . . . .3.

— Either branchiostegal spine, or pterygostomian, or both present . . . . .4.

3. Epipods of maxillipeds II and III bifid (Figure 63) . . . . *H. tropicalis* (Bouvier), 1905.

— Epipods of maxillipeds II and III not bifid . . . . *H. mulleri* (Bate), 1888.

4. Branchiostegal and pterygostomian spines present . . . . *H. villosus* (Alcock and Anderson), 1894.

— Either of two spines absent . . . . .5.

5. Branchiostegal spine present; pterygostomian spine absent . . . . .6.

— Branchiostegal spine absent; pterygostomian spine present. . . . . *H. taprobanensis* (Alcock and Anderson, 1899).

6. Tooth or spine absent on orbital corner . . . . .7.

— Tooth or spine present on orbital corner . . . *H. robustus* Smith, 1885.

7. Merus of pereopod I unarmed. Shrimps inhabit Atlantic coast of

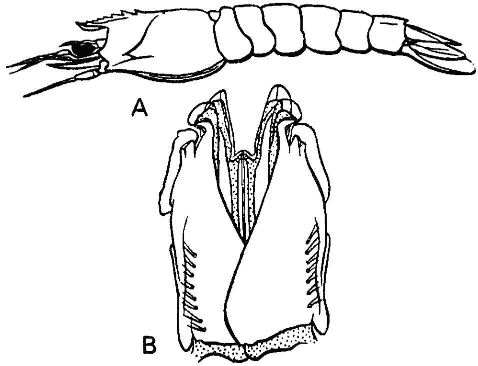


Figure 63. *Hymenopenaeus tropicalis* (Bouvier) (from Williams, 1965).

A—lateral view; *B*—petasma.

America .... *H. modestus* Smith, 1885.

— Merus of pereopod I armed with spine. Shrimps inhabit Indo-Pacific region .... *H. lucasii* Bate, 1881.

8. One postrostral tooth separated from group of postrostral teeth by some distance .... 9.

— Two postrostral teeth separated from group of postrostral teeth by some distance .... 11.

9. Shrimps inhabit Pacific Ocean .... 10.

— Shrimps found off southern Africa .... *H. triarthrus* (Stebbing).

10. Merus of pereopod I with spine .... *H. diomedeae* (Faxon), 1893.

— Merus of pereopod I without spine ..... *H. sibogae* (de Man), 1907.

11. Pterygostomian spine present .... 12.

— Pterygostomian spine absent .... 14.

12. Species inhabits Indian and Pacific oceans .... 13.

— Species inhabits Atlantic Ocean .... *H. laevis* (Bate), 1881.

13. Species inhabits Pacific coast of America; carina on abdominal somites IV and V without sharp teeth ....
Two species: *H. nereus* (Faxon), 1893 and *H. doris* (Faxon), 1893. Species differences have not been described; however, in the illustration *H. doris* is shown with a tooth on the postrostral carina behind the cervical suture.

46 — Species found in region of Maldive Islands; carina on abdominal somites IV and V with sharp teeth ..... *H. sewelli* Ramadan, 1938.

14. Species inhabits Atlantic Ocean .... 15.

— Species inhabits Indo-Pacific region .... 17.

15. Photophores absent .... 16.

— Photophores present .... *H. debilis* Smith, 1882.

16. Species inhabits northern part of Atlantic Ocean ....

. . . . *H. aphoticus* Burkenroad, 1940.

— Species inhabits region south of Gabon . . . . *H. chacei* Crosnier and Forest, 1969.

17. Grooves on branchiostegal regions of carapace do not form L-shaped pattern . . . . 18.

— Grooves on branchiostegal regions of carapace form L-shaped pattern . . . . *H. fattachi* Ramadan, 1938.

18. Abdominal somites I, II, and III without carina . . . . 19.

— Abdominal somite III and possibly also I and II with carina . . . . *H. propinqus* (de Man), 1907.

19. Pereopod I with basial spine . . . . 20.

— Pereopod I without basial spine . . . . *H. aequalis* (Bate), 1888.

20. Middle of posterior margin of dorsal side of abdominal somites IV, V, and VI without spines . . . . 21.

— Middle of posterior margin of dorsal side of abdominal somites IV, V, and VI with spines . . . . *H. neptunus* (Bate), 1881.

21. Postcervical carina present on dorsal side of carapace; distoventral spine present on merus of pereopod I. . . . . *H. obliquirostris* (Bate), 1881.

— Postcervical carina and spine on merus of pereopod I absent . . . . *H. halli* Bruce, 1966.

Subfamily BENTHESICYMINAE Bouvier, 1908

KEY TO GENERA (FROM TIRMIZI, 1958)

1. Prosarthema absent. No immovable spines on telson; tip of telson incised or terminates in a small spine . . . . 2.

— Prosarthema present. Telson with one pair of immovable distal spines in addition to three pairs of movable spines; tip of telson stout and sharply pointed. No podobranchiae on appendages after maxilliped II. Median carina present on all abdominal somites. Maxilliped III and all pereopods divided into secondary segments . . . . *Gordonella* Tirmizi (only one species: *G. polyarthra* Tirmizi).

2. Podobranchiae present on each appendage from maxilliped II up to pereopod III. Telson armed with more than one pair of movable lateral spines . . . . 3.

— Podobranchiae absent on appendages behind maxilliped II. Median carina present only on abdominal somite VI. Telson with only one pair of movable spines; tip incised . . . . *Gennadas* Bate, 1881.

3. In addition to median carina on abdominal somite VI, similar carinae also present on other somites of abdomen. Tip of telson usually pointed . . . . 4.

— Median carina present only on abdominal somite VI. Tip of telson incised . . . . *Bentheogennema* Burkenroad, 1936.

4. Hepatic spine present or absent. Dactyls of pereopods IV and V typical, not divided into secondary segments . . . . *Benthesicymus* Bate, 1881.

47 — Hepatic spine present. Dactyls of pereopods IV and V flagellate and multisegmented . . . . *Benthonecthes* Smith (only species: *B. filipes* Smith, 1884).

Genus Bentheogennema Burkenroad, 1936

KEY TO SPECIES

1. Cervical and postcervical sutures not close to each other dorsally . . . . 2.

— Cervical and postcervical sutures very close to each other dorsally . . . . *B. pasithea* (de Man), 1911.

2. Cervical and postcervical sutures uninterrupted by postrostral carina . . . . *B. borealis* (Rathbun), 1902.

— Cervical and postcervical sutures interrupted by postrostral carina . . . . *B. intermedia* (Bate), 1882.

Subfamily ARISTAEINAE Alcock, 1901

KEY TO SPECIES (FROM ANDERSON AND LINDNER, 1945)

1. Hepatic spine present . . . . 2.

— Hepatic spine absent . . . . 3.

2. Podobranchia on pereopod III and epipod on pereopod IV rudimentary or absent . . . . *Hepomadus* Bate.

— Podobranchia on pereopod III and epipod on pereopod IV well developed (Figure 64, *B*) . . . . *Aristaeomorpha* Wood-Mason (one species: *A. foliacea* [Risso], 1826).

3. Epipod on pereopod IV present. Podobranchia present on pereopod III but rudimentary . . . . 4.

— Epipod on pereopod IV and podobranchia on pereopod III absent . . . . *Aristeus* Duvernoy.

4. Epipod on pereopod IV rudimentary. Podobranchia on pereopod III small . . . . *Hemipenaeus* Wood-Mason.

— Epipod on pereopod IV and podobranchia on pereopod III well developed. Rostrum with three teeth . . . . *Plesiopenaeus* Bate.

Genus Hepomadus Bate, 1881

KEY TO SPECIES (FROM ANDERSON AND LINDNER, 1945)

1. Abdominal somites IV and V with teeth on posterior margin of

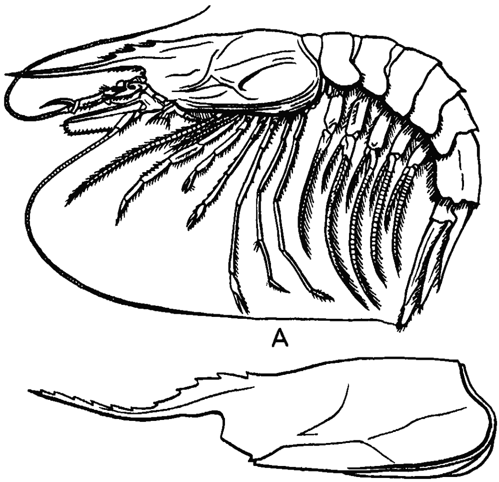


Figure 64. *A—Plesiopenaeus edwardsianus* Johnson (from Kronie, Bondy, and Lefeur, 1967); *B—Aristaeomorpha foliacea* (Risso) (from Perez Farfante, 1970).

dorsal carina .... *H. gladialis* Bate, 1881.
— Abdominal somites IV and V without teeth on posterior margin of dorsal carina .... *H. tener* Smith, 1884.

48 **Genus Hemipenaeus Bate, 1881**

KEY TO SPECIES FOUND IN ATLANTIC OCEAN (FROM ANDERSON AND LINDNER, 1945)

1. Large spine present on tergum of abdominal somite III ....2.
— Large spine absent on tergum of abdominal somite III .... *H. speciosus* Bate, 1881.
2. Rostrum short; less than one-fifth length of carapace and not reaching tip of eyes .... *H. carpenteri* Wood-Mason, 1891.
— Rostrum at least one-fifth length of carapace and reaching tip of eyes .... *H. spinidorsalis* Bate, 1881.

Three more species of this genus have been reported from the Indo-Pacific region: *H. crassipes* Wood-Mason, 1891; *H. gracilis* Bate, 1881; and *H. sibogae* de Man, 1910.

Genus Plesiopenaeus Bate, 1881

KEY TO SPECIES (FROM ANDERSON AND LINDNER, 1945)

1. Exopod of maxilliped II equal in length to endopod or shorter ...2.

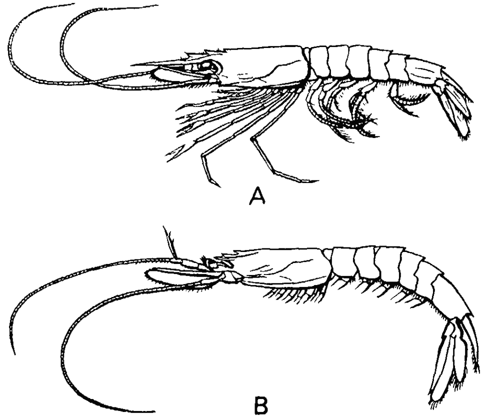


Figure 65. *Aristeus varidens* Holthuis (from Holthuis, 1952).

A—male; *B*—female.

— Exopod of maxilliped II approximately twice longer than endopod (see Figure 64, *A*) . . . . *P. edwardsianus* (Johnson), 1867.

2. Exopod of maxilliped II not longer than endopod. Merus of pereopods I and II with a movable spine. Basis and ischium of pereopod I without fixed tooth . . . *P. coruscans* (Wood-Mason), 1891.

— Exopod of maxilliped II much shorter than endopod. Ischium of pereopod I with strong tooth . . . . *P. armatus* (Bate), 1881.

Genus Aristeus Duvernoy, 1840

KEY TO SPECIES

1. Body smooth, without pubescence. Movable spine on distal end of merus present on only pereopods I and II . . . . 2.

— Body pubescent. Movable spine on distal end of merus present on pereopods I, II, and III . . . . *A. virilis* (Bate), 1881.

2. Pleurobranchiae on pereopods I to IV in form of papillae 1 to 2 mm in size, covered with small setae or spinules . . . . 3.

— Pleurobranchiae on pereopods I to IV very small, visible only with the help of a magnifying lens, and without spinules or setae . . . . *A. alcocki* Ramadan, 1938.

3. Inner lobe of petasma with a deep incision . . . . 4.

— Inner lobe of petasma without deep incision . . . . 5.

4. Chela of pereopods I and II longer than carpus (Figure 65) . . . . *A. varidens* Holthuis, 1952.

49 — Chela of pereopod I equal in length to carpus; chela of pereopod II shorter than carpus . . . . *A. semidentatus* Bate, 1881

5. Usually, no spine present on posterior margin of abdominal somite ....6.
— Small spine present on posterior margin of abdominal somite .... *A. antennatus* (Risso), 1816.
6. Species not found in Atlantic Ocean ....7.
— Species found in Caribbean Sea .... *A. antillensis* Bouvier, 1909.
7. Species found in Indian Ocean .... *A. mabahisse* Ramadan, 1938.
— Species found in region of Galapagos Islands .... *A. occidentalis* Faxon, 1893.

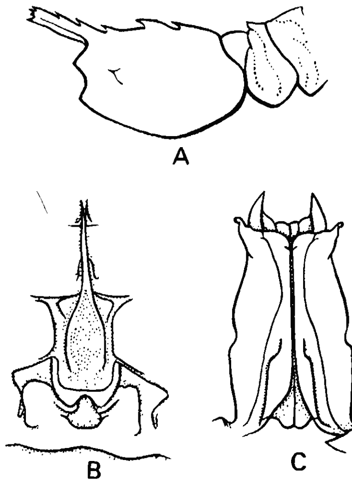
Subfamily SICYONINAE Ortmann, 1890
One genus: *Sicyonia* H. Milne-Edwards, 1830

KEY TO SPECIES FROM PACIFIC COAST OF AMERICA AND ATLANTIC OCEAN[2] (FROM ANDERSON AND LINDNER, 1945, WITH ADDITIONS)

1. Species inhabits Pacific and Atlantic coasts of America. ....2.
— Species found off coast of West Africa and *S. carinata* found in Mediterranean Sea ....18.
2. Species inhabits Atlantic coast of America ....3.
— Species inhabits Pacific coast of America ....9.
3. Antennal angle unarmed. Dorsal carina of abdominal somite II with an incision in the form of a transverse groove at place of joint. Dorsal carina of abdominal somite V does not terminate posteriorly in a tooth or sharp angle. Basis and ischium of pereopod I armed with spines ....4.
— Antennal angle armed with buttressed spine. Dorsal carina of abdominal somite II without transverse groove. Dorsal carina of abdominal somite V terminates posteriorly in a tooth or sharp angle. Basis and ischium of pereopod I unarmed ....5.
4. Dorsal carina of carapace armed with three teeth posterior to orbital margin; middle tooth largest. Anterior tooth smaller than two posterior ones and subequal to rostral teeth, but appears to be one of rostral group. Two subapical teeth on rostrum. Terminal margin of rostrum with four teeth. One or two small movable spines present on ventrodistal end of rostrum. Species inhabits Pacific and Atlantic coasts of America (Figure 66) .... *S. laevigata* Stimpson, 1871.

50 — Dorsal carina of carapace armed with three subequal teeth posterior to orbital margin; anterior tooth much larger than rostral teeth. Three teeth on rostrum. Terminal margin of rostrum armed with

[2]Key to species from the Indo-Pacific regions taken from Ya. I. Starobogatov (1972).



49 Figure 66. *Sicyonia laevigata* Stimpson (from Williams, 1965).
A—cephalothorax (lateral view); *B*—thelycum; *C*—petasma.

three formed teeth and a fourth rudimentary one. No movable spines on ventrodistal end of rostrum (Figure 67) ....*S. parri* (Burkenroad), 1934.

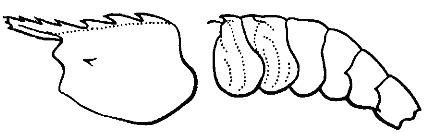


Figure 67. *Sicyonia parri* (Burkenroad) (from Williams, 1965).

5. Postrostral carina with two to three teeth posterior to orbital margin ....6.
— Postrostral carina with three to four teeth posterior to orbital margin; two larger located far behind orbit. Species inhabits Atlantic and Pacific coasts of America (Figure 68) ....*S. brevirostris* Stimpson, 1871.
6. Postrostral carina with one large tooth posterior to level of hepatic spine ....7.
— Postrostral carina with two large teeth posterior to orbital margin . ...*S. edwardsii* Miers, 1881.
7. Rostrum inclined upward at a considerable angle ....8.
— Rostrum horizontal or slightly decurved at tip (Figure 69) ....*S. dorsalis* Kingsley, 1878.
8. Anteroventral angles of first four pleura of abdomen terminate in

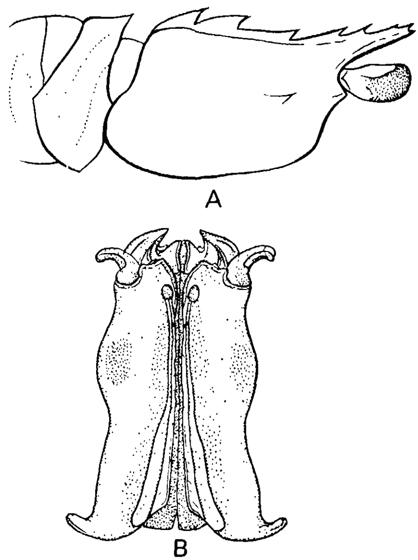


Figure 68. *Sicyonia brevirostris* Stimpson (from Williams, 1965).
A—cephalothorax (lateral view); *B*—petasma.

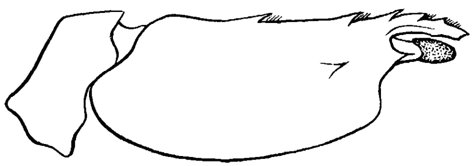


Figure 69. *Sicyonia dorsalis* Kingsley (from Williams, 1965).

sharp spines curved laterally and slightly upward. Posterior angles of dorsal carinae of last three somites of abdomen taper into distinct spines .... *S. burkenroadi* Cobb, 1971.

— Anteroventral angles of first four pleura of abdomen without curved spines. Small backwardly directed teeth present on posterior margin of only last two somites of abdomen (Figure 70) .... *S. stimpsoni* Bouvier, 1905.

9. Antennal angle unarmed. Dorsal carina of abdominal somite II
51 with an incision at place of joint in form of transverse groove. Dorsal carina of abdominal somite V does not terminate posteriorly in teeth or sharp angle. Basis and ischium of pereopod I armed with spines .... 10.

— Antennal angle armed with spines. Dorsal carina of abdominal somite II without transverse groove. Dorsal carina of abdominal

Figure 70. *Sicyonia stimpsoni* Bouvier (from Williams, 1965).

somite V terminates posteriorly in a tooth or sharp angle. Basis and ischium of pereopod I unarmed .... 11.

10. *Dorsal carina of carapace armed with three teeth posterior to orbital margin; middle tooth largest. Anterior tooth smaller than two posterior ones and subequal to rostral teeth, but appears to be one of rostral group. Two subapical teeth on rostrum. Terminal margin of rostrum with four teeth. One or two small movable spines present on ventrodistal end of rostrum. Species inhabits Pacific and Atlantic coasts of America (Figure 66) .... *S. laevigata* Stimpson, 1871.

— Dorsal carina of carapace with three teeth posterior to orbital margin, all approximately equal in size. Anterior tooth larger than teeth of rostral group. Three teeth (excluding terminal ones) on rostrum. Terminal margin of rostrum armed with four to five teeth. Ventral margin of rostrum with one movable spine .... *S. disparri* (Burkenroad), 1934.

11. **Postrostral carina with two to three teeth posterior to orbital margin .... 12.

— Postrostral carina with three to four teeth posterior to orbital margin; three larger located far behind orbit. Species inhabits Pacific and Atlantic coasts of America (Figure 68) .... *S. brevirostris* Stimpson, 1871.

12. Two larger teeth of two to three on postrostral carina located posterior to orbit .... 13.

— Of two teeth on postrostral carina, larger located posterior to level of hepatic spine .... 14.

13. Rostrum with two teeth posterior to bifid tip (excluding anterior tooth of carapace sometimes located anterior to orbital margin). Pair of median acicules on orbital somite divergent and with distinctly curved tips .... *S. disedwardsi* (Burkenroad).

— Rostrum with one tooth posterior to bifid tip. Pair of median acicules

*Description same as under pt. 4 in the Russian original—General Editor.

**A repetition of pt. 5 in the Russian original—General Editor.

on orbital somite, if curved, very slightly so . . . .*S. penicillata* Lockington, 1878.

14. Posterior tooth on carapace very large and very close to posterior margin, merging with it like a high carina . . . . .15.
— Posterior tooth on carapace larger than anterior one, but not very strong and located far ahead of posterior margin . . . . .16.

15. Pleura of abdominal somite I with small and short anteromedian
52 groove. Abdominal surface smooth, although covered with dots and bristles . . . .*S. affinis* (Faxon), 1893.
— Pleura of abdominal somite I with a deep anteromedian groove which extends to ventral margin and joins posteromedian groove. Abdominal surface tuberculate and fairly rugulose . . . . *S. alliaffinis* (Burkenroad).

16. Dorsal carina posterior to last tooth on carapace low but distinct. Rostrum horizonal with three teeth with bifid and slightly decurved tip . . . . .17.
— Dorsal carina posterior to last tooth on carapace very high. Rostrum elevated at a considerable angle with four teeth above and two on terminal margin . . . .*S. picta* (Faxon), 1893.

17. Telson longer than uropods and armed with pair of well-defined immovable lateral spines. Rostrum with lateral crests parallel to ventral margin throughout its length . . . . .*S. ingentis* (Burkenroad).
— Telson shorter than uropods and armed with pair of very small, barely noticeable, immovable lateral spines. Rostrum with lateral crests raised upward from ventral margin toward distal end . . . . *S. disdorsalis* (Burkenroad).

18. Sharp tooth present on pleura of abdominal somite V on lower side . . . . .19.
— No teeth on pleura of first five abdominal somites . . . .*S. carinata* (Brünnich), 1768.

19. Anterior third of dorsal carina of abdominal somite II with a depression. Pleura of abdominal somite IV with tooth on lower side. Pereopod II with basial spine . . . .*S. galeata* Holthuis, 1952.
— Anterior third of dorsal carina of abdominal somite II without depression. Pleura of abdominal somite IV without tooth on lower side. Pereopod II without basial spine . . . .*S. foresti* Rossignol.

52 Tribe Caridea Dana, 1852 (-Eucyphidea)

KEY TO FAMILIES (HOLTHUIS, 1955, WITH ADDITIONS)

1. Pereopods I and II, or only II, chelate or subchelate. Maxilliped III four- or five-segmented. Epipods, when present, small and extend vertically, not reaching branchial chamber .2.

— Pereopods never chelate or subchelate. Maxilliped III seven-segmented. Epipods of first four pereopods very large, forming right angle and extending dorsally into branchial chamber (Figure 71) . . . . .Family **Procarididae** only genus . . . . . . and species: *Procaris ascensionis* (Chace and Manning, 1972).

2. Pereopod I chelate or simple (nonchelate) . . . . .3.

— Pereopod I subchelate . . . . .21.

3. Fingers of all four chelae slender, with pectinate cutting edges . . . . .Family **Pasiphaeidae.**

— Fingers of all four chelae with nonpectinate cutting edges . . . . . . .4.

4. Carpus of pereopod II entire (undivided). Pereopod I always with well-developed chela . . . . .5.

— Carpus of pereopod II usually divided into two or more subsegments. If not, pereopod I nonchelate . . . . .15.

5. Last two segments of maxilliped II placed side by side at end of
53 preceding segment. Fingers of chelae extremely long and slender . . . . .Family **Stylodactylidae** (only genus: *Stylodactylus* A. Milne-Edwards, 1881).

— Last two segments of maxilliped II not placed side by side at end of preceding segment. Fingers of chelae not very long . . . . .6.

6. Both fingers of chelae of pereopod I movable . . . . .Family **Psalidopodidae** (only genus: *Psalidopus* Wood-Mason and Alcock, 1892).

— Only one finger on chelae of pereopod I movable . . . . .7.

7. Pereopod I stouter and stronger, although frequently slightly shorter than pereopod II . . . . .8.

— Pereopod I usually slender, rarely almost as thick as pereopod II . . . . .10.

8. Pereopod I with a flat, semicircular movable finger deeply hidden in slit of propodus when chelae closed. Rostrum dorsoventrally flat . . . . .Family **Disciadidae** (only genus: *Discias* Rathbun, 1902).

— Pereopod I with normal chelae. Rostrum laterally compressed . .9.

9. Last segment of maxilliped II located along lateral side of penulti-

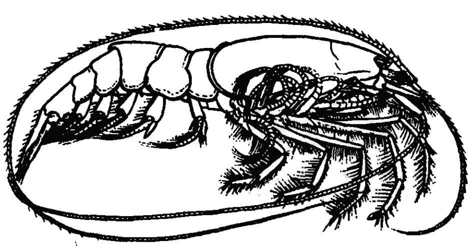


Figure 71. *Procaris ascensionis* Chace and Manning (Chace and Manning, 1972).

mate segment. Exopod of maxilliped I with a well-developed flagellum . . . . Family **Rhynchocinetidae.**

— Last segment of maxilliped II located at end of penultimate segment. Exposed of mailliped I without flagellum . . . . Family **Bresiliidae.**

10. Pereopods usually with exopods. If exopods absent, fingers of chelae with terminal tufts of long hairs . . . . 11.

— Pereopods without exopods. Fingers of chelae without terminal tufts of long hairs . . . . 13.

11. Mandibles without palpi. Fingers of chelae usually with well-developed terminal tufts of hairs. Last three pairs of pereopods slightly elongated. Pereopods with or without exopods. Mostly inhabit fresh waters . . . . Family **Atyidae.**

— Mandibles with palpi. Fingers of chelae without terminal tufts of hairs. Pereopods with exopods. Mostly inhabit deep seas . . . . . . 12.

12. Last three pairs of pereopods not elongated, with carpus shorter than propodus . . . . Family **Oplophoridae.**

— Last three pairs of pereopods considerably elongated, with carpus several times longer than propodus (Figure 72) . . . . Family **Nematocarcinidae** (only genus: *Nematocarcinus* A. Milne-Edwards, 1881).

13. Arthrobranchiae and epipods present on first four pairs of pereopods. Upper antennular flagellum simple . . . . Family **Campylonotidae.**

— Pereopods without arthrobranchiae or epipods. Upper antennular flagellum divided into two . . . . 14.

14. Mandibles usually with incisorial process; if not, maxilliped III not flat and foliate . . . . Family **Palaemonidae.**

— Mandibles without incisorial process; maxilliped III flat and foliate . . . . Family **Gnathophyllidae.**

i5. Chelae of first pair of pereopods moderately well developed, at least on one side . . . . 16.

— Chelae of first pair of pereopods microscopically small or absent . . . . 19.

54

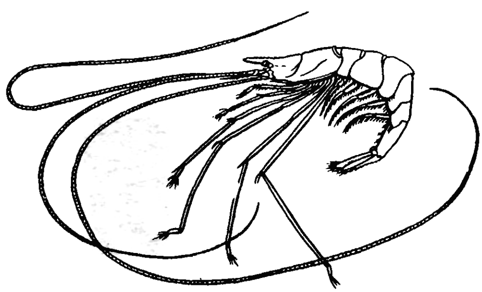


Figure 72. *Nematocarcinus ensifer* (Smith).

16. Both pereopod I chelate. Rostrum dentate or edentate, without subdistal teeth ....17.
— Usually first right pereopod chelate, while left simple with claw-like dactyl. If both first pereopods chelate, rostrum with distal notch covered with bristles and forming subdistal dorsal tooth ....Family **Processidae.**
17. Tips of fingers of chelae of pereopod I usually brightly colored. First pair of chelipeds short and slightly stronger. Eyes free and never extremely elongated ... . .Family **Hippolytidae.**
— Tips of fingers of chelae of pereopod I not brightly colored. Eyes extremely elongated or covered by carapace ....18.
18. Eyes extremely elongated, reaching almost to end of antennular peduncle; cornea small. Pereopod I shorter and not stronger than pereopod II ....Family **Ogyrididae** (only genus: *Ogyrides* Stebbing, 1914).
— Eyes normal or partly or totally covered by carapace, and never elongated. Pereopod I significantly larger than pereopod II and often unequal in size ....Family **Alpheidae.**
19. Carpus of pereopod II not divided into subsegments. Chelae of pereopod II strong ....Family **Thalassocarididae** (only genus: *Thalassocaris* Stimpson, 1860).
— Carpus of pereopod II divided into two or more subsegments. Chelae of pereopod II small ....20.
20. Mandibles with very well developed incisorial and molar processes and palpus. Rostrum laterally compressed and armed with teeth .. ..Family **Pandalidae.**
— Mandibles simple, without palpus. Rostrum broad and constitutes a continuation of carapace; several dorsal teeth on rostrum ....Family **Physetocarididae** (only genus: *Physetocaris* Chace, 1940).
21. Carpus of pereopod II multisegmented ....Family **Glyphocrangonidae** (only genus: *Glyphocrangon* A. Milne-Edwards, 1881).
— Carpus of pereopod II nonsegmented ......Family **Crangonidae.**

FAMILY OPLOPHORIDAE KINGSLEY, 1878

KEY TO GENERA (FROM HOLTHUIS, 1955)

1. Exopods, at least on maxilliped III and pereopod I, foliate and usually hard. Outer margin of scophocerite usually armed with a series of spines. Telson terminates in a point. Eyes large and well pigmented (Figure 73) ....*Oplophorus* H. Milne-Edwards, 1837.
— Exopods never foliate and hard on pereopods ....2.

2. At least last four abdominal somites with one dorsomedian carina each . . . . .3.
— Abdominal somite VI without dorsal carina . . . . .5.
55 3. Straight lateral carina of carapace absent. Posterior margin of hepatic groove not intersected by a sharp oblique outgrowth or carina. Entire cutting edge of mandible dentate (Figure 74) . . . . *Acanthephyra* A. Milne-Edwards, 1881.

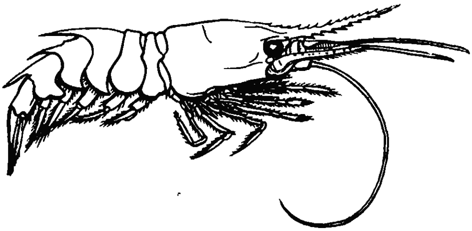


Figure 73. *Oplophorus spinosus* (Brullé) (from Holthuis, 1955).

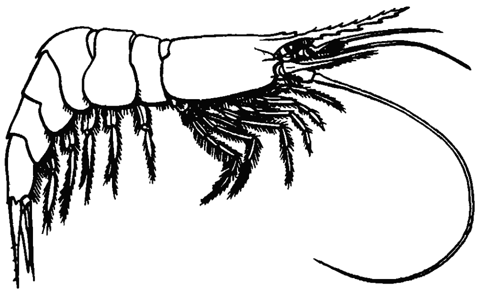


Figure 74. *Acanthephyra purpurea* A. Milne-Edwards (from Holthuis, 1955).

— Carapace with at least one straight lateral carina extending from posterior margin to carapace. Posterior margin of hepatic groove sharply intersected at branchial part of carapace by an oblique carina. Anterior half of incisorial process of mandible unarmed . .4.
4. Single longitudinal carina present on lateral surface of carapace. Dorsal carina of carapace edentate on posterior three-fourths of its length. No dorsal keel on abdominal somite I (Figure 77) . . . . *Meningodora* Smith, 1882.
— More than one longitudinal carina on lateral surface of carapace. Dorsal carina of carapace dentate throughout almost its entire length. Each abdominal somite with a dorsal carina (Figure 76) . . . . *Notostomus* A. Milne-Edwards, 1881.
5. Ischium and merus of pereopods broad and slightly compressed laterally (Figure 75) . . . . *Ephyrina* Smith, 1885.
— Pereopods normal . . . . .6.
6. Eyes very small and poorly pigmented. Anterior margin of abdominal somite I flat and not serrated. Telson with incised and spiny end

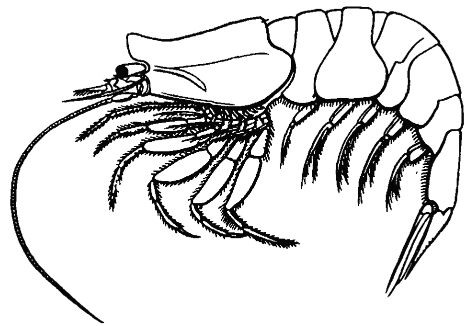


Figure 75. *Ephyrina hoskyni* Wood-Mason and Alcock (from Holthuis, 1955)

(Figure 78) .... *Hymenodora* Sars, 1877.

56 — Eyes very large and well pigmented. Anterior margin of abdominal somite I with distinct projection or teeth, which cover posterior margin of carapace. Telson terminates in a sharply pointed tip and is armed with lateral spines (Figure 79) ..... *Systellaspis* Bate, 1888.

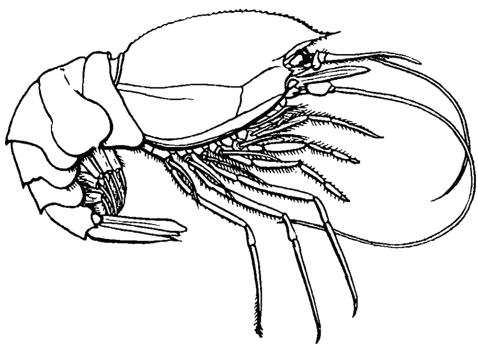


Figure 76. *Notostomus robustus* Smith (from Holthuis, 1955).

FAMILY ATYIDAE DANA, 1852

KEY TO GENERA (FROM HOLTHUIS, 1955, WITH ADDITIONS)

1. Arthrobranchiae present on first four pereopods. Chelae without tufts of long hairs on finger tips (Figure 80)... *Xiphocaris* van Martens, 1872.

57 — Arthrobranchiae absent, at least on last four pereopods. Chelae with tufts of long hairs on finger tips .... 2.

2. Supraorbital spines present .... 3.

— Supraorbital spines absent .... 8.

3. Carapace without pterygostomian spine .... 4.

— Carapace with pterygostomian spine .... 6.

4. All pereopods with exopods. Eyes well developed, cornea pigmented (Figure 81) .. .. *Paratya* Miers, 1872.

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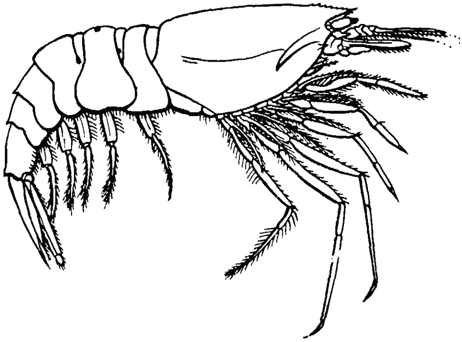


Figure 77. *Meningodora mollis* Smith (from Holthuis, 1955).

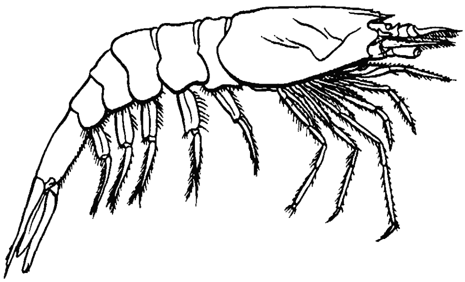


Figure 78. *Hymenodora gracilis* Smith (from Holthuis, 1955).

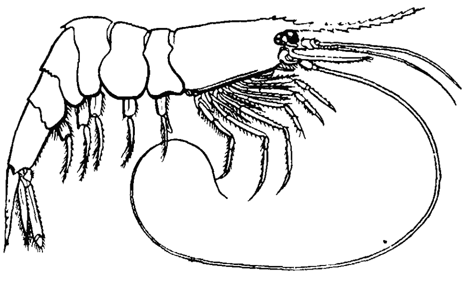


Figure 79. *Systellaspis debilis* (A. Milne-Edwards) (from Holthuis, 1955).

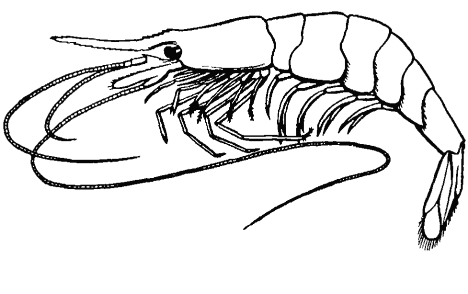


Figure 80. *Xiphocaris elongata* (Guerin-Meneville).

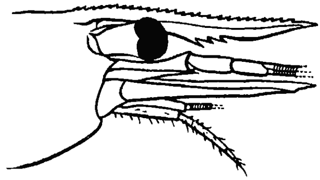


Figure 81. *Paratya compressa* (de Haan).

— Fifth pair of pereopods without exopods; if exopods present, eyes reduced and without pigment . . . . .5.
5. Eyes much reduced and without pigment. In adults exopods present on first four or on all pereopods. Maxilliped III with arthrobranchiae (Figure 82) . . . .*Troglocaris* Dormitzer, 1853.
— Eyes well developed and pigmented. In adults exopods absent on pereopods. Maxilliped III without arthrobranchiae (Figure 83) . . . .*Atyaephyra* de Brito Capello, 1867.

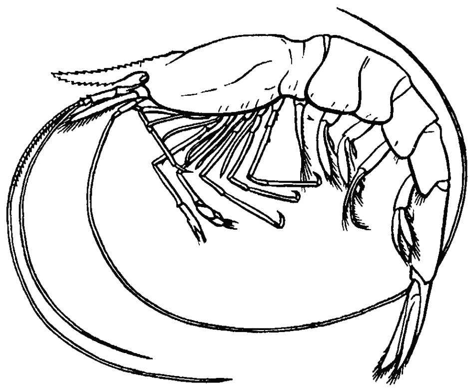


Figure 82. *Troglocaris anophtalmus* (Kollar) (from Holthuis, 1955).

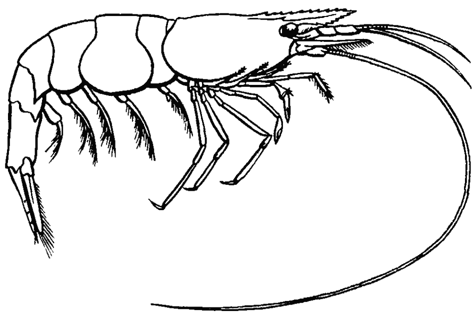


Figure 83. *Atyaephyra desmaresti* (Millet) (from Holthuis, 1955).

6. Carpus of first pereopod excavated but that of second normal. Pereopod V without exopod . . . .*Syncaris* Holmes, 1900.
— Carpus of both first and second pereopods excavated. Pereopod V usually with rudimentary exopod . . . . .7.

7. Eyes much reduced and without pigment (Figure 84, *B*) . . . . *Palaemonias* Hay, 1901.
— Eyes well developed and pigmented (Figure 84, *C*) . . . . *Dugastella* Bouvier, 1912.
8. Exopods present on all pereopods. Eyes reduced and without pigment or with slightly pigmented cornea . . . . 9.
— Exopods absent, at least on last four pereopods. Eyes usually well developed and pigmented . . . . 12.
58 9. Antennal spine present . . . . 10.
Antennal spine absent (Figure 84, *G*) . . . . . *Typhlatya* Creaser, 1936.
10. Shrimps found off Madagascar and Australia . . . . 11.
— Shrimps found off Fiji Island (Figure 84, *D* to *F*) . . . . *Antecaridina* Edmondson, 1954—(*Mesocaris* Edmondson, 1935).
11. Podobranchia present on maxilliped II. Epipod present on pereopod IV. Shrimps found off Australia . . . . *Stygiocaris* Holthuis, 1960.

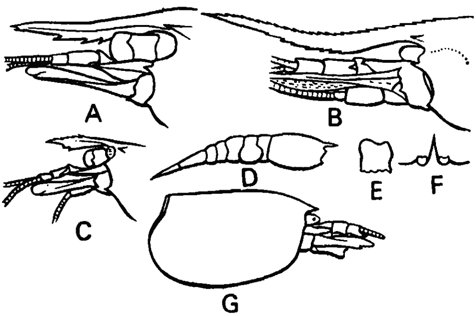


Figure 84. *A—Syncaris pasadenae* (Kingsley); *B—Palaemonias ganteri* Hay; *C—Dugastella marocana* Bouvier; *D—Antecaridina lauensis* (Edmondson) (lateral view); *E*—eye; *F*—rostrum (dorsal view); *G—Typhlatya garciai* Chace (from Holthuis, 1955).

— Podobranchia absent on maxilliped II. Epipod absent on pereopod IV. Shrimps found off Madagascar . . . . *Typhlopatsa* Holthuis, 1956.
12. Pereopod I with arthrobranchiae . . . . 13.
— Pereopod I without arthrobranchiae . . . . 16.
13. Carpus of pereopod II very short, width greater than length, and deeply excavated anteriorly (Figure 85) . . . . *Atya* Leach, 1816.
— Carpus of pereopod II greater in length than width and not deeply

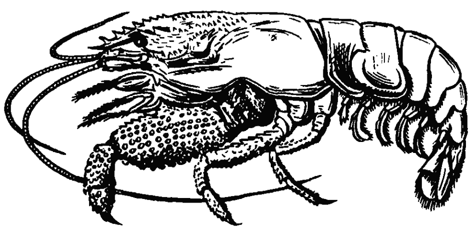


Figure 85. *Atya crassa* (Smith) (from Holthuis, 1955).

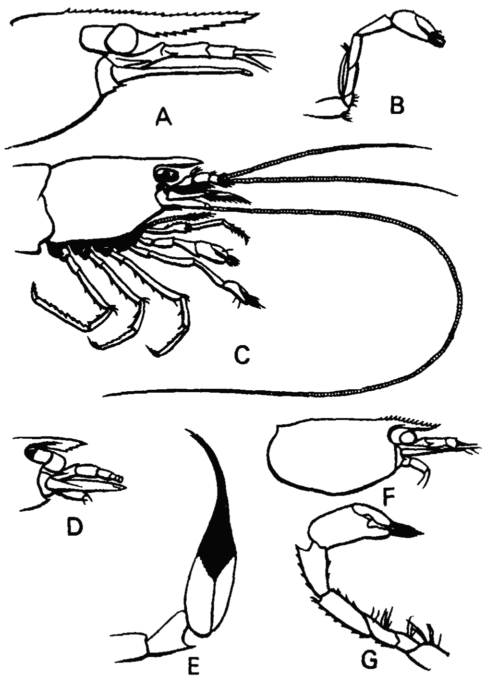


Figure 86. *Caridinides wilkinsi* Calman: *A*—anterior end; *B*—pereopod I; *Caridina acuminata* Stimpson: *C*—anterior end; *Potimirim mexicana* (De Saussure): *D*—cephalic end; *E*—first chela; *Caridella cunnigtoni* Calman: *F*—anterior end; *G*—first chela (from Holthuis, 1955).

excavated anteriorly ....14.

59 14. Exopod present on pereopod I (Figure 86, *A* and *B*) ....*Caridinides* Calman, 1936.*

— Pereopod I without exopod ....15.

15. Palmar portion of chela well developed. Fingers of chela slightly longer than propodus. Rostrum usually laterally compressed and dentate on both upper and lower margins; rarely one or both margins unarmed. Carpus of pereopod II, if anteriorly excavated, very small. Area of generic distribution: Africa and Indo-West-Pacific region (Figure 86, *C*). . . .*Caridina* H. Milne-Edwards, 1837.

— Palmar portion of chela very small. Fingers almost equal in length to propodus. Rostrum short, dorsoventrally compressed basally, and without dorsal (although with ventral) teeth. Carpus of pereopod II usually with well-developed anterior excavation. Area of generic distribution: America (Figure 86, *D* and *E*) ....*Potimirim* Holthuis, 1954.

16. Carpus of pereopod I excavated anteriorly ....17.

— Carpus of pereopod I not excavated or slightly excavated anteriorly ....19.

*Mistake in original. Should read "Calman, 1926"—Technical Editor.

17. Palmar portion of chela indistinct. Chela divided up to or almost up to base so that fingers equal in length. Carpus of pereopod II with anterior excavation . . . . 18.
— Palmar portion of chela distinct. Fingers distinctly shorter than propodus. Carpus of pereopod II without anterior excavation (see Figure 86, *F* and *G*) . . . . *Caridella* Calman, 1906.
18. Anterolateral angle of basal segment of antennular peduncle with slender tooth. Several postorbital teeth occur on upper margin of rostrum. Shrimps found in Lake Tanganyika (Figure 87, *A* and *B*) . . . . *Atyella* Calman, 1906.
— Anterolateral angle of basal segment of antennular peduncle without tooth. Postorbital teeth absent on upper margin of rostrum. Shrimps found off Cuba (Figure 87, *C* and *D*) . . . . *Micratya* Bouvier, 1913.

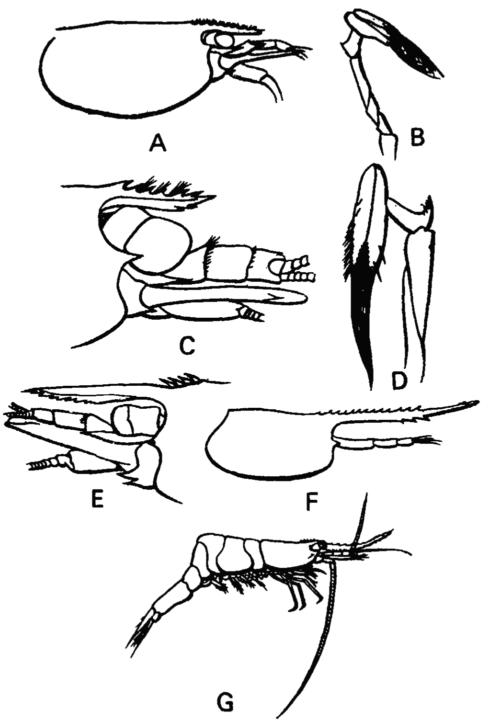


Figure 87. *Atyella brevirostris* Calman: *A*—anterior end; *B*—pereopod I; *Micratya poeyi* (Guerin): *C*—anterior end; *D*—pereopod I; *Caridinopsis chevalieri* Bouvier: *E*—anterior end; *Limnocaridella alberti* (Lenz): *F*—carapace; *G*—*Limnocaridina tanganyike* Calman (from Holthuis, 1955).

19. Epipods present on first four pereopods. All pereopods with pleurobranchiae. Maxilliped III with two arthrobranchiae; maxilliped II with podobranchiae. Rostrum quite long and upper margin devoid of teeth except for postorbitals (Figure 87, *E*) . . . . *Caridinopsis* Bouvier, 1913.

— Epipods absent on first four pereopods. Pleurobranchiae on pereopod V usually absent. Maxilliped III largest with one arthrobranchia. Podobranchiae absent on maxilliped II. Upper margin of rostrum without postorbital teeth ....20.

20. Epipods present on first three pereopods. Rudimentary arthrobranchiae present on maxilliped III (Figure 87, *F*) ....*Limnocaridella* Bouvier, 1913.

— Epipods absent on pereopods. Branchiae absent on maxilliped III (Figure 87, *G*). ....*Limnocardina* Calman, 1899.

FAMILY PASIPHAEIDAE DANA, 1852

KEY TO GENERA (FROM HOLTHUIS, 1955)

1. Mandibles without palpus. Rostrum represented by a raised postfrontal spine (Figure 88, *A*) ....*Pasiphaea* Savigny, 1816.

— Mandibles with palpus. Rostrum represented by forward projection of carapace ....2.

2. Pereopod IV distinctly shorter than pereopods III and V.........3.

— Pereopod IV longer than pereopod V, but both shorter than pereopod III ....7.

3. Antennal and branchiostegal spines absent. Dorsal margin of carapace usually without spines ....4.

— Antennal and branchiostegal spines present. Dorsal margin of carapace with spines ....5.

4. Mandibular palpus two-segmented (Figure 88, *B*) ....*Parapasiphae* Smith, 1884.

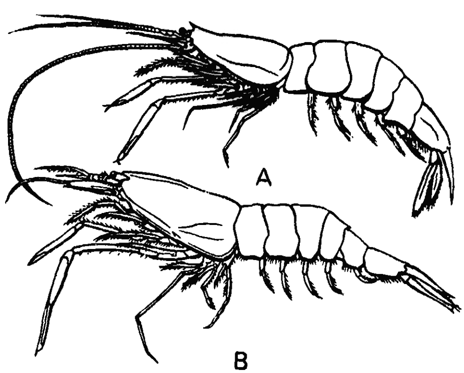


Figure 88. *A*—*Pasiphaea multidentata* Esmark; *B*—*Parapasiphae sulcatifrons* (from Holthuis, 1955).

— Mandibular palpus unsegmented (Figure 89, *A* and *B*) ....*Dantecia* Caullery, 1896.

5. Mandibular palpus unsegmented (Figure 89, *C*) ....*Sympasiphaea* Alcock, 1901.

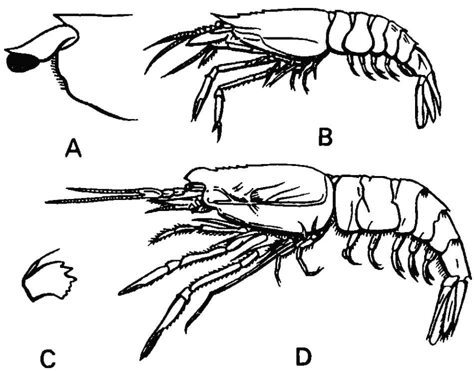


Figure 89. *Dantecia caudani* Caullery: *A*—anterior part of carapace; *B*—mandible; *C*—*Sympasiphaea annectens* Alcock; *D*—*Eupasiphae latirostris* (Wood-Mason and Alcock) (from Holthuis, 1955).

— Mandibular palpus two-segmented . . . . .6.
6. Maxilliped III with one arthrobranchia . . . . . .*Glyphus* Filhol, 1884.
— Maxilliped III with two arthrobranchiae (Figure 89, *D*). . . . .*Eupasiphae* Wood-Mason and Alcock, 1893.
61 7. Pereopods III and IV almost equal in length, slender, and not shorter than pereopod I. Pleopods with very long and narrow exopods. Endopods distinctly shorter. Rostrum with dorsal teeth (Figure 90, *A*) . . . .*Psathyrocaris* Wood-Mason and Alcock, 1893.
— Pereopod IV shorter than pereopod III, and both shorter than pereopod I. Pleopods with short and equally long endopods and exopods. Rostrum without dorsal teeth (see Figure 90, *B*) . . . .*Leptochela* Stimpson, 1860.

FAMILY RHYNCHOCINETIDAE ORTMANN, 1890

KEY TO GENERA (FROM YALDWYN, 1960)

1. Rostrum immovable . . . . .2.
— Rostrum movable (Figure 91) . . . .*Rhynchocinetus* H. Milne-Edwards, 1837.
2. Finger tips of pereopods I and II brightly pigmented (Figure 92) . . . .*Eugonatonotus* Schmitt, 1926.
— Finger tips of pereopods I and II not brightly pigmented . . . .*Lipkius* Yaldwyn, 1960.

FAMILY BRESILIIDAE CALMAN, 1896

KEY TO GENERA (FROM HOLTHUIS, 1955)

1. Exopods present only on first two pairs of pereopods. Pereopod V with a rudimentary pleurobranchia (Figure 93, *A*) . . . .

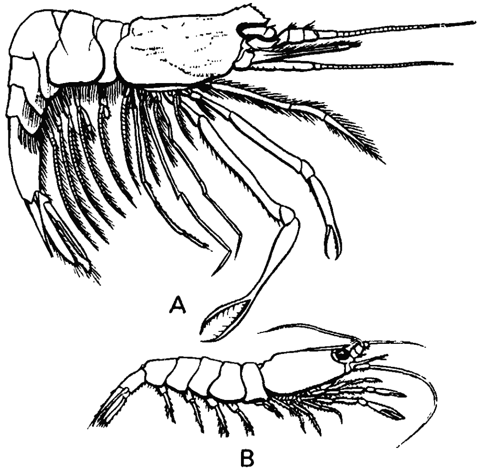


Figure 90. *A—Psathyrocaris infirma* Alcock and Anderson; *B—Leptochela bermudensis* Gurney (from Holthuis, 1955).

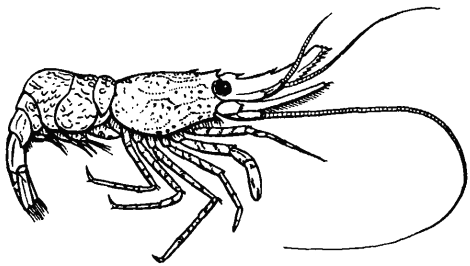


Figure 91. *Rhynchocinetus typus* H. Milne-Edwards (from Holthuis, 1955).

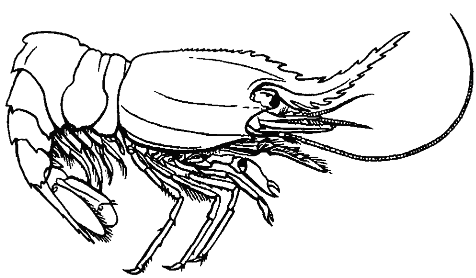


Figure 92. *Eugonatonotus crassus* (A. Milne-Edwards) (from Holthuis, 1955).

. . . . *Bresilia* Calman, 1896.

— Exopods present on all pereopods. Pereopod V with a well-developed pleurobranchia (Figure 93, *B*) . . . . *Lucaya* Chace, 1939.

62 FAMILY CAMPYLONOTIDAE SOLLAUD, 1913

KEY TO GENERA (FROM HOLTHUIS, 1955)

1. Pereopods II similar. Basal part of rostrum with no more than five

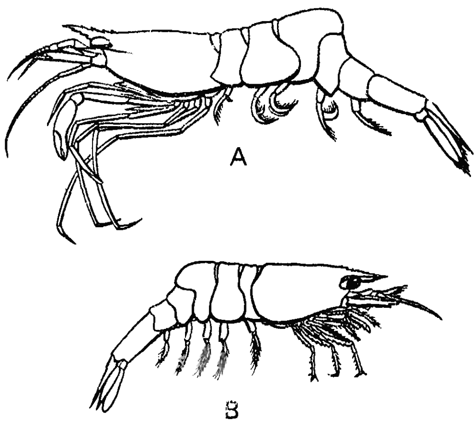


Figure 93. *A—Bresilia atlantica* Calman; *B—Lucaya bigelowi* Chace.

teeth; first tooth situated behind midpoint of carapace (Figure 94, *A*) .... *Campylonotus* Bate, 1888.

— Pereopods II very dissimilar. Basal part of rostrum with more than 10 dorsal teeth, all of which are situated in anterior half of carapace (Figure 94, *B*) .... *Bathypalaemonella* Balss, 1914.

FAMILY PALAEMONIDAE SAMOUELLE, 1819

KEY TO SUBFAMILIES (FROM HOLTHUIS, 1955)

1\. Upper antennular flagellum with two branches which are free throughout their length. Pleopod II in male without appendix masculina, and in female without appendix interna. Pleurobranchiae absent at base of maxilliped III .... Subfamily **Euryrhynchinae** (only genus: *Euryrhynchus* Miers, 1877).

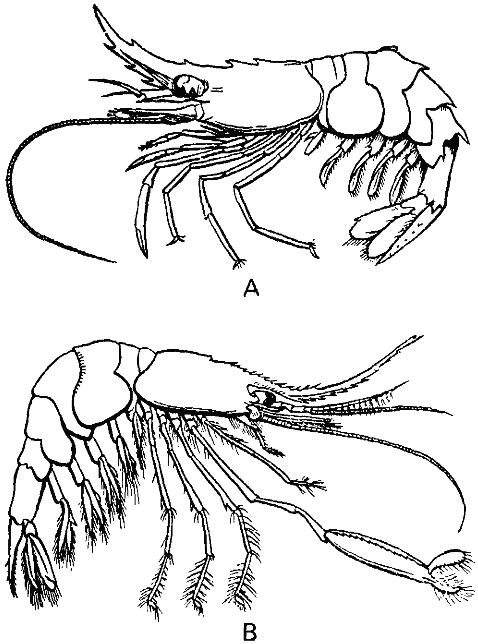
— Upper antennular flagellum with two branches which are basally fused. Pleopod II in male usually with appendix masculina and in female with appendix interna ....2.

2\. Lateral surface of carapace with longitudinal suture throughout its length, extending posteriorly from antennal region. Pleurobranchiae absent on maxilliped III....... Subfamily **Typhlocaridinae** (only genus: *Typhlocaris* Calman, 1909).

— Lateral surface of carapace without suture ....3.

63 3. Pleurobranchiae absent on maxilliped III. Posterior margin of telson with three pairs of spines (except in *Anchistioides* which have fewer) .... Subfamily **Pontoniinae.**

— Pleurobranchiae present at base of maxilliped III. Posterior margin of telson with two pairs of spines and two or more setae .... Subfamily **Palaemoninae.**



62 Figure 94. *A—Campylonotus rathbunae* Schmitt; *B—Bathypalaemonella zimmeri* Balss (from Holthuis, 1955).

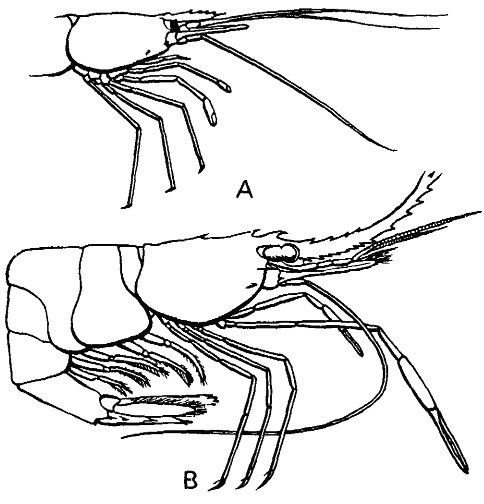


Figure 95. *A—Desmocaris trispinosa* (Aurivillius); *B—Leander urocaridella* Holthuis (from Holthuis, 1955).

Subfamily PALAEMONINAE Dana, 1852

KEY TO GENERA (FROM HOLTHUIS, 1955)

1. Supraorbital spine present . . . .*Desmocaris* Sollaud, 1911.
— Supraorbital spine absent . . . . .2.

Figure 96. *A—Creaseria morleyi* (Creaser): cephalothorax; *B—Leandrites celebensis* (de Man): anterior part of cephalothorax (from Holthuis, 1955).

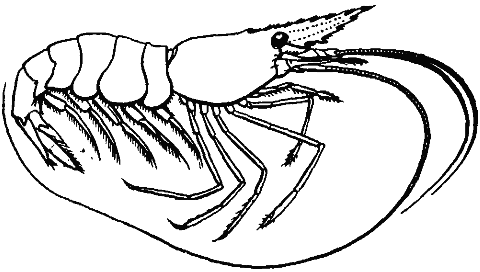


Figure 97. *Palaemon (Palaemon) longirostris* H. Milne-Edwards (from Holthuis, 1955).

2. Branchiostegal spine present . . . . .3.
— Branchiostegal spine absent . . . . .7.
3. Mandibles without palpus . . . . .4.
— Mandibles with palpus . . . . .5.
4. Pleopod I in male with distinct appendix interna on endopod. Branchiostegal groove absent. Propodus of pereopod V without transverse rows of setae on distal part of posterior margin (see Figure 96, *B*) . . . . *Leandrites* Holthuis, 1950.
— Pleopod I of male without appendix interna on endopod. Branchiostegal groove discernible as a sharp line. Propodus of pereopod V with transverse rows of setae on distal part of posterior margin . . . . *Palaemonetes* Heller, 1969.
   A. Eyes usually pigmented. Pereopod II stouter than pereopod I. Outer margin of exopod of uropod terminates in a tooth and a movable spine . . . . Subgenus *Palaemonetes* Heller, 1869.
   — Eyes not pigmented. Pereopod II almost similar to pereopod I. Outer margin of exopod of uropod terminates in a tooth but not a movable spine . . . . Subgenus *Allocaris* Sollaud, 1911.
64 5. Eyes not pigmented, cornea reduced. Anterior margin of basal segment of antennular peduncle concave, gradually converging into a strong anterolateral spine. Branchiostegal groove on carapace absent. Propodus of pereopod V with transverse rows of hairs in distal part of posterior margin. Mandibular palpus two-segmented (Figure 96, *A*) . . . . *Creaseria* Holthuis, 1950.
— Eyes distinctly pigmented, cornea well developed. Anterior margin of basal segment of antennular peduncle rounded; anterolateral spine small . . . . .6.
6. Pleopod I of male with well-developed appendix interna on endopod. Branchiostegal groove absent. Propodus of pereopod V

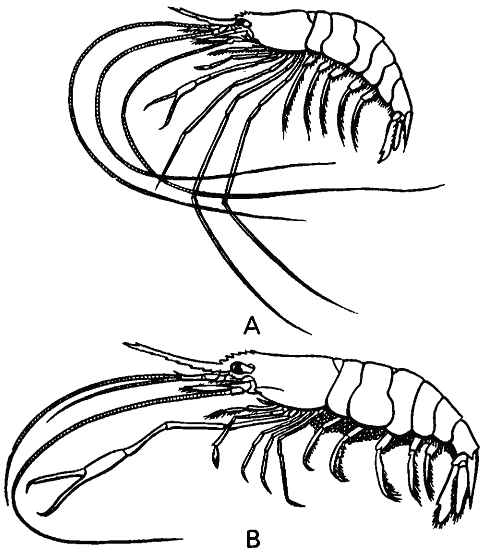


Figure 98. *A—Palaemon (Nematopalaemon) tenuipes* (Henderson); *B—Palaemon (Exopalaemon) styliferus* H. Milne-Edwards (from Holthuis, 1955).

without transverse rows of setae on distal part of posterior margin. Two median setae on posterior margin of telson very strong. Mendibular palpus two-segmented (Figure 95, *B*) .... *Leander* Desmarest, 1849.

— Pleopod I of male without or with rudimentary appendix interna on endopod. Branchiostegal groove usually present as a sharp line. Propodus of pereopod V with transverse rows of setae on distal part of posterior margin. Two median setae on posterior margin of telson slender (Figure 97) .... *Palaemon* Weber, 1795.

A. Rostrum with a raised basal crest with teeth. Pleura of abdominal somite V with broad rounded tip. Mandibular palpus three-segmented .... B.

65 — Rostrum without a raised basal crest. Pleura of abdominal somite V usually with small pointed tip. Branchiostegal groove present .... C.

B. Dactyl of last three pereopods highly elongated, longer than carpus and propodus together. Branchiostegal groove absent on carapace. Stylocerite with large tooth on dorsal surface (Figure 98, *A*) .... Subgenus *Nematopalaemon* Holthuis, 1950.

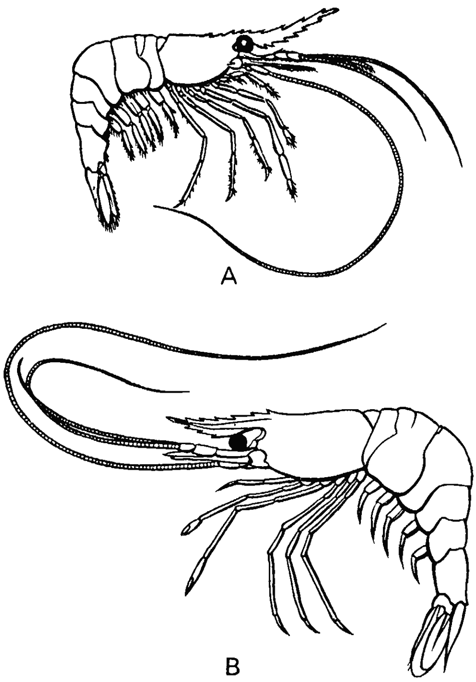
— Dactyl of last three pereopods shorter than propodus. Branchiostegal groove present on carapace. Stylocerite without large dorsal tooth (Figure 98, *B*) .... Subgenus *Exopalaemon* Holthuis, 1950.

C. Mandibular palpus two-segmented (Figure 99, *A*) .... Subgenus *Palaeander* Holthuis, 1950.

— Mandibular palpus three-segmented (Figure 97) . . . . .Subgenus *Palaemon* Weber, 1795.

7. Hepatic spine absent . . . . .8.

— Hepatic spine present . . . . .10.



64 Figure 99. *A—Palaemon (Palaeander) floridanus* Chace; *B—Palaemonetes (Palaemonetes) kadiakensis* Rathbun (from Holthuis, 1955).

8. Mandibles without palpus. Eyes not pigmented (Figure 101, *A*) . . . . *Troglocubanus* Holthuis, 1949.

— Mandibles with palpus. Eyes pigmented . . . . .9.

9. Pereopod II slender and smooth. Carpus 1.5 times or more longer than chela. Rostrum extends beyond scaphocerite (Figure 101, *B*). . . . . *Leptocarpus* Holthuis, 1950.

— Pereopod II robust and spinescent. Carpus less than half chela in length. Rostrum very short and high; does not extend beyond scaphocerite (Figure 102) . . . . *Cryphiops* Dana, 1852.

10. Mandibles without palpus. Dactyl of last three pereopods simple (Figure 103) . . . . *Pseudopalaemon* Sollaud, 1911.

— Mandibles with palpus . . . . .11.

11. Dactyl of last three pereopods simple (Figure 104, *B*) . . . . *Macrobrachium* Bate, 1868.

— Dactyl of last three pereopods biunguiculate (Figure 104, *A*) . . . . *Brachycarpus* Bate, 1888.

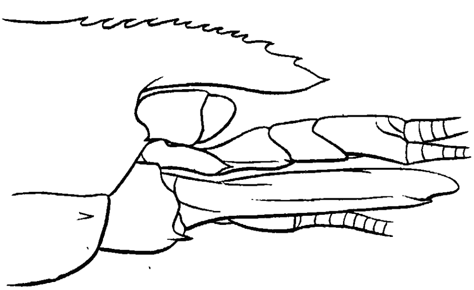


Figure 100. *Palaemonetes (Allocaris) antrorum* Benedict: anterior part of carapace (from Holthuis, 1955).

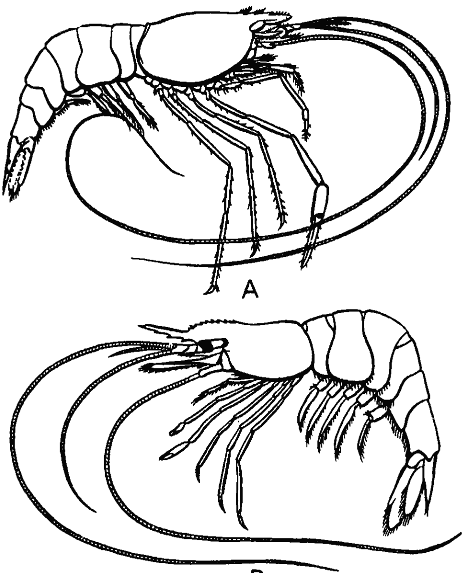


Figure 101. *A—Troglocubanus gibarensis* (Chace); *B—Leptocarpus fluminicola* (Kemp) (from Holthuis, 1955).

66 Subfamily PONTONIINAE Kingsley, 1878

KEY TO GENERA (FROM HOLTHUIS, 1955, WITH ADDITIONS)

1. Mandibular palpus present .... 2.
— Mandibular palpus absent .... 3.
2. Hepatic spine present (Figure 105) ...... *Palaemonella* Dana, 1852.
— Hepatic spine absent .... 2a.
2a. Mandibular palpus two-segmented .... *Eupontonia* Bruce, 1971.
— Mandibular palpus one-segmented (Figure 105, *B*) ....
.... *Vir* Holthuis, 1952.
3. Scaphocerites well developed .... 4.
— Scaphocerites rudimentary .... 37.
4. Exopods present on all maxillipeds .... 5.

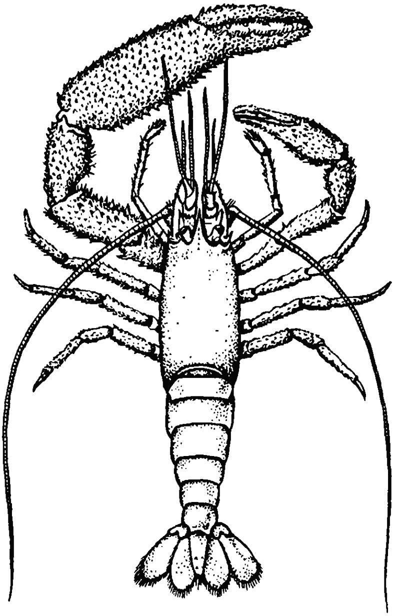


Figure 102. *Cryphiops caementarius* (Molina) (from Holthuis, 1955).

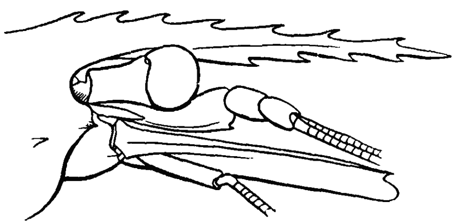


Figure 103. *Pseudopalaemon bouvieri* Sollaud: anterior part of carapace (from Holthuis, 1955).

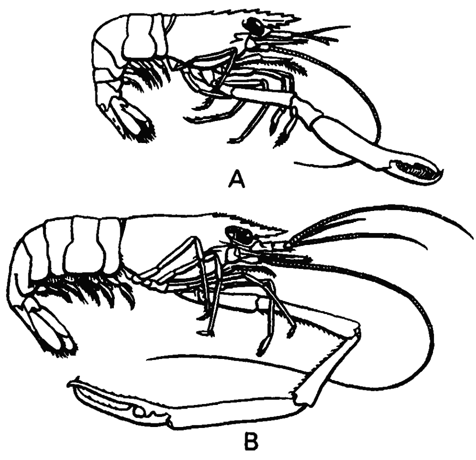


Figure 104. *A—Brachycarpus biunguiculatus* (Lucas); *B—Macrobrachium lar* (Fabricius) (from Holthuis, 1955).

— Exopods absent, at least on maxilliped III . . . . .27.
5. Dactyl of last three pereopods without basal projections. Sometimes dactyl broad at base, but broad part not seen when dactyl bent backward . . . . .6.
— Dactyl of last three pereopods with distinct basal projections, which are visible even when dactyl bent backward . . . . .22.
6. Pleura of first five abdominal segments broadly rounded or obtuse, but never with sharp points . . . . .7.
.67 — Pleura of at least abdominal segments IV and V with sharply pointed ends . . . . .20.

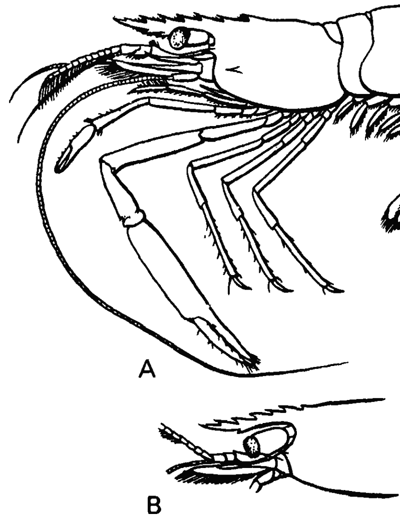


Figure 105. *A—Palaemonella vestigialis* Kemp; *B—Vir orientalis* (Dana): anterior end (from Holthuis, 1955).

7. Hepatic spine present . . . . .8.
— Hepatic spine absent . . . . .11.
8. Rostrum large, dorsally flat, with longitudinal median carina on ventral side, and looks like a "T" in cross section. Carapace with broad and distinct postorbital groove . . . . .9.
— Rostrum laterally compressed, never dorsally flat, and does not look like a "T" in cross section. Postorbital groove, if present, narrow and indistinct . . . . .10.
9. Three posterior pereopods consist of six segments only, since division of ischium and merus indistinct . . . . . *Tuleariocaris* Chace, 1969.
— Three posterior pereopods distinctly divided into seven segments (Figure 106, *A*) . . . . *Stegopontonia* Nobili, 1906.
10. Hepatic spine immovable. Body in most cases slender. Rostrum with distinct teeth. . . . . *Periclimenes* Costa, 1844.
   a. Dactyl of last three pereopods biunguiculate (Figure 107, *A*) . . . .

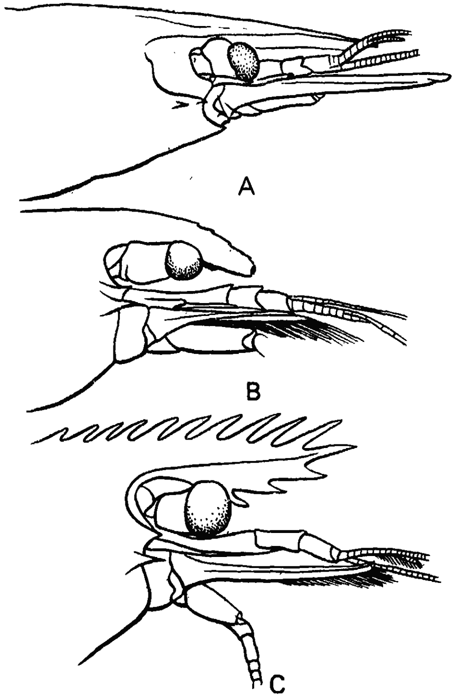


Figure 106. *A—Stegopontonia commensalis* Nobili: anterior part of carapace; *B—Paranchistus biunguiculatus* (Borradaile): anterior part of carapace; *C—Thaumastocaris streptopus* Kemp: anterior part of carapace (from Holthuis, 1955).

. . . . .Subgenus *Periclimenes* Costa, 1844.

— Dactyl of last three pereopods simple (Figure 107, *B*) . . . . .Subgenus *Harpilius* Dana, 1852.

— Hepatic spine immovable.* Body clumsy or heavy. Rostrum with small teeth arranged closer to its tip (Figure 106, *B*) . . . .*Paranchistus* Holthuis, 1952.

68 11. Rostrum laterally compressed, usually dentate . . . . .12.

— Rostrum depressed[3] or cylindrical, usually edentate . . . . .19.

12. Carpus of pereopod I subsegmented. Pereopod I unequal (Figure 106, *C*) . . . .*Thaumastocaris* Kemp, 1922.

— Carpus of pereopod I nonsegmented. Pereopod I equal . . . . .13.

13. Pereopod II very dissimilar in size and shape. Larger pereopod II very high, with short broad fingers with one to three teeth; one tooth hammer-shaped and lodged in cavity of opposite finger. Outer margin of basal antennular segment frequently anterior to stylocerite (Figure 108). . . . .*Periclimenaeus* Borradaile, 1915.

— Pereopod II differ in shape,** sometimes more or less dissimilar in

[3]Here and elsewhere "depressed" conveys a dorsoventral direction and "compressed" a lateral.

*Error in original. Should read "hepatic spine movable"—Technical Editor.

**Error in original. Should read "Pereopod II similar in shape"—Technical Editor.