

until recently. The unique characters which justify a monotypic order are: a thoracic brood pouch formed by the carapace and the first pleopod; a single maxilliped; nonfunctional feeding appendages and the digestive tract of the

adult female; reduced thoracopods; and reduced branchiae.

References. D. I. Williamson, *Amphionides reynaudii* (H. Milne Edwards), representative of a proposed new order of eucaridan Malacostraca, *Crustaceana*, 25(1):35-50, 1973.

DECAPODA

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An extremely large and diverse order which includes the familiar crabs, lobsters, and shrimps. A carapace is present and is fused dorsally to all thoracic segments; it extends to the base of the legs and encloses the gills, forming a branchial chamber. A large exopod, the scaphognathite, which pumps water out of the branchial chamber, is present on the maxilla. There are eight pairs of thoracic appendages, the first three of which are modified as maxillipeds. The sexes are usually separate, with fertilization both external and internal via spermatophores. The nauplius larva is the first larval stage of the suborder Dendro-

branchiata, while the zoea is usually the first larval stage of the Pleocyemata.

The order is divided into 2 suborders, the Dendrobranchiata, with 5 families, and the Pleocyemata, with the remaining 100 families of decapods.

There are about 10,000 Recent species. The size ranges from about 1 mm for some palaemonid shrimps to the giant Japanese spider crab whose claws may extend 365 cm. Representatives occur in terrestrial, freshwater, and marine habitats; marine environment has the greatest number of species.

DENDROBRANCHIATA

This suborder includes the planktonic sergestid shrimps and commercially important penaeid shrimps. The gills are dendrobranchiate, and the first three pereopods are chelate. Fertilization is external by a spermatophore. The eggs are not carried by the female, and the larvae first hatch as a nauplius. The 5 families are grouped in 2 superfamilies: Penaeoidea (Penaeidae, Aristeidae, Solenoceridae, and Sicyoniidae) and Sergestoidea (Sergestidae).

Penaeidae. The total length ranges from about 30 to more than 200 mm. The pleura of the second abdominal somite do not overlap those of the first and third. A rostrum is present, and the eyes are well developed. The basal segment of the antennular peduncle is hollowed to accommodate the eye. The mandible has an incisor process and a palp. The first three peraeopods are slender and chelate, increasing in length posteriorly. During mating the male transfers a spermatophore onto the female thelycum. Fertilization is external, the eggs are demersal, and the first larval stage is a nauplius. [See illustration page 298.]

This family comprises approximately 30 genera and 250 species. Penaeids include the majority of commercial shrimp which occur in estuaries, although a number of species occur in deeper water to at least 400 m. The genus *Penaeus* appears to spawn offshore, and the later larval stages migrate into estuarine nursery grounds as they develop.

References. I. Perez Farfante, Western Atlantic shrimps of the genus *Penaeus*, *Fish. Bull.*, 67(3):461-591, 1969.

Aristeidae. There is no postorbital spine. A distinct median tubercle is present on the ocular peduncle. Epipodites are present on the coxal segments of the appendages in somites 8-14. An anterior arthrobranch is present on somite 13. The cervical sulcus usually extends to the dorsum of the carapace. [See illustration page 298.]

This family was previously considered to be a subfamily of the Penaeidae. There are approximately 9 genera and 50 Recent species. The aristeid shrimps are nektonic and oceanic in distribution. *Gennadas elegans*, for example, is known from waters of about 1 to 15°C and from depths of 200 to 2000 m. This shrimp performs a considerable daily migration.

References. M. D. Burkenroad, The Aristaenae, Solenocerinae and pelagic Penaeinae of the Bingham Oceanographic Collection, *Bull. Bingham Oceanogr. Coll.*, 5(2): 1-151, 1936.

Solenoceridae. The species are about 40 to 75 mm in total length. The carapace is elongate, with a low rostrum. A postorbital spine and branchiocardiac and submarginal carinae are present. Podobranchiae are present on at least the second maxilliped. The first three pairs of peraeopods are chelate, with the legs increasing in length posteriorly. [See illustration page 298.]

This family was previously considered to be a subfamily of the Penaeidae. There are 7 genera and approximately 26 species. Members, in general, occur in deep water off the continental shelf, although species of *Solenocera* and *Pleoticus* occur in depths as shallow as 30 m.

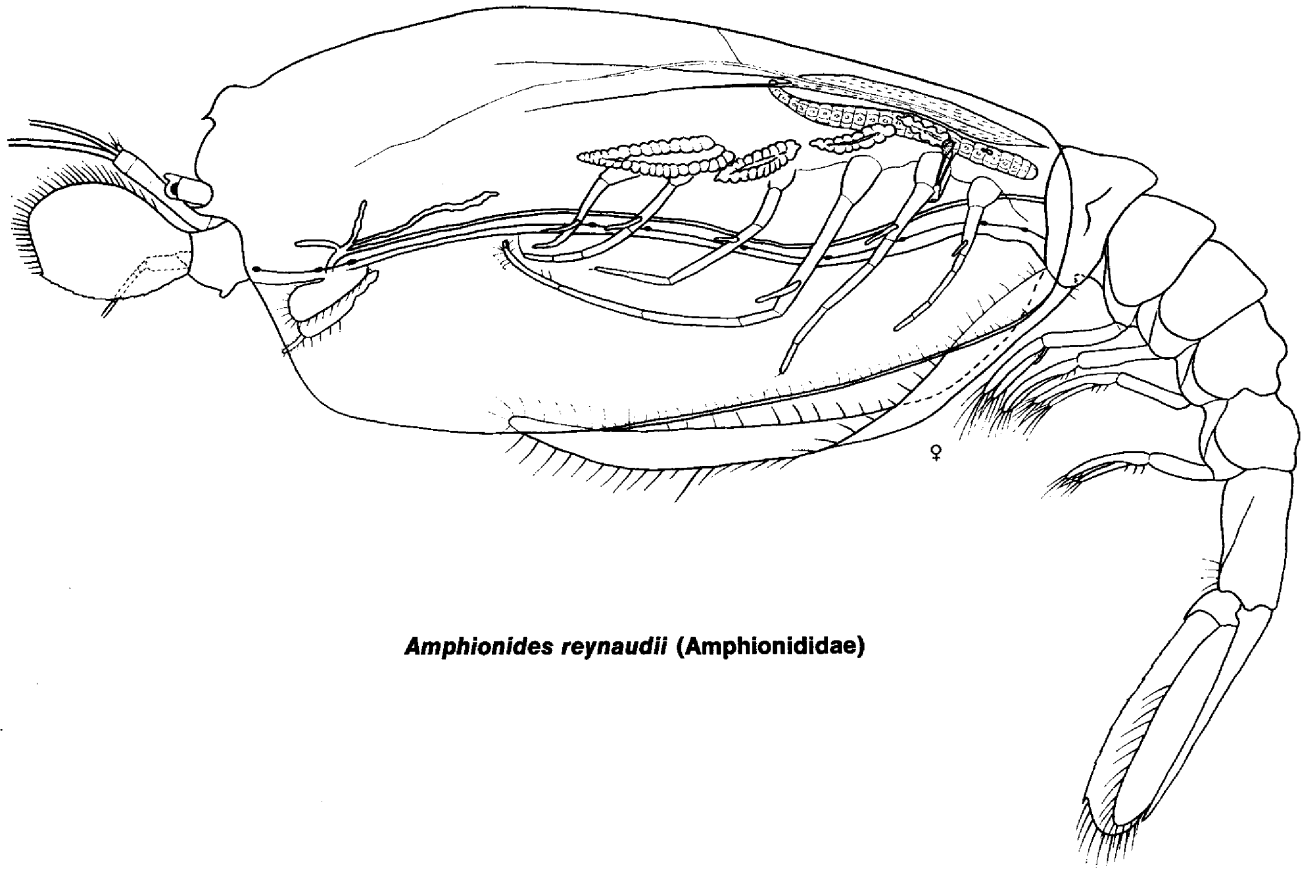
References. I. Perez Farfante, American solenocerid shrimps of the genera *Hymenopenaeus*, *Haliporoides*, *Pleoticus*, *Hadropenaeus* new genus and *Mesopenaeus* new genus, *Fish. Bull.*, 75(2):261-346, 1977.

Sicyoniidae. This monogeneric (*Sicyonia*) family was previously considered to be a subfamily of the Penaeidae. The total length is about 18 to 175 mm. The carapace is strong, and the abdomen is sculptured. There is no postorbital spine. There is no tuft of setae on the proximal margin of the propodus of the first peraeopods. Pleurobranchs are absent behind the ninth somite. Exopodites are absent from the maxillipeds and pereopods. [See illustration page 299.]

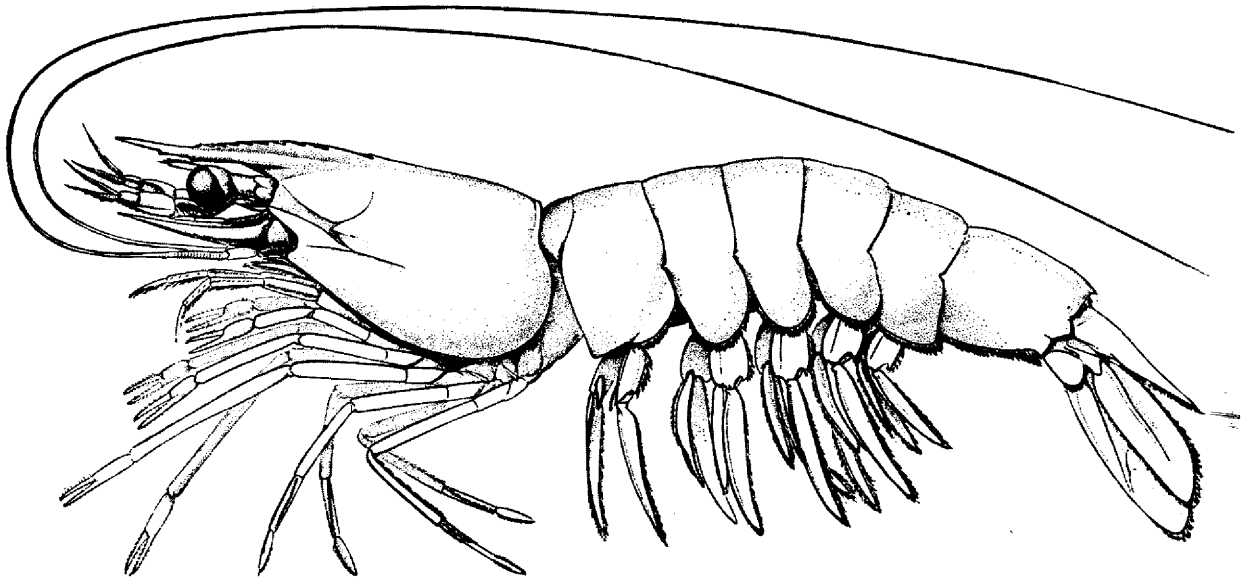
There are approximately 30 Recent species of *Sicyonia*. Sicyoniid shrimps are sufficiently abundant to be exploited commercially in some areas. Most species occur in shallow water on sand or mud-shell bottoms.

References. M. D. Burkenroad, Littoral Penaeidea chiefly from the Bingham Oceanographic Collection, *Bull. Bingham Oceanogr. Coll.*, 4(7):1-109, 1934.

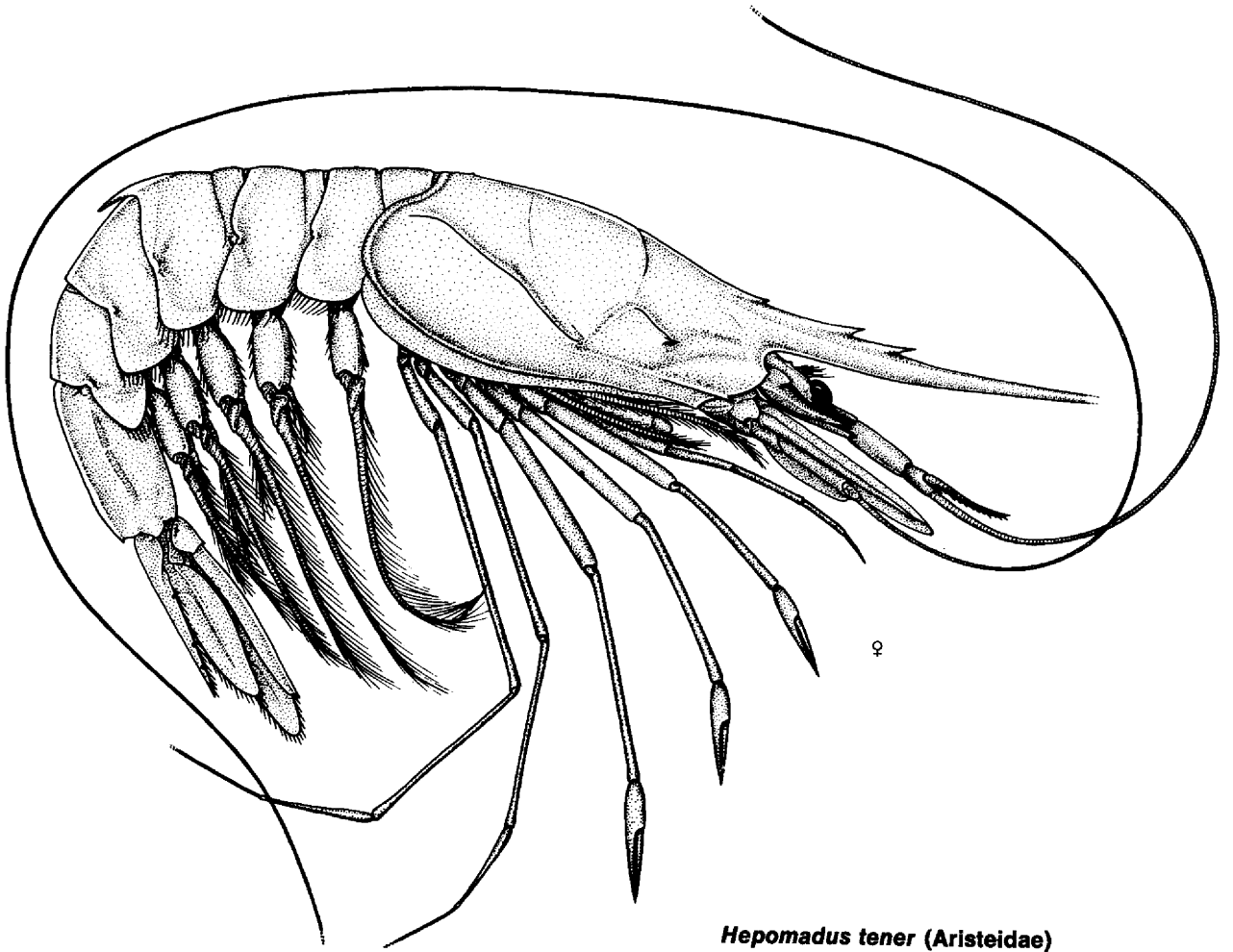
Sergestidae. The carapace is compressed, with the rostrum shorter than the eyestalks. The first three peraeopods are chelate, with the fourth and fifth peraeopods reduced or vestigial. Fertilization is external by a spermatophore; eggs are released, except in *Lucifer*, where the eggs are carried, and hatch as a nauplius.



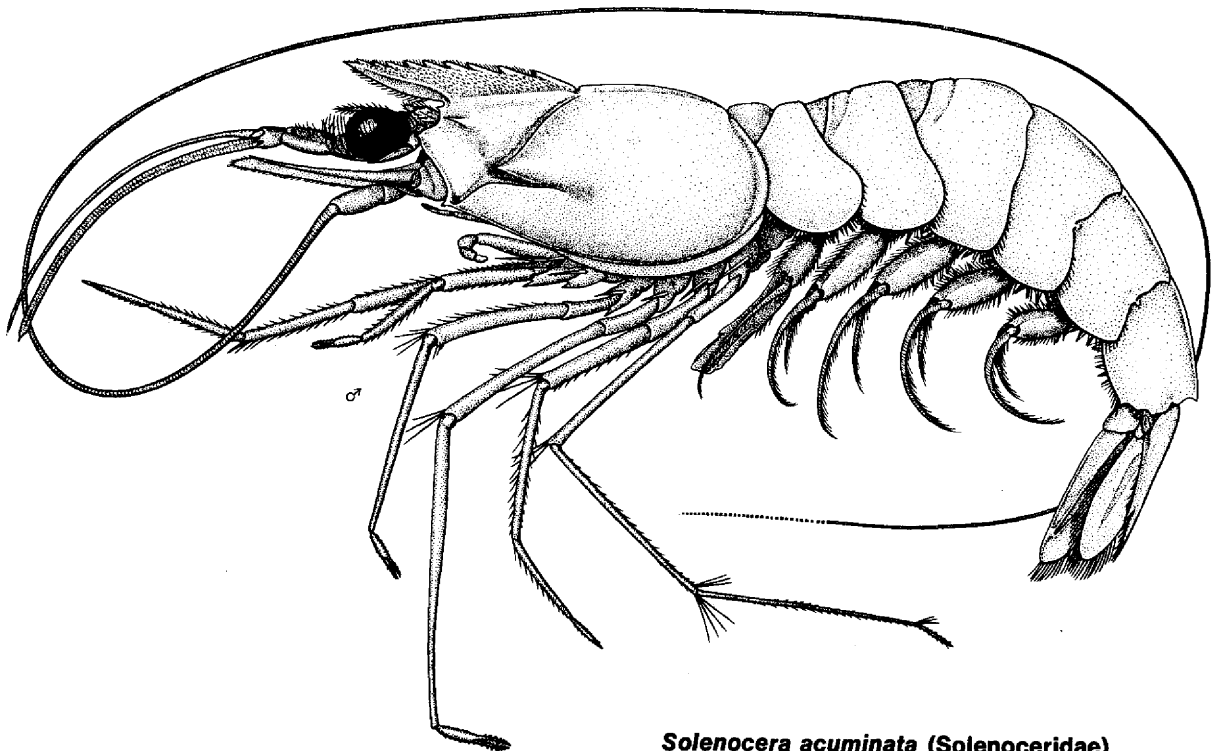
Amphionides reynaudii (Amphionididae)



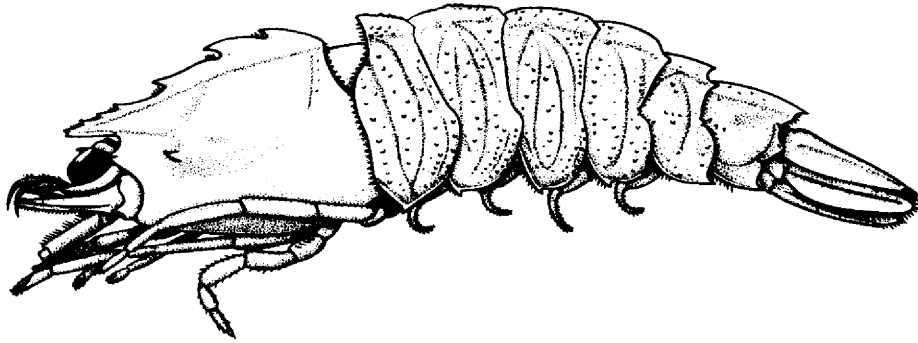
Penaeus setiferus (Penaeidae)



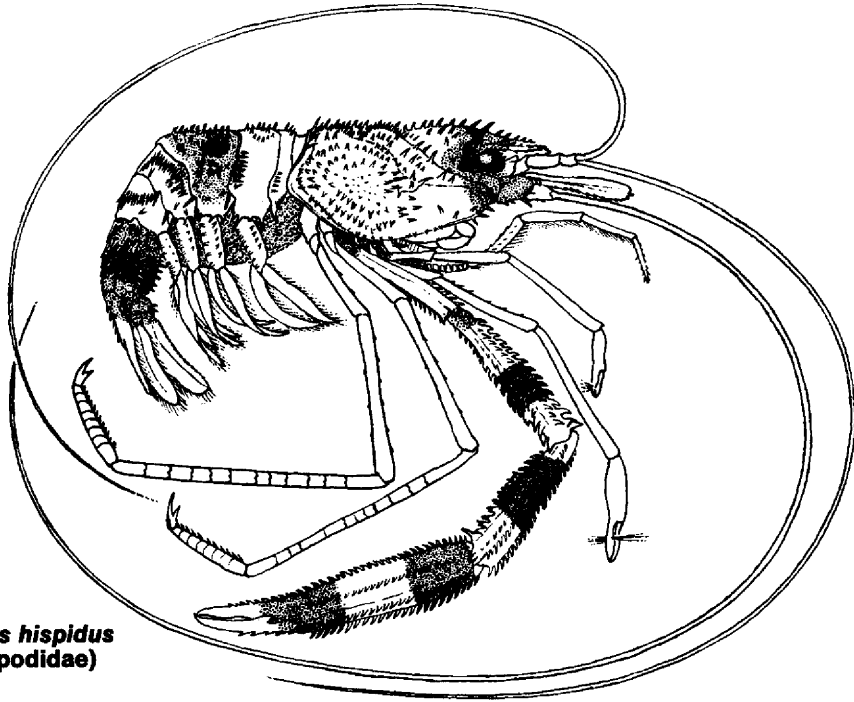
Hepomadus tener (Aristeidae)



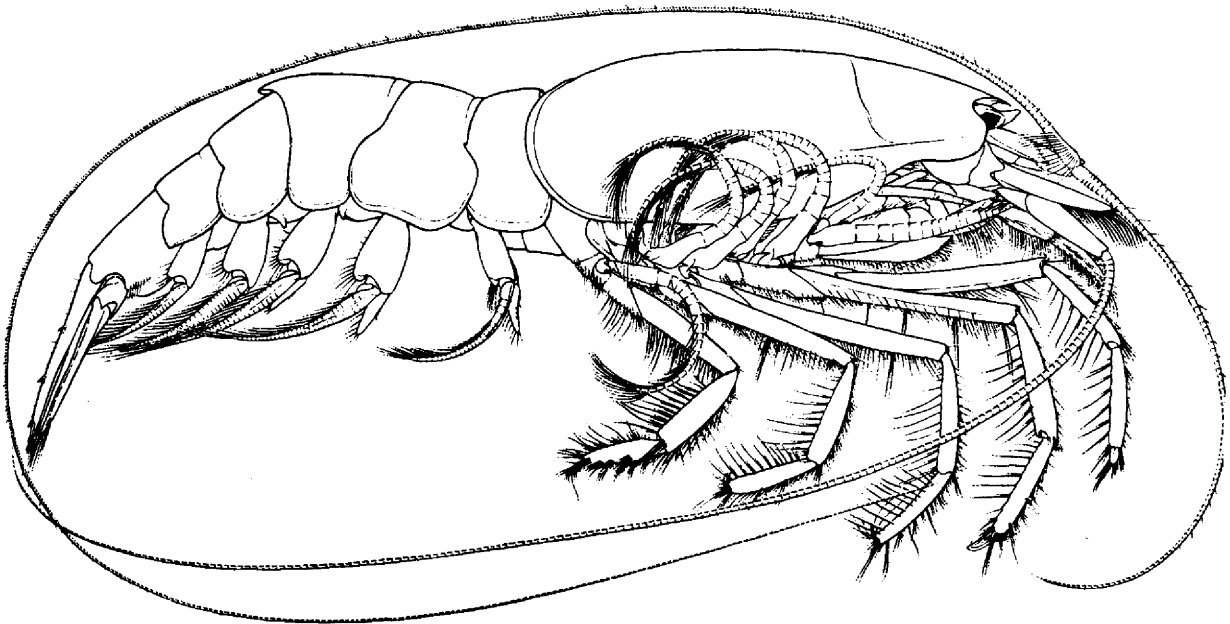
Solenocera acuminata (Solenoceridae)



Sicyonia brevirostris
(Sicyoniidae)

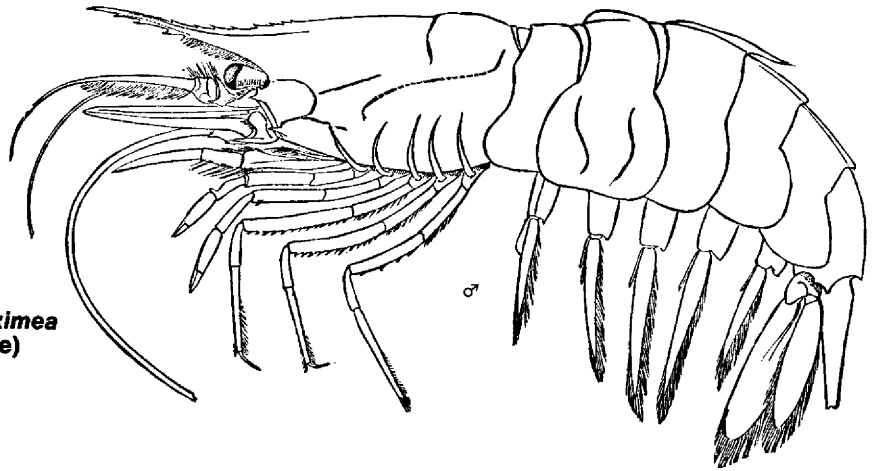


Stenopus hispidus
(Stenopodidae)

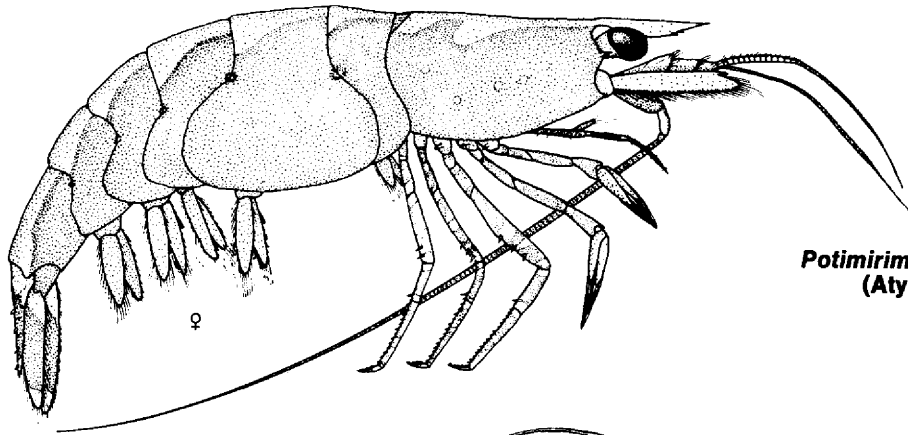


Procaris ascensionis (Procarididae)

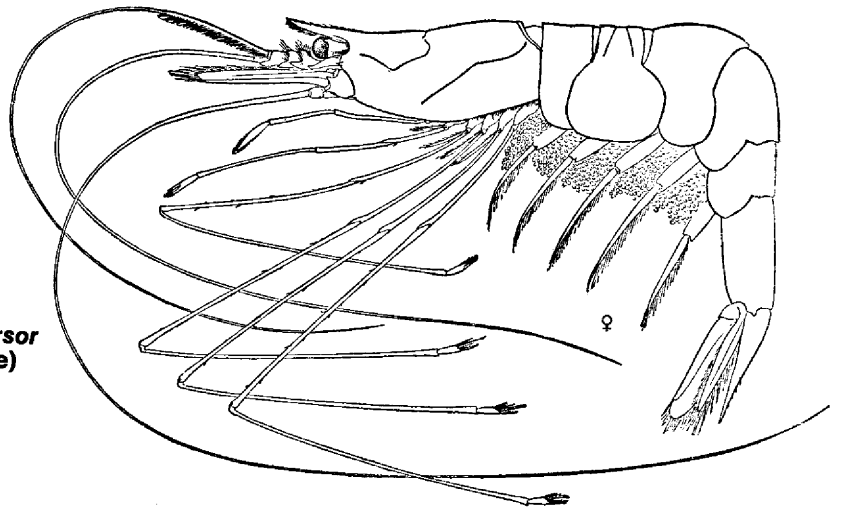
Acanthephyra eximea
(Oplophoridae)



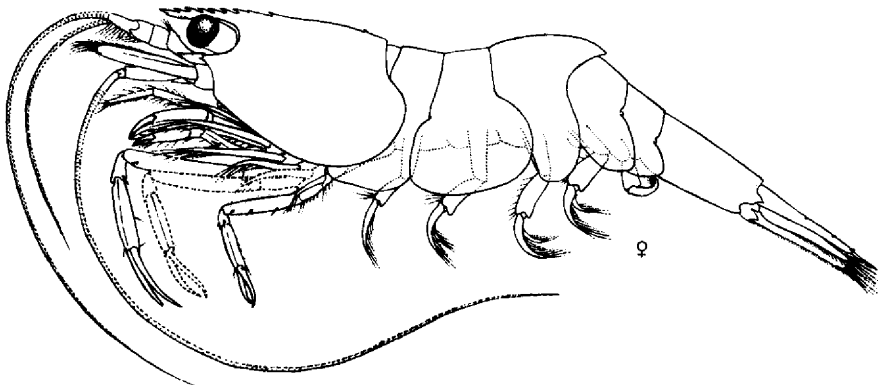
Potimirim potimirim
(Atyidae)



Nematocarcinus cursor
(Nematocarcinidae)



Pseudocheles enigma
(Bresiliidae)



Many species are tropical and pelagic or bathypelagic in distribution, with some members occasionally inhabiting brackish water. The species are about 1 to 12 cm in total length. The genus *Lucifer* includes shrimp which lack gills and are extremely elongate, with the head being one-quarter of the total length. *Acetes* is exploited commercially in India and Southeast Asia.

This well-defined family is currently divided into 2 distinct subfamilies, the Sergestinae and Luciferinae, containing 8 genera and approximately 90 species.

References. H. J. Hansen, The Sergestidae of the Siboga Expedition. *Siboga Exped. Monogr.*, 38:1-65, 1919.

PLEOCYEMATA

All of the remaining decapods are placed in this suborder. The gills lack secondary branches, and the eggs are carried on the female pleopods. The zoea is usually the first larval stage. There are 6 infraorders: the Stenopodidea, Caridea, Astacidea, Palinura, Anomura, and Brachyura.

Stenopodidea

Infraorder containing the single family Stenopodidae. The carapace is cylindrical and usually densely covered with curved spinules, with distinct cervical and branchiocardiac grooves. The rostrum is well developed and provided with spines. The antennular peduncle is armed with numerous spinules; the first segment has a small stylocerite at the base of the outer margin. The antennae have two long flagella of equal length. The third maxilliped is composed of seven segments. The first to third pereopods are chelate, with those of the third much longer than the others. The first pleopod is reduced and uniramous; the remaining pleopods are biramous and carry eggs in the females. The eggs are small and numerous. The abdomen is compressed, with a distinct bend between the third and fourth segments. The dorsal surface of the first segment has a medial transverse carina. The gills are of the trichobranchiate type. [See illustration page 299.]

This family includes 7 genera and approximately 22 species. Members are often brightly marked, and some have been reported to clean fishes. *Spongicola venusta* lives in pairs within glass sponges. Species are known throughout the entire Indo-Pacific, the Mediterranean, and the western Atlantic.

References. L. B. Holthuis, *The Decapod Macrura of the Snellius Expedition*, vol. 1, pp. 1-178, E. J. Brill, Leiden, 1946.

Caridea

The expanded pleura of the second abdominal somite always overlap those of the first and third somites. In most of the families there are no chelae on the third pereopods, but *Procaris* lacks chelae and *Pseudosquilla* has chelae on all five pairs of pereopods. The gills are phyllobranchiate. The eggs, carried by the female on the pleopods, usually hatch as zoea, although a diversity of larval forms are present. The smallest shrimps are approximately 1 mm in length, while some species of *Macrobrachium* from fresh and brackish water may reach 0.5 m when the chelipeds are extended.

This infraorder includes 22 families of shrimps in 11 superfamilies, with approximately 200 genera and 1800 Recent species. Caridean shrimps occur in both freshwater and marine habitats, and one species, *Merguia rhizophorae*, is semiterrestrial. Free-living, symbiotic, and parasitic species are known.

References. L. B. Holthuis, The Recent genera of the

caridean and stenopodidean shrimps (Class Crustacea, Order Decapoda, Supersection Natantia) with keys for their determination, *Zool. Verhandl. Rijksmuseum Nat. Hist. Leiden*, 26:1-157, 1955.

Procarididae. An unusual family of caridean shrimps discovered in 1972 and placed in its own superfamily (Procaridoidea). There is a single genus, *Procaris*, with 2 species of about 10 to 30 mm total length. The third maxillipeds are composed of seven segments. None of the pereopods is chelate or subchelate. Large epipods are present on the four anterior pereopods extending into the branchial chambers. Secondary sexual characteristics appear to be absent. [See illustration page 299.]

Both species, *P. ascensionis* from Ascension Island and *P. hawaiiensis* from Hawaii, occur in land-locked saltwater pools. The feeding behavior of the species appears to be unique among the Decapoda in that a feeding basket is formed by the pereopods, and large food particles (small crustaceans) are trapped and transferred to the mouth area.

References. F. A. Chace, Jr., and R. B. Manning, Two new caridean shrimps, one representing a new family, from marine pools on Ascension Island (Crustacea: Decapoda: Natantia), *Smithson. Contrib. Zool.*, 131, 1972.

Oplophoridae. Most species are of medium size, around 60 mm in total length. A rostrum is always present, but variable in form. The first two pairs of pereopods are chelate, and the carpus of the second is entire. The last three pereopods are slender but not greatly elongated. [See illustration page 300.]

This family consists of approximately 6 genera and 51 species. Species are primarily bathypelagic, occurring from 1000 to 3000 m depth. Some of the species, such as *Acanthephyra purpurea* and *Systellapsis debilis*, seem to be quite abundant. Many oplophorid shrimp tend to be widely distributed, and almost all are some shade of red in life. At least 2 genera possess photophores.

References. F. A. Chace, Jr., Plankton of the Bermuda Oceanographic Expedition, IX: The bathypelagic caridean Crustacea, *Zoologica*, 25:117-209, 1940.

Atyidae. The Atyidae vary greatly in size, ranging from 4 to 124 mm in total length. The rostrum and eyes are small and reduced in most species. The first two pereopods are chelate and are characterized by well-developed tufts of setae for the collection of food. The mandible is not armed with a palp. Epipodites are typically present on the basal segment of the chelipeds and walking legs. [See illustration page 300.]

This primitive family is represented by 21 genera and approximately 138 species. Members occur predominantly in freshwater, with 2 genera inhabiting brackish water. The family has a worldwide, circumtropical distribution. The larvae of most species hatch as free-swimming zoea requiring considerable salinities for development.

References. E. L. Bouvier, Recherches sur la morphologie, les variations, et la distribution géographique des crevettes d'eau douce de la famille des atyides, *Encycl. Entomol.*, 4:1-370, 1925.

Nematocarcinidae. Family which consists of a single genus *Nematocarcinus* with approximately 20 species. The shrimps range in size from about 9 to 30 mm in carapace length. A well-developed rostrum is present. The mandible has a molar and incisor process and a palp. A distinct flagellum is present on the exopod of the first maxilliped. The first pereopods are chelate and usually shorter than the sec-

ond. The second peraeopods are chelate, with the carpus entire. The last three pairs of peraeopods are extremely elongate, with the carpus several times longer than the propodus. [See illustration page 300.]

The nematocarinid shrimps are benthic, occurring in deep water usually from about 500 to more than 3000 m. The eggs of the known species are small (about 0.55 by 0.80 mm), and a large female may carry more than 20,000.

References. J. G. De Man, The Decapoda of the Siboga Expedition. Part IV: Families Pasiphaeidae, Styrodactylidae, Ophlophoridae, Nematocarinidae, Thalassocarinidae, Pandalidae, Psalidopodidae, Gnathophyllidae, Processidae, Glyphocrangonidae and Crangonidae, *Siboga Exped.*, 39a³: 1-318, 1920.

Styrodactylidae. Species are about 50-80 mm in total length. An elongate rostrum is present. The molar and incisor process of the mandible are not clearly separated. In *Styrodactylus* a palp is present, while *Neostyrodactylus* and *Parastyrodactylus* lack a mandibular palp. The second maxilliped is unique, with the last two articles placed side by side. The first two peraeopods are chelate, with extremely long and slender fingers.

This family is represented by 3 genera and approximately 11 species. The species are benthic in habit and usually occur in deeper water from about 200 to 400 m.

References. A. J. G. Figueira, Materials for a revision of the family Styrodactylidae (Crustacea: Decapoda: Caridea) I: Description of a new genus and a new species, *Arg. Mus. Bocage*, ser. 2, 1:1-8, 1971.

Pasiphaeidae. The size of species ranges from 2 to approximately 40 mm in carapace length. A short rostrum, represented in 1 genus by an erect postfrontal spine, is present. The mandibles lack a molar process; a palp may be present or absent. Exopods are present on all of the peraeopods. The first two pairs of peraeopods are chelate; the fingers are slender, with pectinate cutting edges. The carpus of the second peraeopod is entire. The last three pairs of peraeopods are shorter and more slender than the first two pairs.

This family consists of 7 genera and approximately 75 species. Species occur in shallow benthic habitats and in deep water, and some are pelagic in oceanic regions. *Leptochela bermudensis* has been taken in 5.5 m depth, although pelagic specimens were also taken from open water between the surface and 1200 m.

References. F. A. Chace, Jr., Plankton of the Bermuda Oceanographic Expeditions IX: The bathypelagic caridean Crustacea, *Zoologica*, 25(2):117-209, 1940.

Bresiliidae. The species range from about 10 to 20 mm in total length. A rostrum is present, and the eyes are well developed. The first peraeopods are always chelate and larger than the second. The carpus of the second pair is not subdivided. The mandible has a palp, and the second and third maxillipeds and at least the first and second peraeopods have well-developed exopods. The gills on the peraeopodal somites consist of pleurobranchs only. [See illustration page 300.]

This family was recently expanded to include the family Disciidae. There are 4 genera (*Bresilia*, *Pseudocheles*, *Discias*, and *Lucaya*) and 9 species, which occur in a variety of habitats. Species of *Discias*, previously in the family Disciidae, are associated with sponges, while *Lucaya bigelowi* is pelagic in the North Atlantic to a depth of 4773 m. Other bresiliid shrimps are benthic and occur in shallow water from 15 to 1400 m.

References. F. A. Chace, Jr., and D. E. Brown, A new polychelate shrimp from the Great Barrier Reef of Australia and its bearing on the family Bresiliidae (Crustacea: Decapoda: Caridea), *Proc. Biol. Soc. Wash.*, 91(3):756-766, 1978.

Eugonatonotidae. Family represented by a single Recent genus and species, *Eugonatonotus crassus*. The total length is about 85 mm. A well-developed toothed rostrum is present. The first two pairs of peraeopods are chelate, with dark fingertips; the first chela is more robust than the second. The carpus of the second chela is entire. The last joint of the second maxilliped is applied as a strip along the side of the penultimate joint. The exopod of the first maxilliped has a distinct flagellum. Exopods are present on the peraeopods.

The species is benthic in habit and is known from the western Atlantic off the east coast of the United States from Georgia to the Caribbean and Gulf of Mexico. In the Pacific it occurs from Borneo through the Philippines to Japan. Its depth range is from about 180 to 900 m.

References. F. A. Chace, Jr., Revision of the bathypelagic prawns of the family Acanthephyridae, with notes on a new family Gomphonotidae, *J. Wash. Acad. Sci.*, 26(1):24-31, 1936.

Rhynchocinetidae. Family represented by 1 Recent genus (*Rhynchocinetes*) and 7 species. Most species are approximately 3 to 17 mm in carapace length. A movable rostrum is present, but the articulation at the rostral base is difficult to see in small specimens. An incisor process and palp are present on the mandible. The ultimate article of the second maxilliped is attached laterally to the penultimate joint. Exopods are absent from the peraeopods. The first two pairs of peraeopods are chelate, and the carpus of the second is entire. There are corneous spines on the fingers of the chelae, giving the tips a dark color.

Rhynchocinetid shrimps are brightly colored animals often found on coral reefs. Most data suggest that the species are nocturnal, and 5 of the 7 species occur in the Indo-West Pacific.

References. I. Gordon, On the macruran genus *Rhynchocinetes*, with description of a new species, *Proc. Zool. Soc. London*, 1936:75-88, 1936.

Campylonotidae. The carapace lengths range from about 5 to 1.5 mm. A distinct, long rostrum, toothed dorsally and ventrally, is present. The upper antennular flagellum is simple. The first two pairs of peraeopods are chelate, and the second is considerably longer and stronger than the first, with an undivided carpus. Arthrobranchs are present on the first four pairs of peraeopods.

The family consists of 2 genera and about 8 species. *Bathypalemonella* consists of 5 species, 2 in the Gulf of Mexico, 1 in the Indian Ocean, 1 from Hawaii, and 1 from the South China Sea. The species occur from about 900 to 1500 m. One of the species, *B. serratipalma*, carries only 11-16 eggs. *Campylonotus* is represented by 3 species.

References. L. H. Pequegnat, Deep sea caridean shrimps with descriptions of six new species, in W. E. Pequegnat and F. A. Chace, Jr., *Texas A&M Univ. Oceanogr. Stud. Contrib. Biol. Gulf Mexico*, 1:59-123, 1970.

Palaemonidae. The size range of the total length is quite large, from about 1 mm in some pontoniid genera to more than 200 mm, excluding the long chelipeds, in some species of *Macrobrachium*. A rostrum is present. The mandibles

usually have both an incisor and molar process, although a palp may be present or absent. The third maxillipeds are not greatly expanded. The upper antennular flagellum is bifid. The first peraeopods are chelate and usually more slender than the second. The second peraeopods are chelate, and the carpus is entire. The peraeopods lack exopods. [See illustration page 307.]

This very large and diverse family consists of at least 50 genera and 450 species in 4 rather distinct subfamilies. Species occur in freshwater, brackish, and fully marine habitats. Many species in the subfamily Pontoniinae are associated with marine invertebrates, including sponges, cnidarians, gastropods, bivalves, echinoderms, and tunicates. Species in the subfamily Euryrhynchinae occur in freshwater in South America and Africa, while the 3 species in the Typhlocaridinae occur in subterranean freshwater of Israel, Libya, and southern Italy. The subfamily Palaemoninae occurs worldwide and includes species which occur in a diversity of habitats from freshwater to marine environments.

References. L. B. Holthuis, The Decapoda of the Siboga Expedition, Part X, XI: The Palaemonidae collected by the Siboga and Snellius Expeditions with remarks on other species, I: Subfamily Palaemoninae, II: Subfamily Pontoniinae, *Siboga Exped.*, 39:1-268, 1952.

Gnathophyllidae. Most species are small, being around 20 mm in total length. Gnathophyllid shrimps are small and robust and have a compressed, serrate rostrum. The mandible is simple, without an incisor process or a palp. The maxillipeds are unusual; in *Levicaris* the second pair is extremely well developed and larger than the third. In all species the third maxillipeds have some or all of the joints expanded; exopods and epipods are present. The first two peraeopods are chelate, and the second pair are larger, with an undivided carpus. [See illustration page 307.]

The family consists of 6 genera and about 16 species, and it may be divided into two groups. The first consists of *Hymenocera* and *Phyllognathia*, which are probably free-living predators. The former genus is known to feed on asteroids. A second group consists of *Gnathophylloides*, *Levicaris*, *Pycnocaris*, and *Gnathophyllum*. The first two, and probably the third, are "commensals" with echinoids, while the last occurs free-living and with echinoids.

References. A. J. Bruce, *Gnathophylloides robustus* sp. nov., a new commensal gnathophyllid shrimp from western Australia with the designation of a new genus *Levicaris* (Decapoda: Caridea), *Crustaceana*, 24(1):17-32, 1973.

Psalidopodidae. Family represented by a single Recent genus, *Psalidopus*, with 2 species. The carapace lengths range from about 9 to 32 mm. A distinct, armed rostrum, longer than the carapace, is present. The first abdominal somite has a shallow lateral lobe which forms a secure, sliding junction with the submarginal ridge of the carapace. The mandible has a molar and incisor processes and a large two-segmented palp. The first peraeopod is more robust than the second, and has a chela of two movable, scissorlike fingers; the ischium and merus are practically fused. The second peraeopod terminates in a tuft of setae arising from the distal surface of an imperfect chela; the carpus is undivided. [See illustration page 307.]

Psalidopus barboursi occurs on continental and insular slopes, from 412 to more than 750 m, in the Gulf of Mexico and western Atlantic, while the second species, *P. huxleyi*, occurs widely in the Indo-West Pacific, from about 530 to 929 m. The females of both species, in addition to differing

from the males, apparently vary morphologically depending on their breeding condition. The eggs apparently hatch at a relatively advanced stage.

References. F. A. Chace, Jr., and L. B. Holthuis, *Psalidopus*, the scissor-foot shrimps (Crustacea: Decapoda: Caridea), *Smithson. Contrib. Zool.*, 277, 1978.

Alpheidae. Snapping shrimp. The carapace is smooth, and the rostrum is reduced. The eyes are usually partly or entirely covered by the carapace. The first peraeopods are strong, chelate, and often asymmetrical; the propodus and dactylus are usually modified into a hammer-and-socket arrangement of varying size and complexity. The carpus is short. The second peraeopods are slender, and the carpus is subdivided. The sixth abdominal segment is short, broad, and sexually dimorphic. [See illustration page 308.]

This diverse family is one of the largest in the infraorder, with 23 genera and 425 Recent species. It includes *Alpheus*, with approximately 140 species, and *Synalpheus*, with about 90 species. Alpheid shrimp are found in four major habitats: (1) on coral reefs associated with living and dead coral, where most of the species are found; (2) in tide pools and in small pockets of water in the sand or sand-mud intertidal, especially *Athanas*; (3) in burrows in the substrate, especially 2 large species groups of *Alpheus*; and (4) as symbionts with sponges, crinoids, corals, anenomes, echinoids, fish, and polychaetes. A few species have been reported from freshwater, but these species also occur in brackish environments.

References. A. H. Banner and D. M. Banner, The alpheid shrimp of Thailand, *Siam Soc. Monogr.*, ser. no. 3, pp. 1-168, 1966.

Ogyrididae. Family consisting of 1 Recent genus, *Ogyrides*, and 10 species. The total length varies from about 10 to 30 mm. The rostrum is reduced or absent. The eyestalks are extremely long, extending beyond the antennular peduncle. The first two peraeopods are chelate, nearly equal in size, and not much larger than the remaining peraeopods. The carpus of the second peraeopods is subdivided.

The ogyridid shrimps occur in and on sandy and sand-mud bottoms, from about 1 to 25 m. At least one species, *O. limicola*, occurs from 9 to 31‰ salinity and has been taken in the plankton. Other species burrow into sand and sand-mud bottoms.

References. A. B. Williams, Marine decapod crustaceans of the Carolinas, *Fish. Bull.*, 65(1):1-298, 1965.

Hippolytidae. Most species are about 5 to 25 mm in total length. A rostrum is present. The first pair of peraeopods is chelate, usually short, and heavy, with dark-colored finger tips. The second peraeopods have the carpus subdivided into two or more articles.

This large and diverse family is composed of approximately 30 genera and 225 Recent species. Most species inhabit shallow tropical seas, but the family is extremely diverse ecologically. *Merguia* occurs semiterrestrially in mangroves, *Callinasmata* and *Ligur* occur in land-locked saltwater pools, some species of *Lyasmata* appear to be cleaners of fish, and some species of *Bythocaris* occur in deep waters of the Arctic. Protandric hermaphrodites have been described among species of this family.

References. L. B. Holthuis, The Hippolytidae and Rhynchocinetidae collected by the Siboga and Snellius expeditions with remarks on other species, *Siboga Exped.*, 39a⁸: 1-100, 1947.

Processidae. The carapace is smooth, and the rostrum is short, with an unarmed ventral surface. The carapace is armed with at most antennal spines. The eyes are large and well developed. The mandible lacks an incisor process and a palp. Both first peraeopods are chelate in *Ambidexter*, but only one is chelate in *Processa* and *Nikoides*. The second peraeopods are chelate and slender, have a subdivided carpus, and are often asymmetrical in length. The remaining peraeopods are slender, terminating in a simple dactylus. [See illustration page 308.]

This family consists of 3 genera and approximately 26 species. Processid shrimps are small, primarily nocturnal animals which are common in shallow-water habitats, particularly on grass flats. Several species have been taken in plankton at night, and one species has been collected from a polychaete burrow.

References. R. B. Manning and F. A. Chace, Jr., Shrimps of the family Processidae from the northwestern Atlantic Ocean (Crustacea: Decapoda: Caridea). *Smithson. Contrib. Zool.*, 89, 1971.

Pandalidae. Pandalid shrimps vary from about 5 mm in carapace length to more than 40 mm. A rostrum, which is usually long, compressed, and dentate, is present. The mandible is bifid, with a palp. The chela of the first peraeopod is microscopically small or absent. The second peraeopod has a small chela present, and a carpus subdivided into at least two articles.

The family is represented by 14 genera and approximately 115 species. It includes several commercially valuable species which have been well studied. There are a number of protandric hermaphrodites among species in *Pandalus*; a portion of the males become females when about 2 years old. Most species have numerous small eggs.

References. J. G. De Man, The Decapoda of the Siboga Expedition, Part IV: Families Pasiphaeidae, Stylodactylidae, Oplophoridae, Nematocarcinidae, Thalassocaridae, Pandalidae, Psalidopodidae, Gnathophyllidae, Processidae, Glyphocrangonidae and Crangonidae, *Siboga Exped.*, 39a³: 1-318, 1920.

Thalassocarididae. Family with 1 Recent genus, *Thalassocaris*, and 2 species. The species are small, about 9 to 10 mm in total length. The rostrum is well developed and toothed. Supraorbital spines are present. The pleuron of the third somite has a middorsal spine extended posteriorly. The first peraeopods are slender and achelate, and the second are chelate and robust, with an undivided carpus. The third through the fifth are long and slender.

The species *T. crinita* occurs in the Sulu Sea, while *T. lucida* occurs off Assumption Island in the Ladrones.

References. J. G. De Man, The Decapoda of the Siboga Expedition, Part IV: Families Pasiphaeidae, Stylodactylidae, Oplophoridae, Nematocarcinidae, Thalassocaridae, Pandalidae, Psalidopodidae, Gnathophyllidae, Processidae, Glyphocrangonidae and Crangonidae, *Siboga Exped.*, 39a³: 1-318, 1920.

Physetocarididae. Family represented by a single Recent genus and species, *Physetocaris microphthalmia*. The carapace length is about 9.2 mm, and the total length is about 54 mm. The rostrum is a broad prolongation of the carapace. The first peraeopods are achelate, and the second are chelate with a subdivided carpus. The mandible lacks an incisor process and a palp. The species is bathypelagic in distribution, from about 1000 to 1200 m off Bermuda.

References. F. A. Chace, Jr., Plankton of the Bermuda Oceanographic Expeditions, IX: The bathypelagic caridean Crustacea, *Zoologica*, 25:117-209, 1940.

Crangonidae. Most species are about 4 to 10 cm in total length. A small rostrum is present, and the carapace is sculptured to varying degrees. The first peraeopods are strong and subchelate. The second peraeopods are slender and often reduced or, in one genus, absent, but never have the carpus subdivided.

This family is composed of 11 genera and about 137 species. Studied species are nocturnally active benthic omnivores. They are common in temperate regions and in deeper water of the tropics. *Crangon crangon* is caught commercially in Europe, and the genus *Crangon* has been studied extensively by physiologists.

References. J. G. De Man, The Decapoda of the Siboga Expedition, Part IV: Families Pasiphaeidae, Stylodactylidae, Oplophoridae, Nematocarcinidae, Thalassocaridae, Pandalidae, Psalidopodidae, Gnathophyllidae, Processidae, Glyphocrangonidae and Crangonidae, *Siboga Exped.*, 39a³: 1-318, 1920.

Glyphocrangonidae. Family represented by 1 Recent genus, *Glyphocrangon*, and 2 subgenera, *Glyphocrangon* and *Plastocrangon*, with 37 species. The shrimp are about 70 to 120 mm in total length. The integument of the body is sclerotized. A well-developed rostrum is present, and a complex series of ridges form a locking mechanism between abdominal somites 4 and 5, 5 and 6, and 6 and the telson. The eyes are large (*Glyphocrangon*) or reduced (*Plastocrangon*). The first peraeopods are strong and subchelate. The second peraeopods are subchelate and slender, and have the carpus subdivided into numerous articles. An appendix masculina is present in males. [See illustration page 309.]

The family is benthic and occurs in deep water of the Atlantic, Pacific, and Indian Ocean regions, from about 250 to 6370 m. The eggs are fairly large, with diameters from about 2.0 to 3.4 mm.

References. L. B. Holthuis, The Atlantic shrimps of the deep-sea genus *Glyphocrangon* H. Milne Edwards, 1881, *Bull. Mar. Sci.*, 21(1):267-373, 1971.

Nephropidae. A well-developed rostrum is present, with lateral and sometimes dorsal or ventral teeth. There are a complex series of grooves, carinae, and spines on the carapace described by a detailed system of nomenclature reviewed by L. B. Holthuis. All nephropids have, in the anterolateral margin of the carapace, an incisura clavicularis, an incision whose two lobes partly overlap each other and fit around a tubercle or ridge of the epistome, apparently serving to lock the carapace to the epistome. The abdominal pleura are usually well developed, longer than wide, and pointed. The telson is longer than wide, with a strong spine at each posterolateral angle. Eyes are always present, although they may be reduced and without pigment. The first peraeopods are chelate, very heavy, and equal or unequal. The second and third are shorter, more slender, and chelate; the fourth and fifth are achelate, but have a small padlike process of the dactylus. A distinct thelycum is present between the fourth pair of peraeopods of females. The first male pleopod is a copulatory stylet, and in the female is slender, with two segments. [See illustration page 309.]

This family of lobsters is subdivided into 3 distinct subfamilies, represented by 9 genera (including *Homarus* and *Nephrops*) and 38 species. These commercially important

species are distributed in tropical and temperate marine waters of the world.

References. L. B. Holthuis, The lobsters of the superfamily Nephropoidea of the Atlantic Ocean (Crustacea: Decapoda), *Bull. Mar. Sci.*, 24(4):723–884, 1974.

Thaumastocheilidae. Family represented by a single Recent genus, *Thaumastocheles*, and 2 species. A dorsoventrally flattened rostrum, with small lateral teeth, is present. The carapace has small postorbital and antennal spines only. There are no carinae, but distinct grooves are present. The carapace is immovably fused with the epistome, a character which distinguishes this family from the Nephropidae. The abdominal pleurae are short, wide, and broadly truncate laterally. A thelycum is present between the bases of the fourth peraeopods in females; it consists of three plates, one posterior median triangular and two anterior submedian oval. The telson is broadly quadrangular and without spines. The eyes are absent, the last remnants being fused with the ophthalmic somite. The first peraeopods are unequal and chelate, with extremely long fingers which are armed with two rows of diverging slender teeth. The second and third peraeopods are chelate, the fourth is simple, and the fifth is minutely chelate. The first pleopods consist of two narrow segments, and the remaining have endopods and exopods. [See illustration page 309.]

Thaumastocheles zaleucus is known from four localities in the West Indies: off the Yucatan Peninsula in 1143 m, off the east coast of Nicaragua in 640 m, off Sombrero Island in 824 m, and off Grenada in 1054 m. The species appears to be white. The second species, *T. japonicus*, is known from Japan. Both species seem to be rare.

References. L. B. Holthuis, The lobsters of the superfamily Nephropoidea of the Atlantic Ocean (Crustacea: Decapoda), *Bull. Mar. Sci.*, 24(4):723–884, 1974.

Cambaridae. Males exhibit cyclic dimorphism; either the first pleopod bears a shallow sperm groove mesially or the distal portion is tightly folded, with the distal end of the sperm groove opening onto one central projection of two to four terminal elements. Hooks are present in the male on the ischium of one or more of the second through the fourth peraeopods. Females may or may not have an annulus ventralis or a first pleopod. The articles of the lateral ramus of the antennule may bear one or two clusters of aesthetascs. [See illustration page 309.]

This family consists of 10 genera and approximately 264 species, of which 19 are troglobitic. All are freshwater, inhabiting lakes, ponds, ditches, and caves. Females produce eggs which are held under the abdomen, where they are fertilized. Development is direct.

References. H. Hobbs, Jr., Synopsis of the families and genera of crayfishes (Crustacea, Decapoda), *Smithson. Contrib. Zool.*, 164, 1974.

Astacidae. The males never exhibit cyclic dimorphism; the distal portion of the first pleopod is rolled to form a cylinder, and contracted to form a tube or produced into two simple spoonlike lobes. The ischia of male peraeopods are not armed with hooks. Females lack a spermatheca.

The family contains 3 genera (*Astacus*, *Austropotamobius*, and *Pacifastacus*) and approximately 13 species. All are freshwater species, but some are rarely found in brackish water. Crayfish inhabit lakes, streams, ponds, and ditches, building burrows in soft mud in which they hide by day. The burrows may also be used for overwintering sites. Fe-

males produce eggs which are held under the abdomen by mucus from glands in the abdominal sternites and pleopods, where they are fertilized. Eggs covered by mucus adhere to the plumose setae of the pleopods, which the female aerates by movements of the pleopods. Development in this family is direct.

References. H. Hobbs, Jr., Synopsis of the families and genera of crayfishes (Crustacea, Decapoda), *Smithson. Contrib. Zool.*, 164, 1974.

Parastacidae. The carapace is without a dorsomedial, longitudinal suture or ridge in the cardiac and posterior gastric regions. The sternal plate between the fifth peraeopods is not anteriorly fused with the sternal complex. The telson is not divided by a transverse suture. The podobranchiae on the first three peraeopods are not differentiated into branchial and epipoditic portions. The epipodite of the first maxilliped has branchial filaments attached. The articles of the lateral ramus of the antennule are never found with more than one cluster of aesthetascs. The first pleopod is absent in both males and females. The second pleopod is unmodified in the male, lacking bilobed, plaited laminae on any of the podobranchiae.

This family contains 14 genera and approximately 120 described species. All species are freshwater, and are found only in Madagascar, Australia, Tasmania, New Guinea, New Zealand, and southern South America. *Euastacus serratus*, which may reach 50 cm in total length, is the largest extant freshwater crustacean. The eggs are large and exhibit direct development.

References. H. Hobbs, Jr., Synopsis of the families and genera of crayfishes (Crustacea, Decapoda), *Smithson. Contrib. Zool.*, 164, 1974.

Thalassinidae. Family of astacidean decapods containing a single genus, *Thalassinia*, and 5 described species. The carapace is compressed, and the abdomen is weakly calcified and symmetrical. A moderately developed linea thalassinica is present. The first and second peraeopods are subchelate. The abdominal pleurae are reduced. The uropods are lanceolate and without diarsis. The gills are of the trichobranchiate type.

Members of the family inhabit burrows in sand or mud, or in cavities in rocks, corals, or sponges. *Thalassinia anomala* is found in mangrove swamps at the tidal zone and in mud, and digs burrows up to 1.5 m in depth. They rarely leave their burrows (which are dug with the first peraeopods) to search for food. Species occur primarily in the Indo-South Pacific Region.

References. J. G. De Man, The Decapoda of the Siboga Expedition. Part VII: The Thalassinidae and Callianassidae collected by the Siboga Expedition with some remarks on the Laomediidae, *Siboga Exped.*, 39a⁶:1–187, 1928.

Axiidae. The carapace is flat, without a linea thalassinica. The rostrum is triangular and flattened. The antennular flagellum is well developed, with the scaphocerite spiniform and movable between the second and third segments of the antennular peduncle. An antennal spine is present. The first peraeopods are chelate, large, and unequal; the second peraeopods have small, equal chelae. The subsequent pairs of peraeopods are simple, with the fifth legs subchelate. The abdomen is long and shrimplike. The tail fan is well developed; the exopodite of the uropods is with or without diarsis. The gills are of the trichobranchiate type. [See illustration page 310.]

This marine family of astacidean crabs contains 9 genera and 81 species, which inhabit coral reefs in depths of rarely less than 20 m. Axiids occur in a variety of subtidal marine habits, and most species occur in the tropics.

References. V. V. Markarov, Fauna of the U.S.S.R., Anomura, *Zool. Inst. Acad. Sci. U.S.S.R.*, 10(3):1-283, 1938.

Laomediidae. A carapace, with a well-developed rostrum and linea thalassinica, is present. The abdomen is well developed, and the pleura are not reduced. The antennular flagellum is short. The first pereopods are subequal in size and subchelate or simple; the second pair are simple or subchelate. There is a suture on the distal portion of the uropods. [See illustration page 310.]

This small family of thalassinoid decapods consists of 3 genera and 8 species, divided into 2 subfamilies, the Laomediinae, represented by *Jaxea* and *Laomedia*, and the Naushoniinae, represented by *Naushonia*. Laomediid decapods appear to occur on soft and mud bottoms to about 48 m depth. *Laomedia healyi*, from Australia, is a fairly large species (with a carapace length of 16 mm) which occurs in burrows in the intertidal mud of mangrove swamps.

References. J. W. Goy and A. J. Provenzano, Jr., Juvenile morphology of the rare burrowing mud shrimp *Naushonia crangonoides* Kingsley, with a review of the genus *Naushonia* (Decapoda: Thalassinidea: Laomediidae), *Proc. Biol. Soc. Wash.*, 92(2):339-359, 1979.

Callianassidae. The carapace is weakly calcified, with a linea thalassinica present. The rostrum is large and flat, or may be small and almost lacking. The antennular flagellum is short or moderately long. The scaphocerite is small and scalelike. The third maxillipeds have an exopodite. The first pereopods are simple and chelate or subchelate. The abdominal pleura are reduced or absent. [See illustration page 310.]

This family of marine astacideans contains 6 genera and 169 described species. These decapods are commonly called mud shrimp for their habit of building Y- or U-shaped burrows in mud, usually in shallow water. These shrimp feed on diatoms and other small organisms which inhabit the mud, but may also take large polychaete worms. All members of the family have burrowing habits.

References. V. V. Markarov, Fauna of the U.S.S.R., Anomura, *Zool. Inst. Acad. Sci. U.S.S.R.*, 10(3):1-283, 1938.

Callianideidae. This was previously considered a subfamily of the Callianassidae and was recently raised to a family rank. There are 2 Recent genera, *Callianidea* and *Meticonaxius*, and 4 species. These genera are similar in appearance to *Callianassa*, but they lack a linea thalassinica. Epipodites are present on pereopods 1-4. There is no suture on the exopods of the uropods.

Species of *Callianidea* are found in shallow water, intertidally, and on coral reefs. Representatives are known from throughout the Indo-Pacific (*C. typa*) and the West Indies (*C. laevicauda*). *Meticonaxius* (= *Metaxius*) occurs in deeper water (230-360 m) off Santa Cruz (*M. microps*) and Java (*M. monodon*).

References. J. G. De Man, The Thalassinidae and Callianassidae collected by the Siboga Expedition with some remarks on the Laomediidae, *Siboga Exped. Monogr.*, 39^a: 1-187, 1928.

Upogebiidae. Family of thalassinoid decapods consisting of the single genus *Upogebia*, with approximately 30 known species. A carapace, with a well-developed spinous rostrum,

is present. A linea thalassinica is present. There are no pleurobranchs or epipods on the pereopods. The ocular peduncles are cylindrical, with a terminal cornea. The third maxilliped has an exopod but no cristata dentata. The first pereopods are equal and chelate, subchelate, or simple. Pereopods 2-4 are simple, and 5 is chelate or subchelate. Males lack a first pleopod; pleopods 2-5 lack an appendix interna.

The genus *Upogebia* occurs worldwide in mud burrows in shallow water, although some species are found to 200 m, and others occur in coarse substrates.

References. D. Thistle, A taxonomic comparison of the American *Upogebia* (Decapoda, Thalassinidea) including two new species from the Caribbean, *Breviora*, 408:1-23, 1973.

Axianassidae. Family of thalassinoid decapods consisting of a single genus, *Axianassa*, and 2 species. A rostrum is present. A linea thalassinica is present, as well as a distinct cervical groove. The abdominal pleura are greatly reduced, and the exopods of the uropods lack a suture. A movable antennal scale is present, and an immovable antennal spine is absent. The third maxillipeds lack exopods. The first pereopods are large, unequal, and chelate, the second, third, and fourth are simple, and the fifth are imperfectly subchelate. The pleopods lack an appendix interna. The branchial formula is: the first maxilliped has a tiny epipodite; the second and third maxillipeds and pereopods 1-3 have epipodites, a podobranch, and two arthrobranchs; the fourth pereopod has a small epipodite and two arthrobranchs; the fifth pereopod has no gills.

Axianassa intermedia was collected from a muddy creek at Spanish Fort, Curaçao. The second species is *A. mineri*.

References. W. L. Schmitt, The macruran, anomuran and stomatopod Crustacea, Bijdragen Fauna Curaçao, *Bijdr. Dierk.*, 23:61-81, 1924.

Glypheidae. The carapace is laterally compressed and subcylindrical, with longitudinal ridges anteriorly. The rostrum is small and triangular. The first pereopods are without chelae.

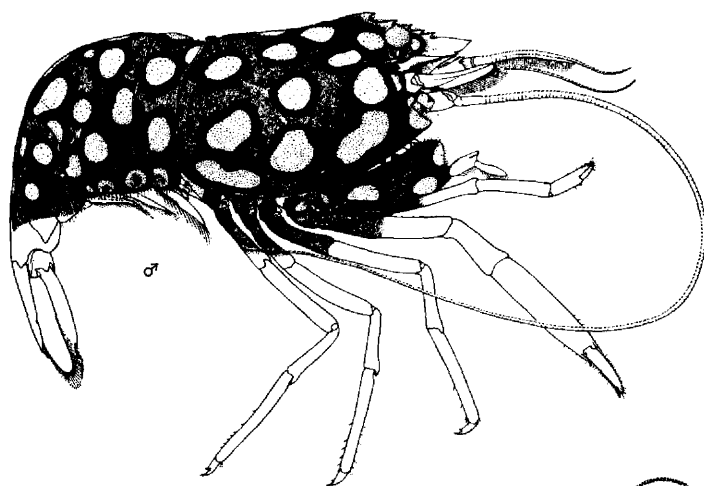
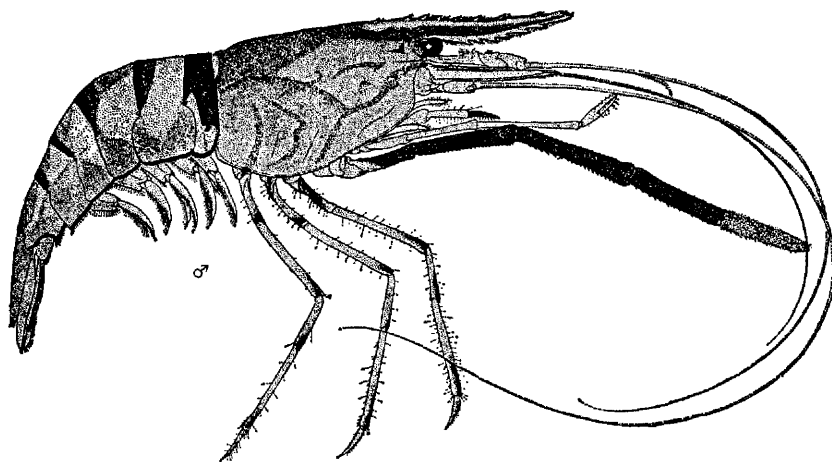
This family of palinuran decapods was believed until recently to have been extinct since the Eocene. A unique specimen was collected by the U.S. Fisheries steamer *Albatross* from 187 m on a mud-shell bottom in the South China Sea on July 17, 1908. In 1976 this specimen was identified as a glypheid and assigned to a new genus and species, *Neoglypheia inopinata*. Glypheids are considered by some carcinologists to represent the ancestral stock from which the majority of the Recent families of decapod crustaceans have evolved.

References. J. Forest, M. de Saint Laurent, and F. A. Chace, Jr., *Neoglypheia inopinata*: A crustacean "living fossil" from the Philippines, *Science*, 192:884, 1976.

Polychelidae. The carapace is dorsoventrally flattened, with sharp lateral margins and a truncate anterior margin. The abdomen is symmetrical, extends posteriorly, and bears well-developed uropods. The telson is triangular. The eyes are reduced. The first segment of the second antenna is not fused to the epistome. The first to fourth pereopods are chelate, the first being longer and stronger than the others. The fifth pereopod is slender. [See illustration page 311.]

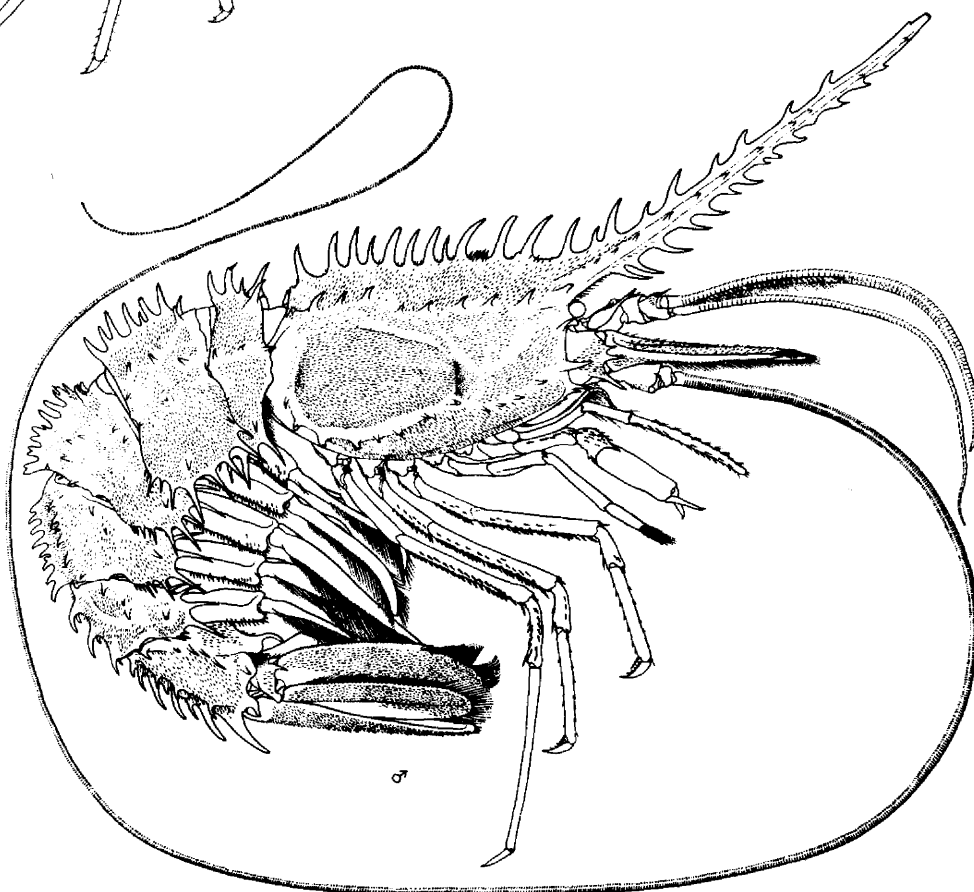
In the past, this family of deep-water lobsters united 2 families, the Eryonidae and Polychelidae. (The Eryonidae are now considered to be exclusively fossil.) There are 3 Recent genera (*Polycheles*, *Willemoesia*, and *Stereomastis*) and

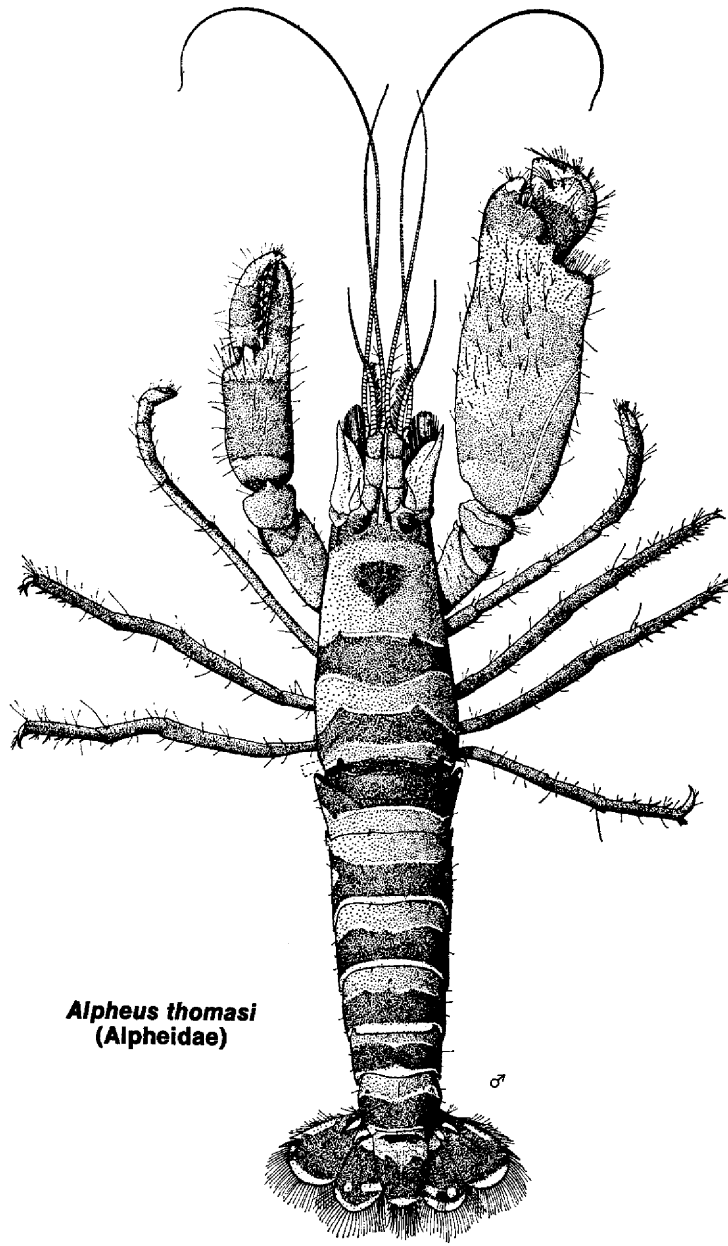
Macrobrachium acanthurus
(Palaemonidae)



Gnathophyllum splendens
(Gnathophyllidae)

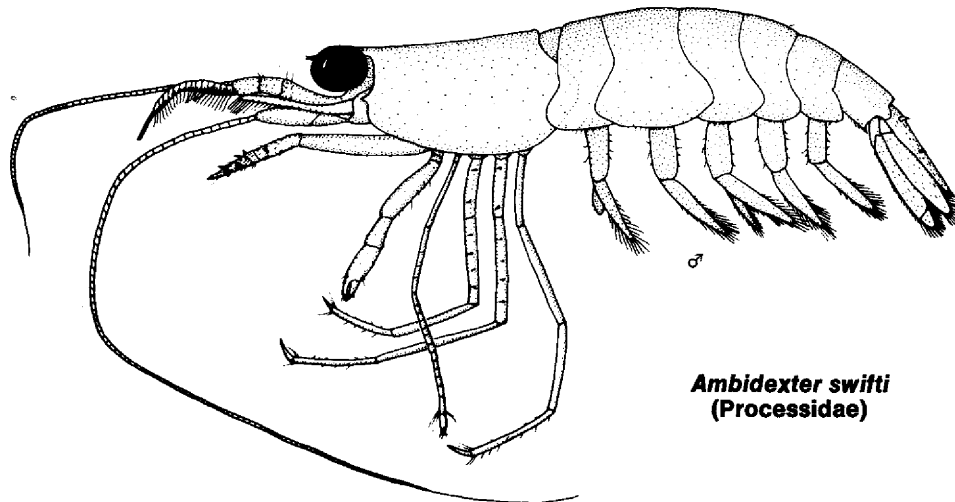
Psalidopus barbouri
(Psalidopodidae)





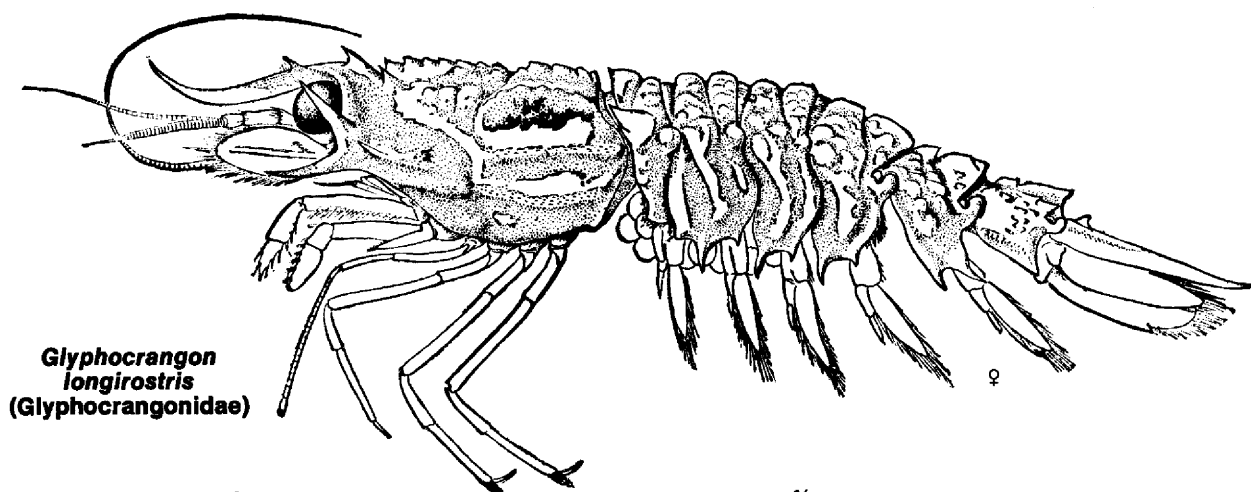
Alpheus thomasi
(Alpheidae)

♂

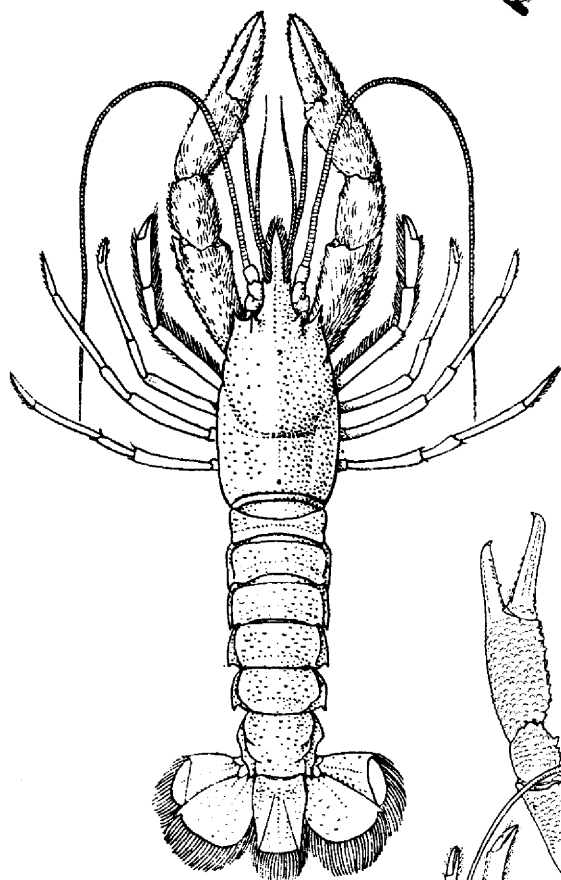


Ambidexter swifti
(Processidae)

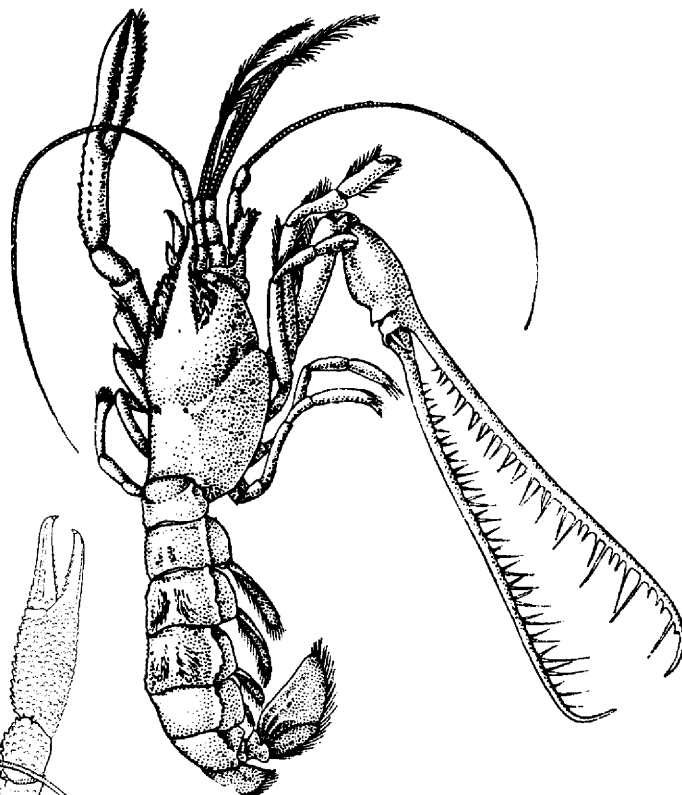
♂



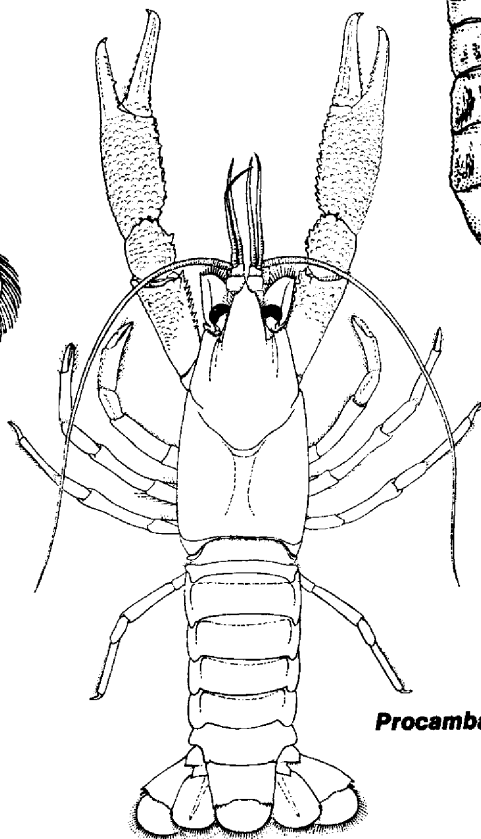
***Glyphocrangon
longirostris***
(Glyphocrangonidae)



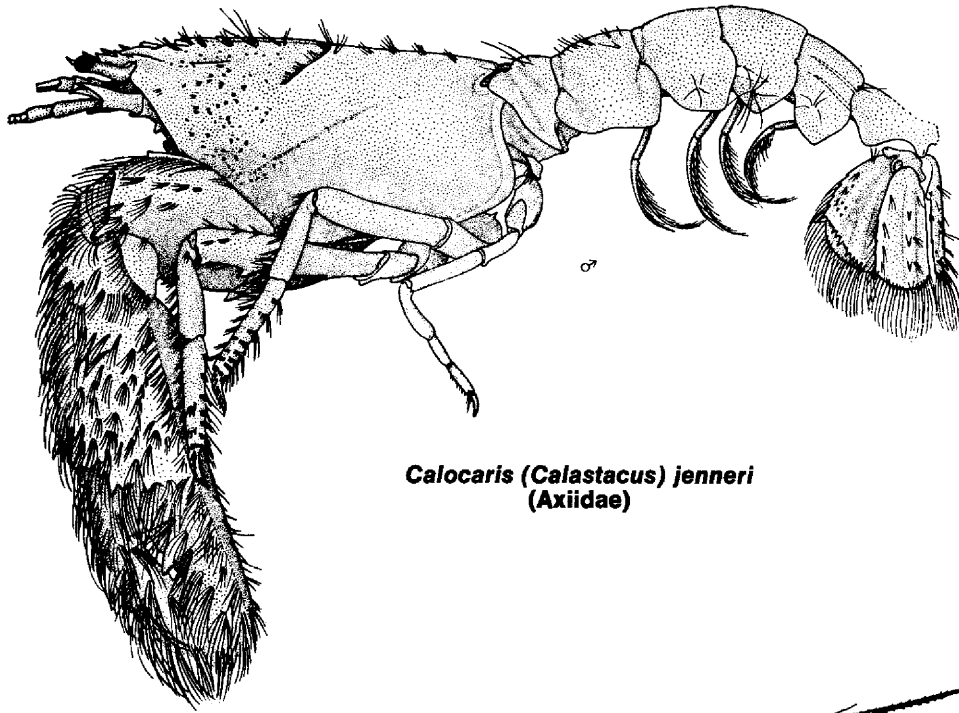
Nephropsis stewartii
(Nephropidae)



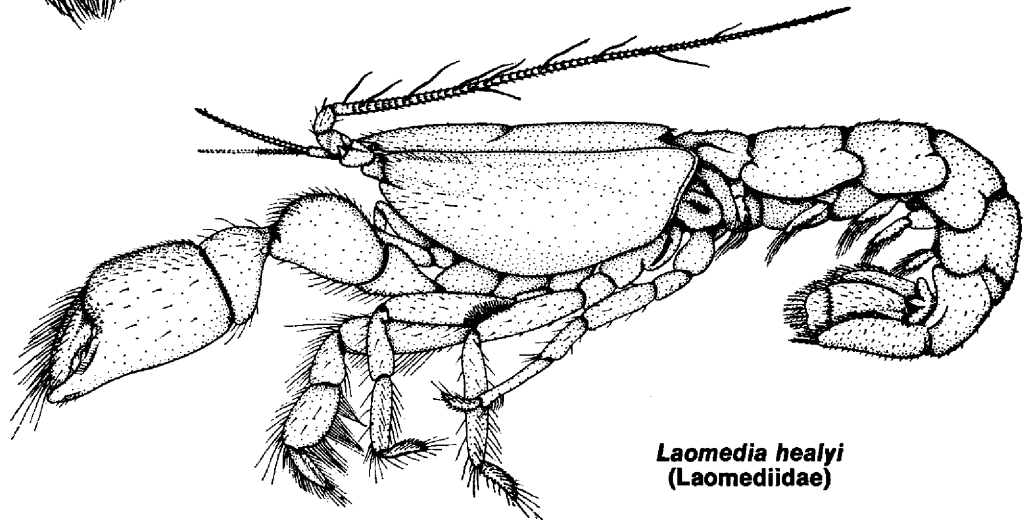
Thaumastocheles zaleucus
(Thaumastocheilidae)



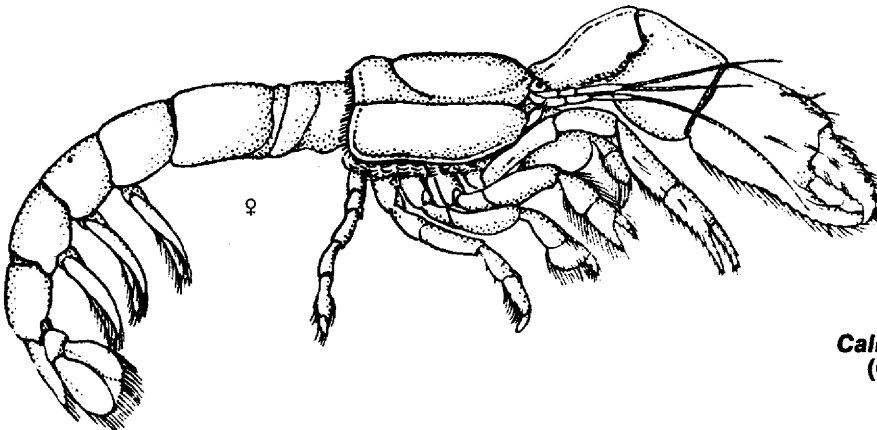
Procambarus cubensis cubensis
(Cambaridae)



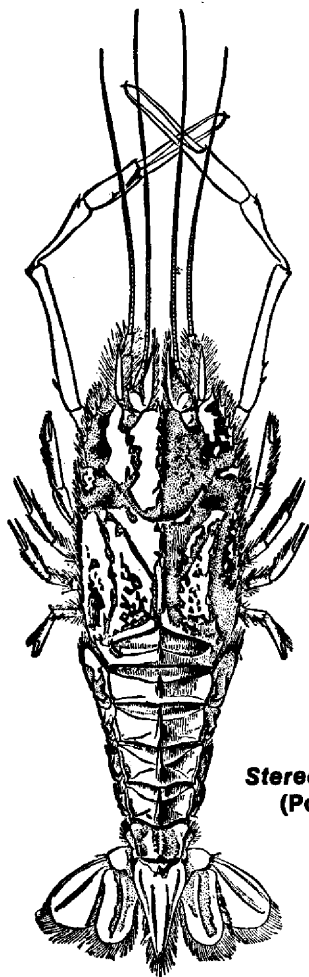
Calocaris (Calastacus) jenneri
(Axiidae)



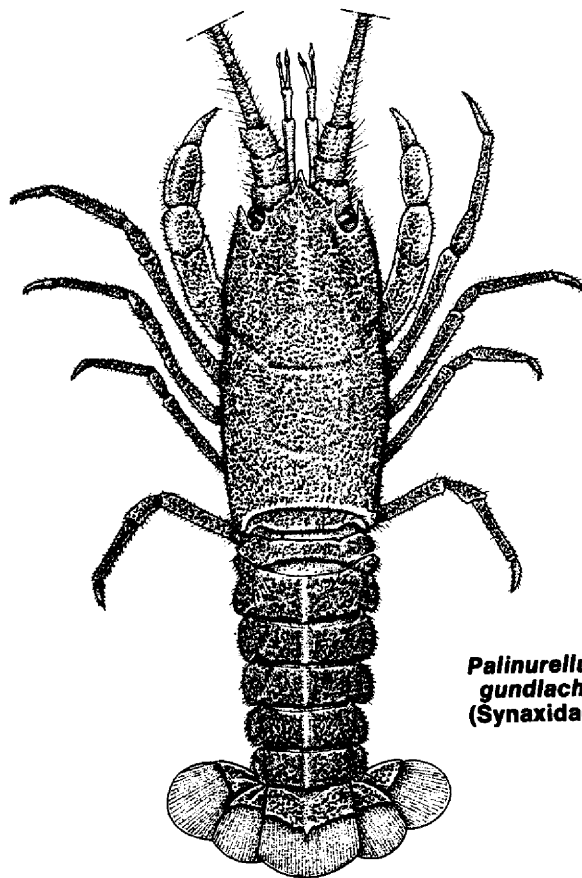
Laomedea healyi
(Laomeidiidae)



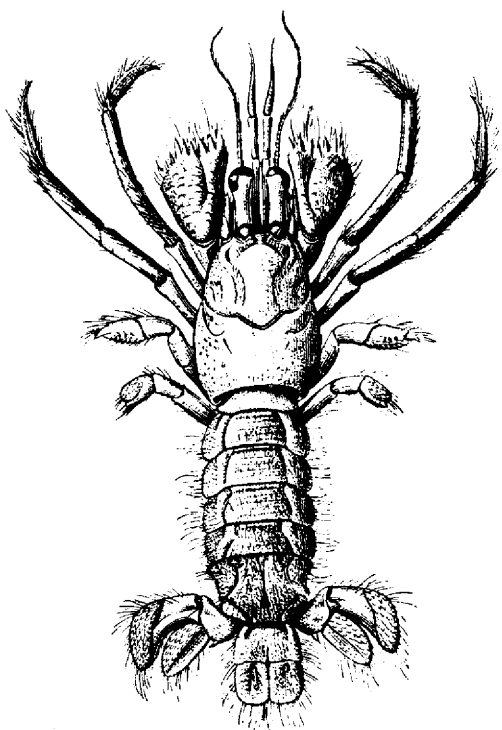
Callianassa stebbingi
(Callianassidae)



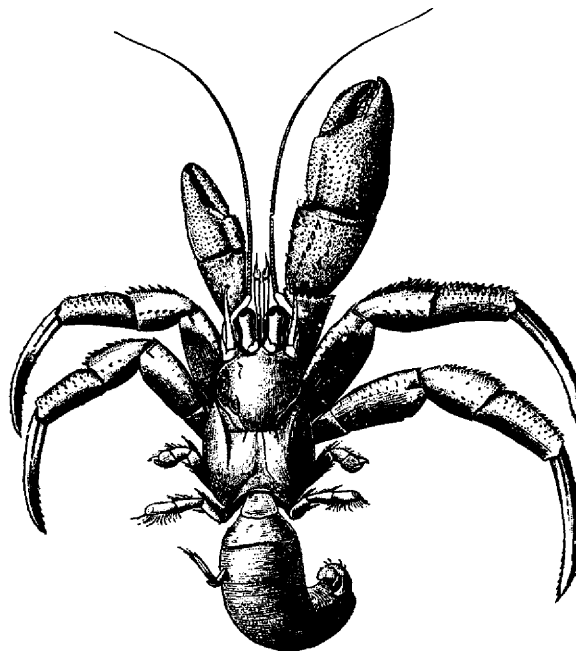
Stereomastis nanus
(Polychelidae)



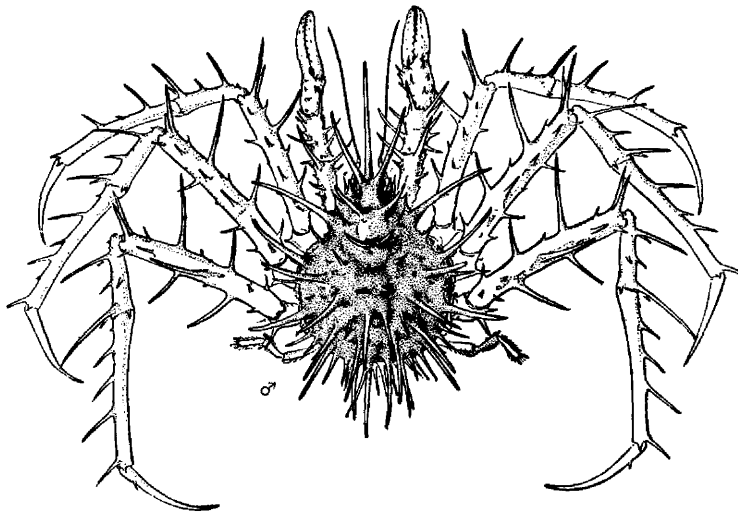
Palinurellus gundlachi
(Synaxidae)



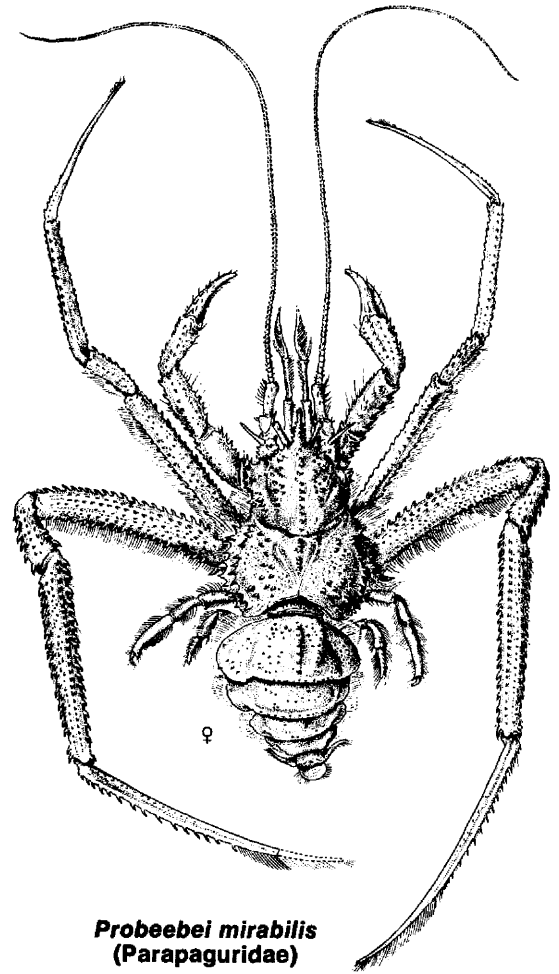
Pylocheles partitus
(Pomatochelidae)



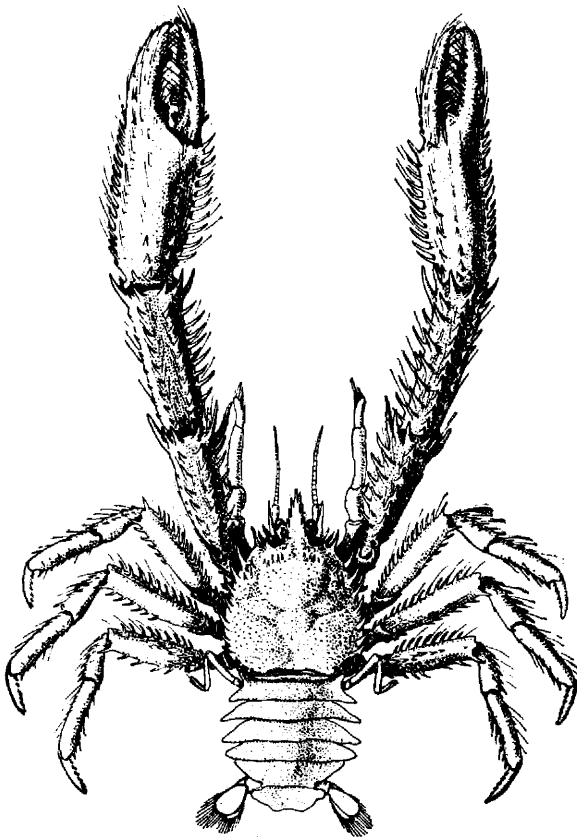
Pagurus acadianus
(Paguridae)



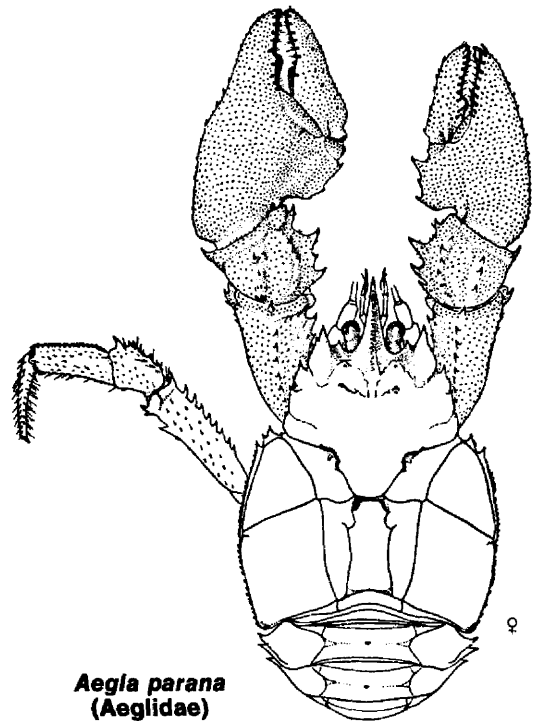
Lithodes agassizii (Lithodidae)



Probeebei mirabilis
(Parapaguridae)



Urotychus princeps
(Chirostylidae)



Aegla parana
(Aeglidae)

approximately 40 species. Polychelid lobsters tend to live in deep water on soft bottoms. Species of *Polycheles* have been taken from 200 to 2000 m, and *Willemoesia* from 2000 to 4500 m. The early larval stages are unknown, but a late larval stage was described under the generic name *Eryoneicus*, which is characterized by a large, spherical carapace and a short abdomen.

References. K. H. Barnard, Descriptive catalogue of South African decapod Crustacea (crabs and shrimp), *Ann. S. Afr. Mus.*, 38:1–837, 1950.

Palinuridae. The carapace is subcylindrical, without lateral keels. The eyes are not enclosed in separate orbits formed by the edge of the carapace. The antennae are cylindrical and supplied with long, strong, usually spinose flagella. The first abdominal segment overlaps the hind margin externally, and an internal knob is present on the side of the last thoracic segment. There are no appendages on the first abdominal segment in the female. The fifth pereopods have small chelae in the male. The eggs are numerous and small and carried on the pleopods of the female. The phyllosoma larva is a flattened, leaf-shaped planktonic form which, before its true identity was discovered, was considered a distinct genus.

Eight genera and approximately 35 species have been described for this family. This commercially important group inhabits coral reefs and rocky areas from the low tide mark to 100 m.

References. K. H. Barnard, Descriptive catalogue of South African decapod Crustacea (crabs and shrimps), *Ann. S. Afr. Mus.*, 38:1–837, 1950.

Scyllaridae. Spanish lobsters. The carapace is depressed dorsoventrally, and the exoskeleton is well calcified and sculptured. The eyes are in definite orbits. The second antennae are short, flattened, and stiff, without a whiplike flagellum. The mandibles have a single-jointed palp. The legs are simple, except for the minutely chelate fifth pair in females. There are no appendages on the first abdominal segment; the second to fifth pleopods in the male are biramous, lamellate, and reduced in size. The females carry large numbers of small eggs.

The family contains 6 genera and approximately 49 species. Species are found in a wide range of habitats from shallow water to 200 m. Although most species are very sluggish and walk very slowly, many can use their powerful abdomen for propulsion and defense.

References. K. H. Barnard, Descriptive catalogue of South African decapod Crustacea (crabs and shrimps), *Ann. S. Afr. Mus.*, 38:1–837, 1950.

Synaxidae. Monotypic family of palinurid lobsters consisting of *Palinurellus gundlachi* (= *Synaxes hybridica*) from the West Indies. A carapace is present, with a pair of strong teeth set behind the orbits (one tooth on each side is set just lateral to the midline). The rostrum is short, does not extend beyond the antennular peduncle, and has granulate margins. The proximal base of the rostrum is wide, forming a portion of the orbit. The antennules are slender and end in two short flagella. The antenna has the first two articles fused with the carapace; the next three articles are free and end in a long, rigid flagellum. The pereopods are achelate; the first pair is the strongest. [See illustration page 311.]

The exact status of this family is unclear. It is related to the Palinuridae and Scyllaridae, according to C. S. Bate.

References. C. S. Bate, On *Synaxes*, a genus of Crustacea, *Ann. Mag. Nat. Hist.*, ser. 5, 5:220–228, 1881.

Pomatochelidae. The carapace is well calcified, and its lateral portions are flat and very high. The antennules end in two flagella. The mandibles have a palp, and the bases of the third maxillipeds are set close together. The first pair of pereopods is chelate and similar; all the walking legs have equal lengths. The abdomen has well-developed articulating tergites. The gills are of the trichobranchiate type. There are 14 branchiae on each side: two arthrobranchiae on each of the first four pairs of pereopods and on the third maxillipeds, and one pleurobranch on each of the last four pereopods. All segments of the abdomen have paired pleopods; in the male the pleopods of the first segment are modified into gonopods. [See illustration page 311.]

This is a primitive family of anomuran crabs (previously referred to as Pylochelidae) consisting of 4 genera (*Pomatocheles*, *Pylocheles*, *Parapylocheles*, and *Chiroplataea*) and 17 species. Members cover their well-developed abdominal tergites with a sponge or hollow piece of bamboo or mangrove. Most species are found in tropical and subtropical waters at moderate depths.

References. V. V. Markarov, Fauna of the U.S.S.R., Anomura, *Zool. Inst. Acad. Sci. U.S.S.R.*, 10(3):1–283, 1938.

Diogenidae. There are usually 14 pairs of gills, 10 arthrobranches, and one pleurobranch on pereopods 2–5, although in some genera the pleurobranch on the fifth pereopod is absent. The third maxillipeds are set close to each other at the base. A crista dentata may be present or absent, but there is never an accessory tooth. The chelipeds may be subequal or unequal. On the male there are usually no paired pleopods, and unpaired pleopods are on somites 2–5, except in *Paguristes* and *Paguroopsis*, where the pleopods on abdominal somites 1 and 2 are paired, and in *Cancellus*, where there are no pleopods on somites 1–5. In the females there are no paired or unpaired pleopods on abdominal somites 2–5, except in *Paguristes* and *Paguroopsis*, where there are paired pleopods on the first abdominal somite.

This large and diverse family of hermit crabs consists of approximately 15 genera and 350 species. Species are extremely common in tropical shallow waters. They are often brightly colored, and color is an important taxonomic character among species.

References. J. Forest and M. de Saint Laurent, Compagne de la *Calypso* au large des côtes Atlantiques de l'Amerique de Sud (1961–1962), I: 6, Crustacés Décapodes: Pagurides, in Résultats scientifiques des campagnes de la "Calypso," *Ann. Inst. Ocean.*, 45:47–169, 1967.

Coenobitidae. The carapace is well calcified, and the third maxillipeds are approximated basally. The first pereopods are chelate, with the left being larger than the right. The second and third pereopods are long and ambulatory. The fourth pereopods are chelate or subchelate. The fifth are chelate. [See illustration page 319.]

Members of this family carry a small supply of water in the gastropod shell they inhabit. The gills are reduced and do not permit respiration in water. The posterior portion of the abdomen has numerous blood sinuses underneath transverse grooves. The females release larvae into the sea, and they remain in the plankton until the postlarvae settle to the substrate.

This terrestrial family of anomuran crabs, represented by 2 genera and 17 species of hermit crabs, inhabits the ocean only during reproductive periods. *Birgus latro*, the coconut crab, may reach up to 32 cm in length. Members of the genus *Coenobita* are small (with a carapace 1–5 cm in length) and occur throughout the tropics.

References. A. Kaestner, *Invertebrate Zoology*, vol. 3: *Crustacea*, Wiley Interscience, New York, 1970.

Lomisidae. Monotypic family consisting of a single Recent species, *Lomis hirta*. The species is crablike, resembling a porcellanid crab, although it is in the hermit crab superfamily Coenobitoidea. The carapace is short, extending only to the level of the third peraeopods. Orbits are absent. The abdomen is well calcified, symmetrical, and folded beneath the thorax. The first peraeopods are chelate and flattened; the third through fourth are ambulatory in form; the fifth are reduced and located in the branchial chamber. Pleopods are present on both sexes. In the male they are well developed on segments 1 and 2 and vestigial on segments 3–6. In the female the first pair of pleopods are vestigial, the second pair are reduced in size, and the third to sixth pairs are well developed. The species is known from marine waters of eastern Australia.

References. R. L. C. Pilgrim, Some features in the morphology of *Lomis hirta* (Lamarck) (Crustacea: Decapoda) and a discussion of its systematic position and phylogeny, *Austral. J. Zool.*, 13:545–557, 1965.

Paguridae. The carapace is usually broad and elongate, and weakly calcified posteriorly. The rostrum is very short, and the abdomen is generally soft and coiled (the abdomen may be secondarily symmetrical in some forms). The eye scales are triangular. The first peraeopods are chelate and usually heterochelous. The second and third peraeopods are elongate and ambulatory. The fourth and fifth are reduced and commonly subchelate. The middle abdominal terga are separated more or less by a membrane. The abdominal appendages in many forms are on the left side only. [See illustration page 311.]

This large family of anomuran crabs consists of 44 genera and approximately 555 described species. Hermit crabs are so named for their habit of carrying gastropod shells for protection of their soft abdomen. Most species are of moderate size, with a carapace length ranging from about 5 to 75 mm. Both deep- and shallow-water forms occur throughout the world's oceans.

References. A. W. Alcock, *Catalogue of the Indian Decapod Crustacea in the Collection of the Indian Museum*, Part II, Anomura, fasc. 1, Pagurides. Calcutta, 1905.

Lithodidae. The carapace is well calcified and crablike. The rostrum is well developed, triangular or styliform, and armed with an accessory spine. The third maxillipeds are pediform in shape. The first peraeopods are chelate, with the right usually larger than the left. The fifth peraeopods are reduced and folded under the carapace. The abdomen of females is distinctly asymmetrical and dorsally smooth or covered with calcified plates. The pleopods are completely lacking in males. The female bears rudimentary pleopods on the first abdominal segment; segments 2–5 bear uniramous pleopods on the left side. Uropods are lacking in all species. [See illustration page 312.]

This marine family of anomuran crabs is composed of 16 genera and 53 species. Members of the family resemble the true crabs and inhabit cold waters. The morphology of the adults superficially resembles that of members of the Majidae. *Paralithodes camtschatica*, the king crab, of the North Pacific, is commercially fished for food.

References. V. V. Markarov, Fauna of the U.S.S.R., Anomura, *Zool. Inst. Acad. Sci. U.S.S.R.*, 10(3):1–283, 1938.

Parapaguridae. There are 11 pairs of gills, 10 arthrobranches from the third maxillipeds to the fourth peraeopods, and

often a rudimentary pleurobranch on the fifth peraeopod. The gills are variable in form, from phyllobranchiate to trichobranchiate. The telson is entire, without a transverse median constriction. The maxillipeds are widely separated at the base by the sternite armed with a pair of acute tubercles. A well-developed crista dentata is present. The chelipeds are unequal (except in *Probeebei*), the right usually being longer and stronger. Peraeopods 2 and 3 are typically very long; the fourth is subchelate, and the fifth is chelate. Males have paired gonopores on the coxa of the last pair of peraeopods. Females have a single gonopore on the left coxa of the third peraeopod. [See illustration page 312.]

This is a family of deep-sea hermit crabs in the superfamily Paguroidea which consists of 4 genera and 44 species. The 3 monotypic genera are *Typhlopagurus foresti*, *Probeebei mirabilis*, and *Tylaspis anomala*. The last species has been recorded from greater depths (4343 m) than any other anomuran. The fourth genus, *Parapagurus*, contains 41 species.

References. M. de Saint Laurent, Sur la famille Parapaguridae Smith, 1882: Description de *Typhlopagurus foresti* gen. nov., sp. nov., et de quinze espèces ou sous-espèces nouvelles de *Parapagurus* Smith (Crustacea: Decapoda), *Bijdr. Dierk.*, 42:97–123, 1972.

Galatheidae. The carapace is elongate, with well-defined transverse lines. The rostrum is well developed, triangular, and styliform, and projects beyond the eyes. The antennular peduncle is elongate. The antennae have a four-jointed peduncle and usually are without a scaphocerite. The first peraeopods are chelate and greatly elongate. The second to the third peraeopods are well developed. The fifth is feeble and reduced in size. The abdomen is curved ventrally, but not bent under the thorax. Males have a pair of sexually modified pleopods on segment 2, and a pair of uniramous pleopods on segments 3, 4, and 5. Females have rudimentary pleopods on the second abdominal segment, and fully developed pleopods on the third, fourth, and fifth. The eggs are small and numerous.

This is an entirely marine family of anomuran crabs, containing 7 genera and approximately 258 species. The species are mainly found in tropical seas, from both abyssal and littoral zones. The abyssal forms are usually blind. Most of the members of this family are benthic.

References. J. E. Benedict, Description of a new genus and forty-six new species of crustaceans of the family Galatheidae with a list of the known marine species, *Proc. U.S. Nat. Mus.*, 26(1311):243–334, 1902.

Aeglididae. Entirely freshwater family of anomuran crabs containing a single Recent genus, *Aegla*, and approximately 25 species, of which one is troglobitic. The carapace-rostrum length ranges from 15 to 44 mm. The carapace is compressed and flattened medially. The rostrum is long and sharply carinated-triangular in cross section. The orbits are moderately deep and wide. The branchial region of the carapace is armed with a complex arrangement of sutures. The first peraeopods are swollen and chelate; the outer margins exhibit short spines. The second and third peraeopods are nonchelate; the fifth is smaller than the second third, and fourth; its coxa is mesial and slightly caudal to that of the fourth peraeopod. The telson has a longitudinal medial suture. The basal segment of the uropod is at least half as long as the lateral ramus. [See illustration page 312.]

The family is endemic to temperate South America and occurs in shallow freshwater basins.

References. W. L. Schmitt, The species of *Aegla*, endemic South American fresh-water crustaceans, *Proc. U.S. Nat. Mus.*, 91:431–520, 1942.

Chirostylidae. The carapace length ranges from about 5 to 14 mm. The carapace is longer than broad. The last segment of the broad thoracic sternum is reduced or atrophied. The abdomen is folded ventrally, with the telson folded beneath the preceding abdominal somites. The third maxillipeds are without epipodites. The antennular peduncle has five segments; the third is not fused to the second. Arthrobranch gills, resembling pleurobranchs, are located on the thorax. [See illustration page 312.]

This marine family of anomuran crabs is represented by 5 genera (*Eumunida*, *Chirostylus*, *Gastroptychus*, *Uroptychus*, and *Pseudomunida*) and approximately 71 extant species. Members occur at moderate to considerable depths, often living on gorgonian coral. The family has a worldwide distribution in temperate to tropical seas.

References. W. E. Pequegnat and L. H. Pequegnat, Contributions on the biology of the Gulf of Mexico, *Texas A&M Univ. Oceanogr. Stud.*, 1:1-229, 1970.

Porcellanidae. Porcelain crabs; the carapace is well calcified and flat. The rostrum is blunt and never projects beyond the eyes. The antennae have three movable segments and a flagellum. The third maxillipeds are too robust to be contained within the buccal cavity; the distal segments are armed with long, plumose setae. The chelipeds are elongate and are usually broad and depressed. The second, third, and fourth peraeopods are well developed; the fifth are reduced, inflexed, and chelate, and rest on the carapace. The abdomen is broad, symmetrical, composed of seven segments, and bent under and pressed closely to the thorax. Males usually have a pair of pleopods on segment 2, but in some genera they are rudimentary or absent. The females have a pair of pleopods on segments 3, 4, and 5, with those on segment 3 reduced or absent. [See illustration page 317.]

This almost entirely marine family of crablike decapods contains 17 genera and 225 described species distributed throughout the tropics and temperate oceans. Most members are maxillary filter feeders inhabiting tidal regions under and between coral crevices or stones. Ranging from 6 to 35 mm in total length, many species are symbionts of sponges, tube worms, and anemones.

References. J. Haig, The Porcellanidae (Crustacea: Anomura) of the Eastern Pacific, *Allan Hancock Pac. Exped.*, 24:1-440, 1960.

Albuneidae. The carapace is subquadrangular and flat, without posterolateral extensions covering the peraeopods. The first peraeopods are subchelate, and the second to fourth have the terminal segment flat and curved. The third maxillipeds are narrow. The telson is not conspicuously lengthened and oval.

This marine family of anomuran crabs contains 6 genera and approximately 35 species. Species occur in temperate and tropical regions, from the extreme high-tide mark to 70 m. These sand dwellers burrow backward into sand and may obtain food by specialized setose antennules.

References. A. B. Williams, Marine decapod crustaceans of the Carolinas, *Fish. Bull.*, 65(1):1-298, 1965.

Hippidae. The carapace is oval and strongly convex, with lateral extensions which cover all but the first peraeopods. The third maxillipeds are lacking an exopodite. The mandibles are reduced and are nonfunctional as feeding appendages. The first peraeopods are nonchelate. The telson is elongate and lanceolate.

This small family of anomuran crabs consists of 3 genera (*Hippa*, *Emerita*, and *Mastigochirus*) and 25 described species.

Members are commonly called mole crabs or sand fleas owing to their habit of burying themselves in the shifting sand of high-energy beaches. The adults swim using the uropods, but are primarily adapted for burrowing backward in wet sand. The fringed antennae strain particulate matter from the receding water of waves and then transfer it to the mouth. The family is distributed worldwide.

References. J. Haig, A review of the Australian crabs of the family Hippidae (Crustacea, Decapoda, Anomura), *Mus. Queensland Mem.*, 17(1):175-189, 1974.

Homolodromiidae. The carapace is longer than broad, and convex, with cervical and branchial grooves present. The antennal flagella are longer than the carapace. The third maxillipeds are pediform. The chelipeds are of equal size and are generally longer than the remaining legs. The first pair of walking legs are larger than the chelipeds; the third and fourth pair are shorter and subdorsal. The abdomen of both sexes consists of seven segments. Twenty-one pairs of gills are present on each side; some forms have trichobranchiate gills, and others are intermediate between trichobranchiate and phyllobranchiate types. The sternal grooves of the female are short, ending at the level of the genital openings.

This primitive family of brachyuran crabs consists of 2 genera (*Homolodromia* and *Dicranodromia*) and about 2 described species. Species occur in the eastern and western Atlantic, the Indian Ocean, and off the coast of Japan, in deep water from approximately 600 to 1000 m.

References. M. J. Rathbun, The oxystomatous and allied crabs of America, *U.S. Nat. Mus. Bull.*, 166:1-278, 1937.

Dromiidae. The carapace is subglobular, or rarely flattened with dense short setae. The carapace width ranges from 13.5 to 115 mm. The third maxillipeds are operculiform, covering the entire buccal cavity. The abdomen is folded under the thorax, with the penultimate segment lacking appendages. The first peraeopods are strongly chelate; the fourth and fifth are reduced and subdorsal. The walking legs are of moderate size and terminate in small, hooklike dactyli. The sternum of the female has grooves; the abdomen has seven segments; the sixth generally has rudimentary uropods. In both sexes the gonopores are coxal. [See illustration page 319.]

This primitive marine family of brachyuran crabs consists of 18 genera and 156 described species. Members of this curious family, commonly referred to as the masked or sponge crabs, often carry living sponges or ascidians over the carapace for concealment and protection. Other objects are held in position by the subchelate fifth peraeopods.

References. M. J. Rathbun, The oxystomatous and allied crabs of America, *U.S. Nat. Mus. Bull.*, 166:1-278, 1937.

Dynomenidae. The carapace is either longer than broad and convex, or broader than long and flat with the lateral borders distinct; species are approximately 11 to 20 mm in carapace length. The antennal flagella are not as long as the carapace. The third maxillipeds are operculiform, completely covering the buccal field. The chelipeds are equal and generally stouter than the legs. The abdomen in both sexes consists of seven segments, with intercalated platelets between the sixth and seventh segments. The fifth peraeopods are greatly reduced and positioned dorsally. The sternal grooves of the females end at the level of the genital openings. The gills are of the phyllobranchiate type.

This family of brachyuran crabs consists of 3 genera, *Dynomene*, *Paradynomene*, and *Acanthodromia*; there are approximately 13 extant species. Members are primarily ben-

thic and occur in water from 150 to 300 m in tropical seas.

References. A. W. Alcock, Materials for a carcinological fauna of India, No. 1: The Brachyura Oxyrhyncha, *J. Asiatic Soc. Bengal*, 64-2(2): 157-291, 1895; M. J. Rathbun, The oxystomatous and allied crabs of America, *U.S. Nat. Mus. Bull.*, 166:1-278, 1937.

Cymonomidae. The carapace is quadrate, with a rather narrow, triangular rostrum. The first three abdominal segments are visible dorsally, with the last pair of peraeopods dorsally located. A large flagellum is present on the third maxilliped. The spermatheca of the female is formed by the sutures of sternal somites 7 and 8, and the opening is covered by a small flap. The male gonopod is a sheath surrounding pleopod 2, which is a boot-shaped structure.

This family of primitive crabs consists of 2 Recent genera, *Cymonomus* and *Cymopolus*, and approximately 11 species. The family is very closely related to the Tymolidae, from which it differs in the form of the female spermatheca and in the presence of a flagellum on the third maxilliped.

References. I. Gordon, On the relationship of Dromiacea, Tymolinae and Raninidae to the Brachyura, in *Phylogeny and Evolution of Crustacea*, Harvard Mus. Comp. Zool. Spec. Publ., Cambridge, 1963.

Tymolidae. The carapace is short, and the first three abdominal segments are visible dorsally. The antennulae and antennae are very long; the third maxillipeds cover the buccal cavity, and the last two pairs of legs are located dorsally. The females have the genital opening coxal, with the spermatheca formed by the sternal ridges. The male gonopod is broad and leaflike, enclosing a hypodermiclike second pleopod.

This family of primitive crabs consists of 4 Recent genera and 16 species. It has been considered a subfamily of the Dorippidae, but the group is clearly distinct, as shown by I. Gordon. The genera are *Tymolus* (a senior synonym of *Cyclodorippe*) with 9 species, *Clythrocerus* with 4 species, *Corycodus* with 2 species, and *Xeinostoma* with 1 species. The group is most common in deep water.

References. I. Gordon, On the relationship of Dromiacea, Tymolinae and Raninidae to the Brachyura, in *Phylogeny and Evolution of Crustacea*, Harvard Mus. Comp. Zool. Spec. Publ., Cambridge, 1963.

Homolidae. The carapace is rectangular and longer than broad, with deep vertical sides. The front is narrow, forming a rostrum, which is either entire or bidentate at the tip. The eyes are not completely sheltered by the orbits when retracted. The terminal and basal segments of the eyestalks are almost equal in length. The antennal flagellum is much longer than the carapace. The third maxillipeds are pediform, subpediform, or suboperculiform. The sternum of the female is without longitudinal grooves. The gills number 8, 10, 13, or 14 on each side. [See illustration page 319.]

This family of brachyuran crabs is represented by 9 genera and about 20 described species. Members are bottom dwellers and are occasionally taken from sponges at 15-350 m. *Homola barbata*, with a carapace length of about 30 mm, inhabits deep water up to 120 m from off southeastern Massachusetts to the Caribbean Sea, and from Portugal to South Africa and the Mediterranean Sea.

References. M. J. Rathbun, The oxystomatous and allied crabs of America, *U.S. Nat. Mus. Bull.*, 166:1-278, 1937.

Latreilliidae. The carapace is pyriform or elongate-quadrangular. The basal joint of the eyestalk is much longer than

the terminal joint. The antennal flagella is not as long as the carapace. The third maxillipeds are suboperculiform. Eight gill plumes are present on each side of the cephalothorax. There are no epipodites on the chelipeds or the walking legs. [See illustration page 317.]

This family of brachyuran crabs is represented by 2 genera (*Latreillia* and *Latreillopsis*) and approximately 9 species. *Latreillia elegans*, with a carapace length of about 12.7 mm, occurs on both sides of the Atlantic Ocean and in the Mediterranean Sea, from 140 to 400 m.

References. A. Alcock, Materials for a carcinological fauna of India, No. 5: The Brachyura Primigenia, or Dromiacea, *J. Asiatic Soc. Bengal*, 68:1-130, 1899.

Raninidae. The carapace is smooth and elongate, and does not cover the abdominal terga. The abdomen is narrow in both sexes, and the antennules are large and not folded into grooves. The proximal segments of the exopodite and endopodite of the first maxillipeds form a respiratory canal. The third maxillipeds completely cover the buccal cavity. The first peraeopods are subchelate, with some or all of the remaining legs flattened and modified for burrowing; the last pair is subdorsal and reduced in some genera. There is a reduction of the branchiostegite, with eight gills present on each side. The oviducts open at the coxae of the third peraeopods, and the male gonopore opens on the coxae of the fifth peraeopods.

This is an entirely marine family of decapods, with 9 extant genera; approximately 32 Recent species have been described. The majority of the species occur on sand bottoms in tropical waters of 3-30 m. Members of this group are primitive burrowing crabs, habits which have had a considerable effect on their form and organization.

References. Z. Števcic, The systematic position of the family Raninidae, *Syst. Zool.*, 22:625-632, 1973.

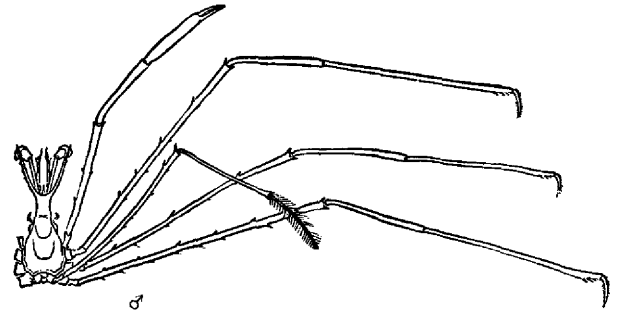
Dorippidae. The carapace is short and does not cover the first two abdominal segments. The antennae and antennules are large; the latter are often too large to fold into their fossettes. The male genital openings are coxal; the female openings may be sternal or coxal, and when coxal, a pair of sternal grooves is present. [See illustration page 317.]

This is a small family of brachyuran crabs consisting of 10 genera and 77 described species. *Dorippe lanata*, with a carapace length of 26 mm, holds a bivalve shell, an acidian, or the head of a fish above its body with its posterior peraeopods. It turns this shield toward potential predators without turning its body.

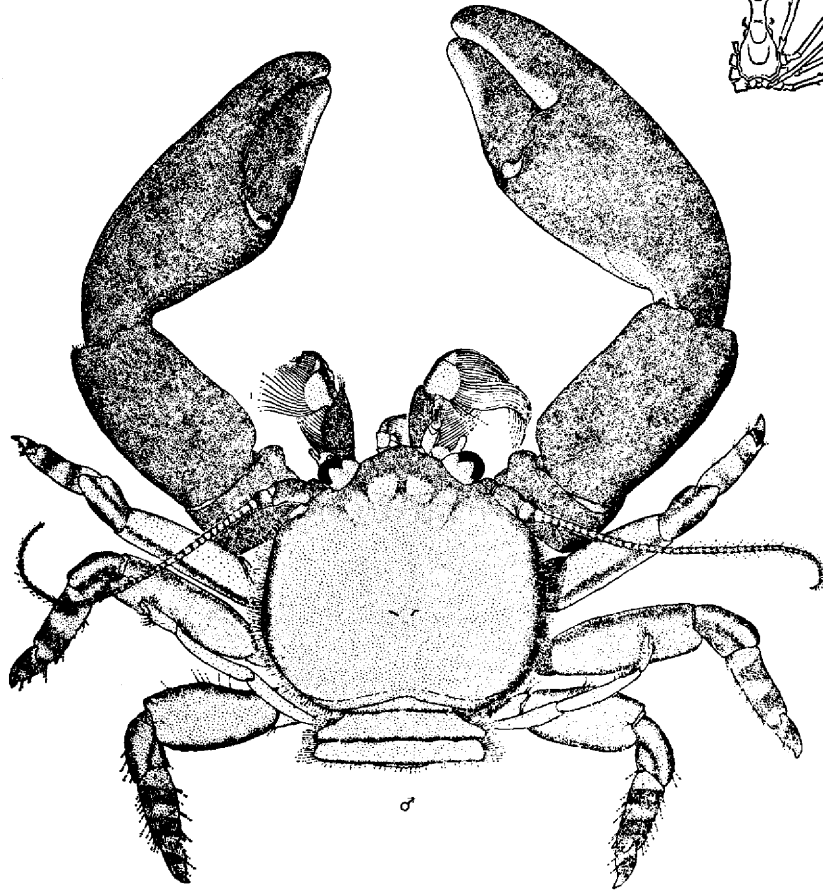
References. A. Alcock, Materials for a carcinological fauna of India, No. 2: The Brachyura Oxystomata, *J. Asiatic Soc. Bengal*, 65-2(2): 139-301, 1896.

Calappidae. The carapace is strongly convex, with spinose or lobate margins. Species have a carapace width ranging from 7 to 13 cm. The orbits are small and circular, and the eyestalks short and stout. The third maxillipeds may or may not completely cover the buccal cavity. The chelae of the first peraeopods are very large and equal, except for the fingers, which on the one hand have near the base a stout projecting tubercle. The abdomen consists in the male of five segments, the third to fifth terga being fused. Seven separate segments are seen in the female and in young males. The vasa deferentia perforate the bases of the fifth pair of legs in the males.

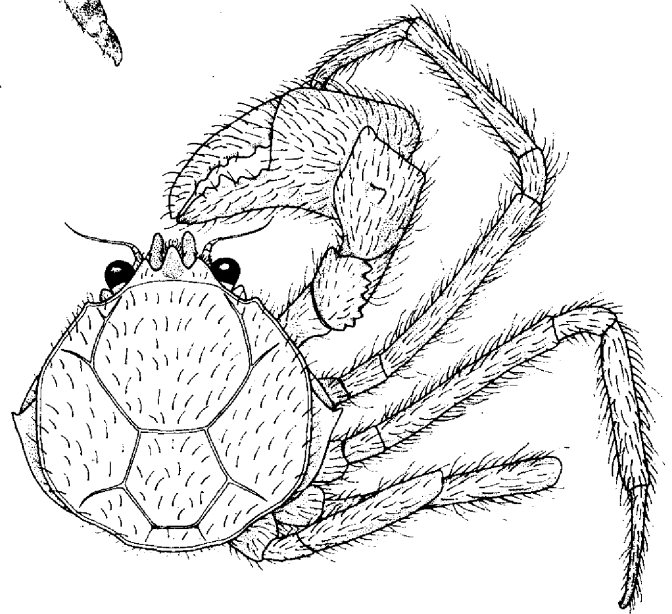
This is an entirely marine family of brachyuran crabs composed of 10 genera and about 65 species. They are



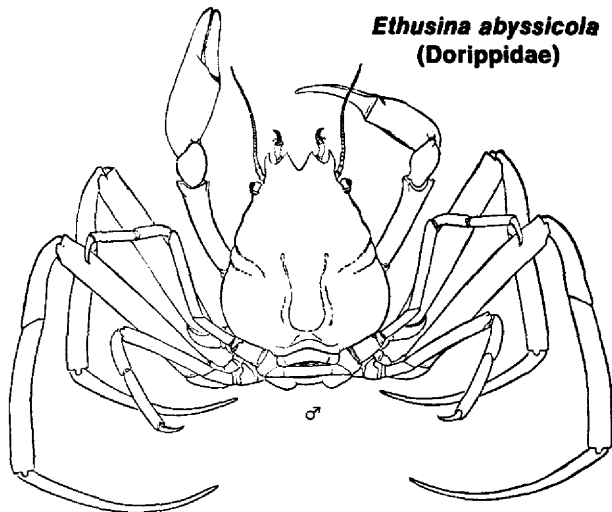
Latreillia elegans (Latreilliidae)



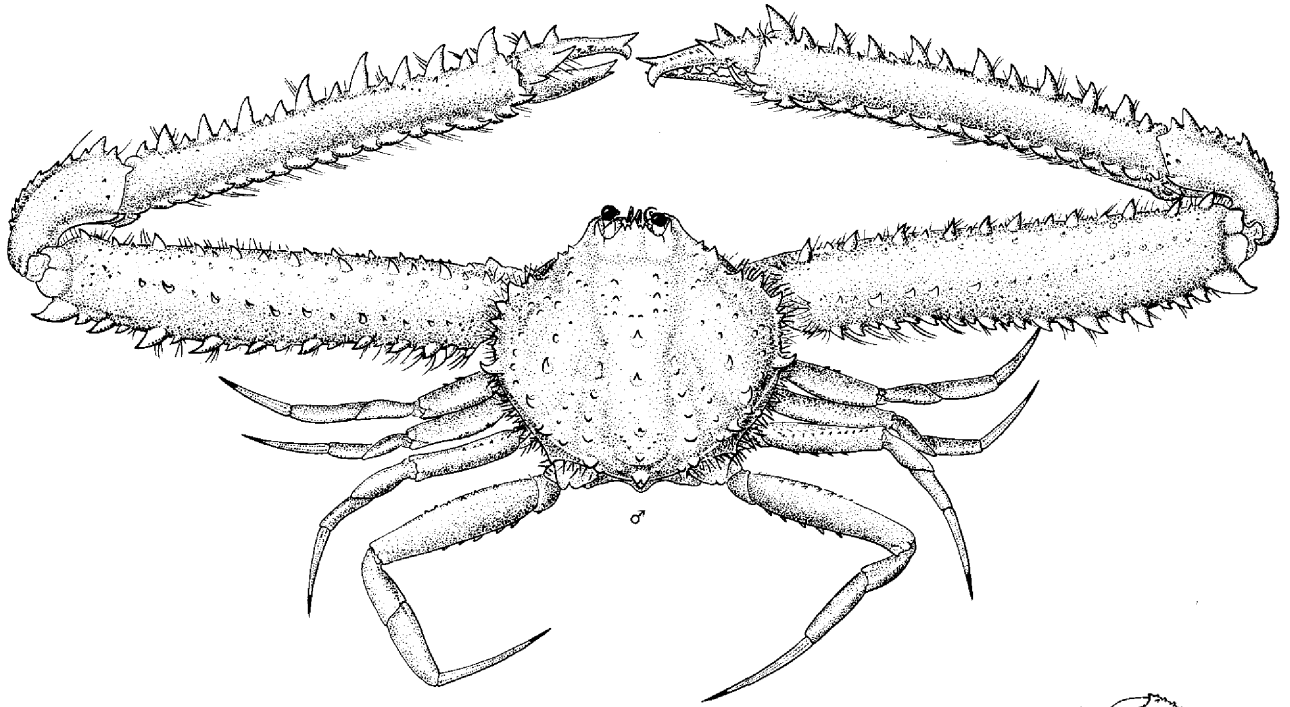
Petrolisthes quadratus (Porcellanidae)



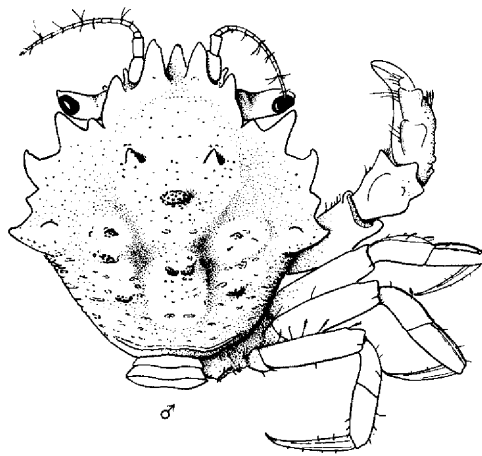
Elamenopsis kemp
(Hymenosomatidae)



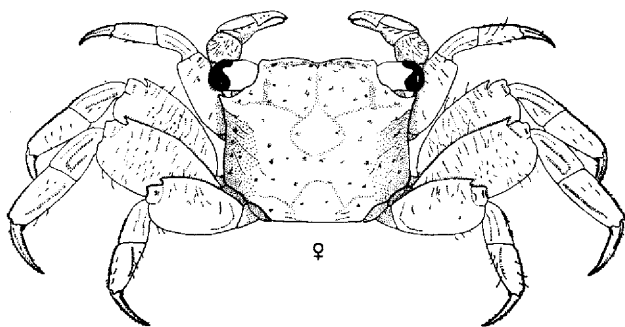
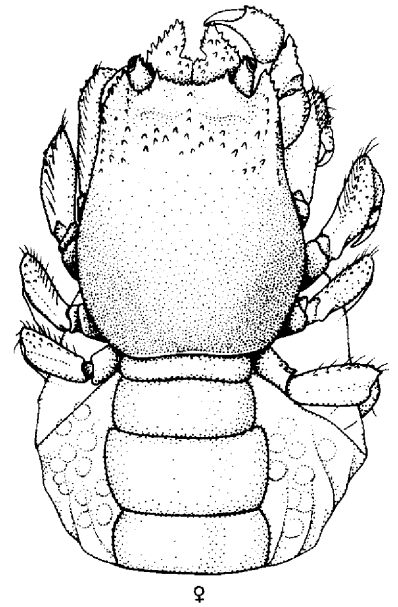
Ethusina abyssicola
(Dorippidae)



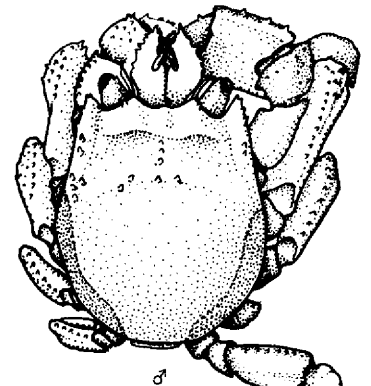
Mimilambrus wileyi (Mimilambridae)



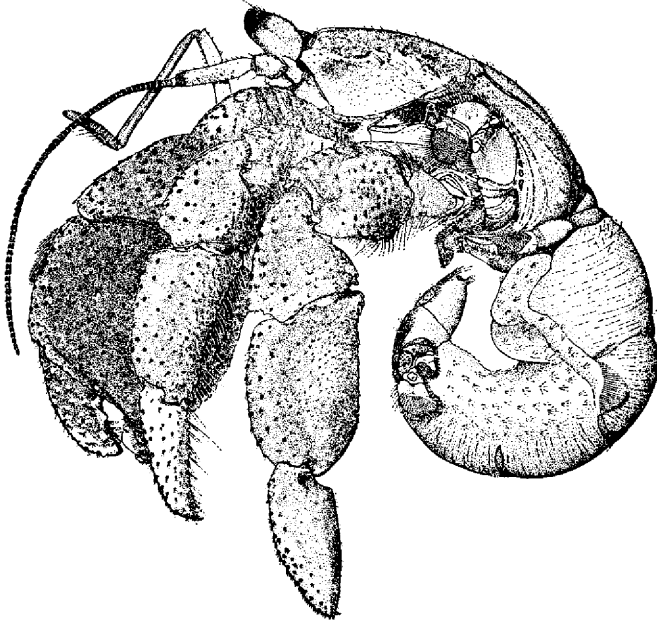
Sirpus monodi (Pirimelidae)



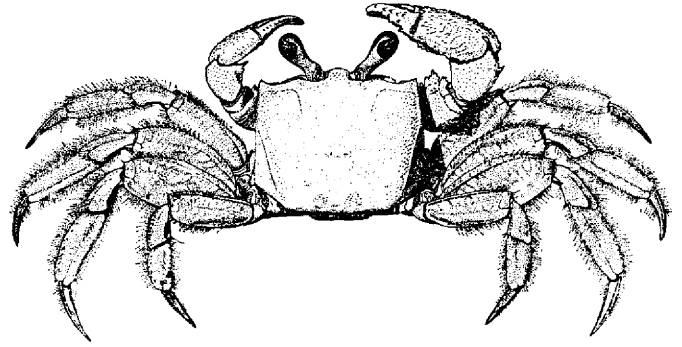
Sesarma rubinofforum (Grapsidae)



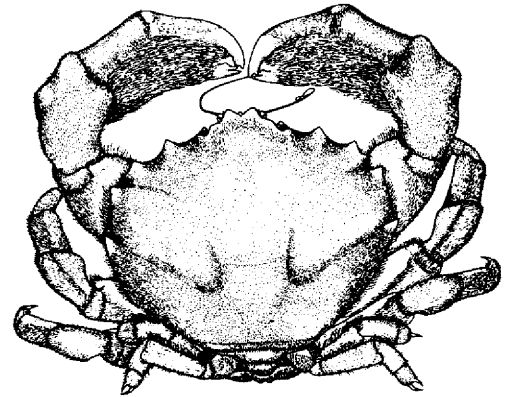
Pseudocryptochirus hypostegus (Hapalocarcinidae)



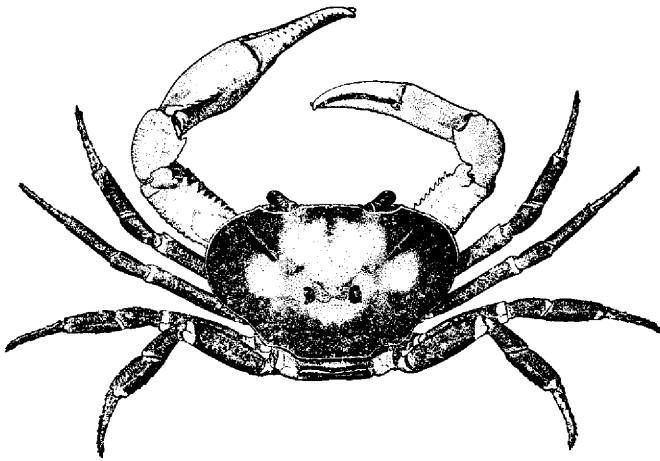
Coenobita clypeatus (Coenobitidae)



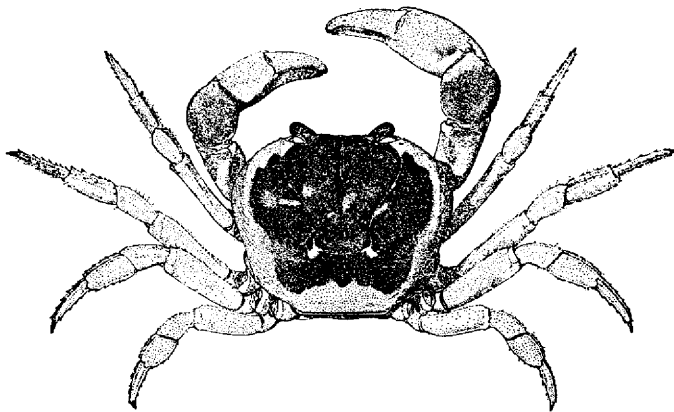
Ocypode quadrata (Ocypodidae)



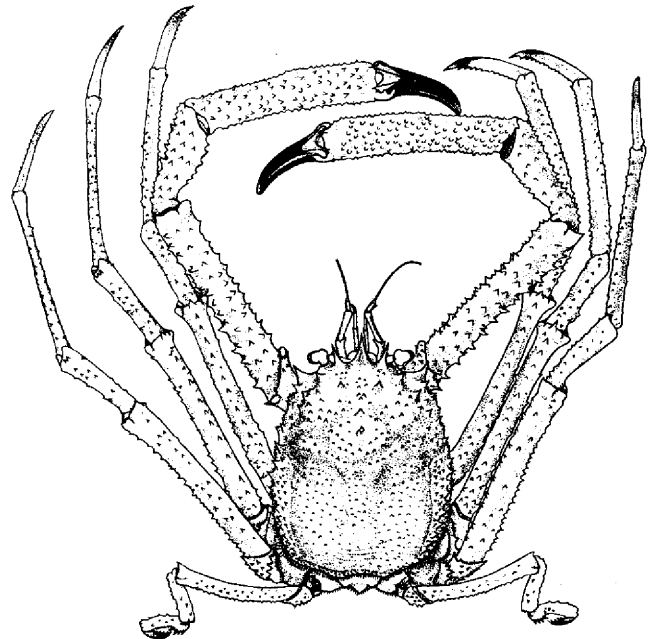
Dromia personata (Dromiidae)



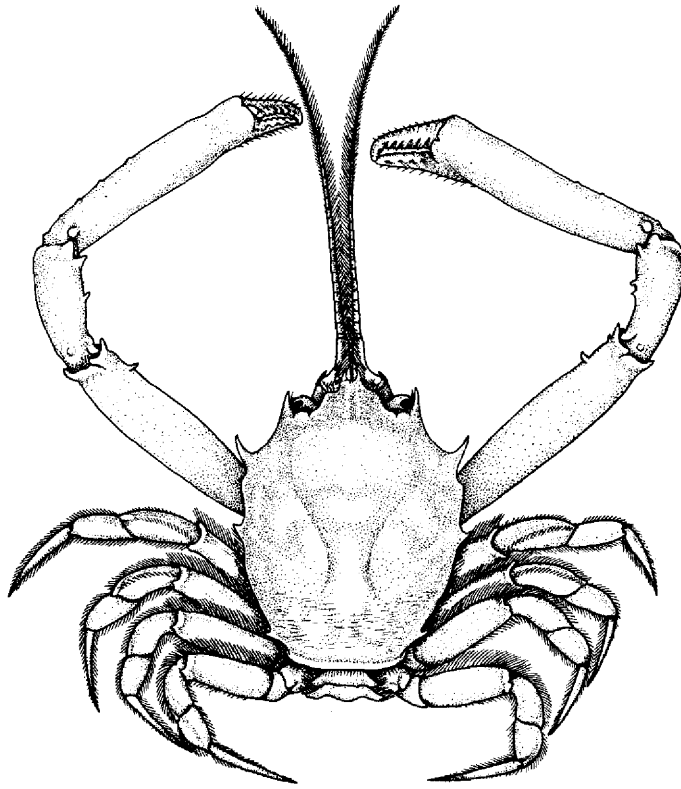
Guinotia dentata (Potamocarcinidae)



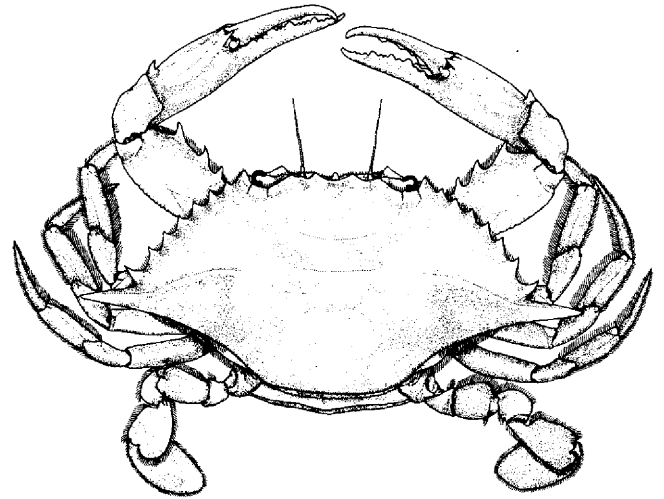
Gecarcinus lateralis (Gecarcinidae)



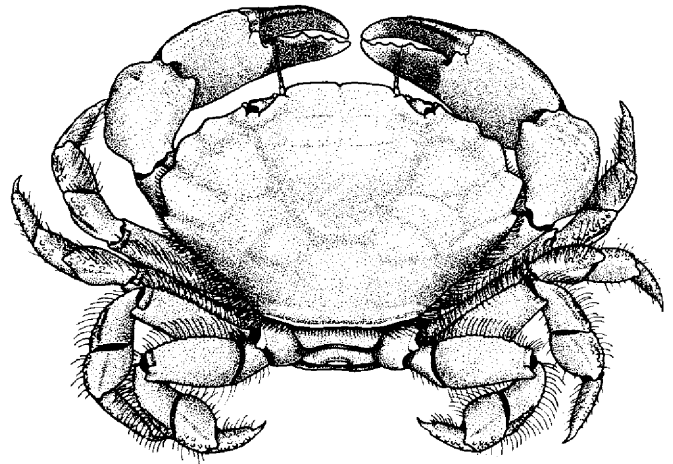
Paromola cuvieri (Homolidae)



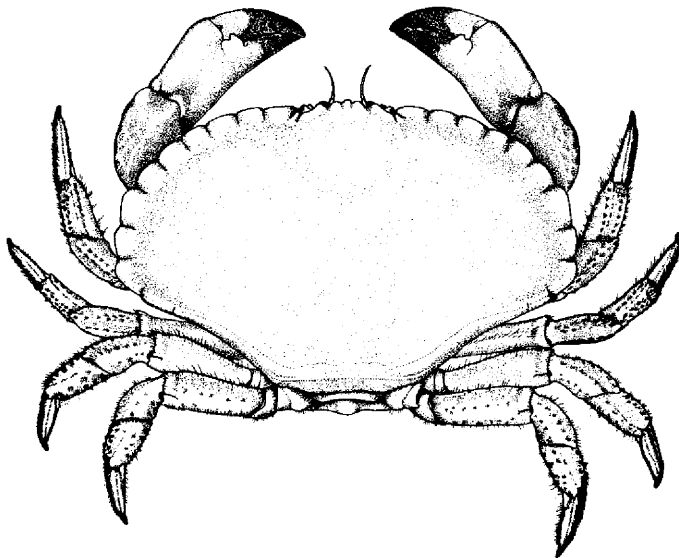
Corystes cassivelaunus (Corystidae)



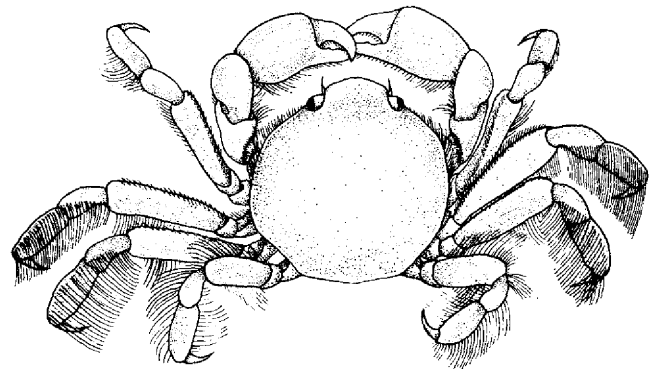
Callinectes sapidus (Portunidae)



Xantho pilleps (Xanthidae)



Cancer pagurus (Cancridae)



Pinnotheres pisum (Pinnotheridae)

commonly called the shame-face crabs or box crabs due to their habit of covering their "faces" with enlarged flattened chelae when disturbed. These modified chelae are specialized for opening mollusk shells, particularly gastropods. Many species are brightly colored with flame-shaped blotches of bright red.

References. A. W. Alcock, Materials for a carcinological fauna of India, No. 2: The Brachyura Oxystomata, *J. Asiatic Soc. Bengal*, 65-2(2):139-301, 1896.

Leucosiidae. The carapace is round, oval, or polygonal and covers the abdomen. The eyes and orbits are short; the antennules fold obliquely; the antennae are either small or missing. The third maxillipeds cover the buccal cavity; the afferent respiratory channels along the side of the oral region are covered by the exopodites of the third maxillipeds. The chelipeds are equal and may be drawn out and finely toothed. Usually the third to sixth abdominal terga are fused, with the sixth segment sometimes independent. The gonopore of both sexes emerges at the base of the coxa of the fifth pereopods.

This family of marine decapods consists of 40 genera and 338 species. Commonly called purse crabs, these crustaceans often bury themselves with just the tip of the eyestalks exposed above the substrate. The chelipeds are long and narrow, with all the pereopods being held out to the side. The chelae of some species may be long and finely toothed for rapid capture of small fish and crustaceans. *Leucosia* occurs in the Indo-Pacific Region. *Ebalia cranchii*, with a carapace width up to 1.1 cm, occurs in the North Sea from 20 to 60 m. Some members of the family are known to feign death when disturbed.

References. M. J. Rathbun, The oxystomatous and allied crabs of America, *U.S. Nat. Mus. Bull.*, 166:1-278, 1937.

Majidae. Spider crabs. The chelipeds are of equal size and often are not much longer than the other pereopods. The second segment of the antenna is well developed and generally fused with the epistome and often with the front. The orbits are often more or less incomplete. The palp of the third maxilliped is articulated at the apex or at the anterointernal angle of the merus. The first pleopod is much larger than the second in length. The male genital openings are coxal.

This large family of brachyuran crabs consists of 145 genera and approximately 700 species. It is an entirely marine group, inhabiting intertidal areas down to depths of more than 2000 m. Species occur in all oceans and seas, except those of polar regions, and range in size from 8 mm to the huge Japanese spider crab *Macrocheira kaempferi* which may reach up to 4 m across the legs.

References. D. J. G. Griffin, The marine fauna of New Zealand: Spider crabs, family Majidae (Crustacea, Brachyura), *N.Z. Oceanogr. Inst. Mem.*, no. 35, Bull. 172, 1966.

Hymenosomatidae. The carapace is flat, thin, and not well calcified. The rostrum is horizontal, with the orbits reduced and the eyes exposed. The chelipeds are short and robust. The female genital openings are concealed beneath the abdomen on the thoracic sternite of the second pereopod. The development may be without free-swimming stages; the young crabs hatch from eggs and are protected by the abdomen of the female. [See illustration page 317.]

This family of brachyuran crabs is represented by 10 genera and approximately 63 species. Members are typically found in shallow marine to brackish water, with 6 species being reported exclusively from freshwater. Most species

are benthic, and others inhabit coral reefs in tropical seas.

References. J. S. Lucas, A monograph on spider crabs of the family Hymenosomatidae (Brachyura: Oxyrhyncha), particularly considering Australian species, *Rec. Austral. Mus.*, 1980.

Mimilambridae. A family of brachyuran crabs superficially resembling members of the family Parthenopidae and represented by a single Recent species, *Mimilambrus wileyi*. The carapace width ranges from 26 to 30 mm. The carapace is subcircular, with a pointed rostrum present. The third maxillipeds more or less cover the triangular buccal field. The exognath is hidden beneath the endognath, with the palp exposed. The antennules fold obliquely. The antennae are small. The female genital openings are sternal, and the male openings are coxal. [See illustration page 318.]

Mimilambrus wileyi was collected at Tobago in the West Indies over sand in shallow water.

References. A. B. Williams, A new crab family from shallow waters of the West Indies (Crustacea: Decapoda: Brachyura), *Proc. Biol. Soc. Wash.*, 92(2):339-413, 1979.

Parthenopidae. The carapace is equilaterally triangular or semielliptical in outline and lacks hooked setae. The chelipeds are much longer and heavier than the other pereopods. The eyes are retractile within small, circular, well-defined orbits, the floor of which is nearly continuous to the anterior, leaving a hiatus that is usually filled by the second segment of the antennular peduncle. The antennules fold obliquely. The third maxillipeds have a palp articulating at the anterolateral angle of the merus. The male genital openings are coxal.

This family of brachyuran crabs is represented by 21 genera and 150 described species. Species range in carapace length from approximately 15 to 36 mm and in carapace width from 18.6 to 47 mm. They inhabit various bottom types in shallow water, to depths of up to 400 m worldwide.

References. M. J. Rathbun, The spider crabs of America, *U.S. Nat. Mus. Bull.*, 129:1-613, 1925.

Corystidae. The carapace is longer than broad and suboval. The front has two to three teeth, and the antennules fold longitudinally. The antennae are long and armed with short stout setae. The third maxillipeds are elongate and extend almost to the antennules. [See illustration page 320.]

This is a family of burrowing crabs consisting of 6 genera and approximately 14 species. *Corystes cassivelaunus*, with a carapace length of 2-4 cm, is a predator in the North Sea. Members of the family bury themselves completely in soft substrate, with only the tips of the antennae protruding. The antennae form a breathing tube of interlocking setae through which the crab draws its respiratory water. In order to accomplish this, the normal brachyuran respiratory current is reversed. Elongate third maxillipeds extend to the bases of the antennae, and the current flows into the branchial chamber of either side. The exhalant flow gushes out the base of the legs, and may be seen bubbling up through the surrounding sand. Members of the family occur predominantly in the Indo-Pacific Region.

References. M. E. Christiansen, Crustacea Decapoda Brachyura, *Marine Invertebrates of Scandinavia*, no. 2, Universitetsforlaget, Oslo, 1969.

Atelecyclidae. The carapace is suboval and is longer than broad; its borders are armed with spines. The front is entire and dentate. The orbits are complete. The first anten-

nae fold longitudinally. The flagella of the second antennae are usually stout and setose, but sometimes are rudimentary or lacking. The buccal field is elongate and longer than broad. The chelipeds are larger and unequal in males. The legs are strong, setose, and more or less spiny, ending in stout, styliform dactyli.

A family of Cancroid crabs consisting of 13 genera and 30 described species. Two species of *Atelecyclus* occur commonly in the eastern Atlantic. *Kraussia* is included by some authors in this family (see Thiidae).

References. A. Alcock, Materials for a carcinological fauna of India, No. 4: The Brachyura Cyclometopa, Part II: A revision of the Cyclometopa with an account of the families Portunidae, Cancridae and Corystidae, *J. Asiatic Soc. Bengal*, 68-2:1-104, 1899.

Pirimelidae. The carapace is hexagonal, with well-defined regions and four or five anterolateral teeth. The interorbital region is trilobed and advanced, forming a small rostrum. The buccal region is somewhat elongate. The epistome is sunken and well overlapped by the third maxillipeds, which completely enclose the buccal area. The antennules are folded obliquely, and the basal antennal joint is immovable. [See illustration page 318.]

This family of corystoid crabs is represented by the Recent genera *Pirimela* and *Sirpus*. There are 3 species, *P. denticulata*, *S. monodi*, and *S. zariquieyi*. All are small (with a carapace length of 7-14 mm), and it has been suggested that the species of *Sirpus* are neotenous. The family has a fairly restricted distribution in the Mediterranean and eastern Atlantic.

References. I. Gordon, On *Sirpus*, a genus of pigmy Cancroid crabs, *Bull. Brit. Mus. Nat. Hist. Zool.*, 2(3):3-65, 1953.

Thiidae. The carapace is not much broader than long, and almost subcircular in outline. The regions are not well defined at all, and long setae fringe the margins. The eyes and orbits are small. The basal antennal article is large, and the antennules are folded obliquely. The buccal area is squarish or slightly elongate, and is completely covered by the third maxillipeds. The efferent branchial channels are not defined. The chelipeds are subequal, about as long as the carapace, and robust. The walking legs are short, with slender dactyli.

This family of corystoid crabs is represented by *Thia* and possibly *Kraussia*. The monotypic genus *Thia* (*T. scutellata*) occurs in the eastern Atlantic and Mediterranean. *Kraussia*, sometimes placed in the family Atelecyclidae, is represented by 4 species, one from the eastern Pacific and the remainder from the Indo-West Pacific Region.

References. M. E. Christiansen, Crustacea Decapoda Brachyura, *Marine Invertebrates of Scandinavia*, no. 2, Universitetsforlaget, Oslo, 1969.

Cancridae. The carapace is broadly oval and hexagonal, and the front is armed with several teeth. The antennules are folded longitudinally or obliquely, and the antennae are short and setose. The third maxillipeds usually overlap the epistome. The last pair of legs are not adapted for swimming. [See illustration page 320.]

This is a family of Cancroid crabs consisting of 1 genus (*Cancer*) and approximately 22 species, found primarily on rocky intertidal substrates. The Pacific North American edible crab, *C. magister*, with a carapace width of up to 19.8 cm, is found from the Aleutians to lower California on sandy bottoms some distance from shore. Young of *C. grac-*

ilis and the megalops larvae of this species have been found clinging to the underside of jellyfish. Many commercially important crabs are members of this family, which are predators of fish, crustaceans, mollusks, and echinoderms.

References. J. D. Nations, The genus *Cancer* (Crustacea: Brachyura): Systematics, biogeography and fossil record, *Nat. Hist. Mus. Los Angeles Sci. Bull.*, 23:1-104, 1975; M. J. Rathbun, The Cancroid crabs of America of the families Euryalidae, Portunidae, Atelecyclidae, Cancridae and Xanthidae, *U.S. Nat. Mus. Bull.*, 152:1-609, 1930.

Geryonidae. Small family usually considered to consist of the single genus *Geryon*, with a few species, although D. Guinot includes *Progeryon*, *Platypilumnus*, *Paragalene*, and possibly *Bathyplax* and *Platycheilon* in this family. The carapace is hexagonal to trapezoid in shape. The anterolateral margins of the carapace are generally armed with three to five teeth, with the front bearing four short teeth. The orbits and eyes are well developed. The antennules are transverse or transversely oblique. The basal antennal article is movable and does not reach the front of the carapace. The genital openings in the male are coxal. The legs are long and compressed.

Geryon tridens, with a carapace width up to 7.4 cm, occurs on the northern European coast at depths of 450-1800 m. Species have been reported from the western Atlantic, northern coast of Denmark, western and southern coasts of Africa, southern Atlantic, Indian Ocean, and Mediterranean Sea.

References. D. Guinot, Recherches préliminaires sur les groupements naturels chez les Crustacés Décapodes Brachyours, VIII: Synthèse et bibliographie, *Bull. Mus. Nat. Hist. Natur.*, sér. 2, 42(5):1063-1090, 1971.

Portunidae. The carapace is depressed, hexagonal, sometimes subquadrate, and generally broader than long. The regions of the carapace are not well defined, having the anterolateral borders armed with teeth from five to nine in number. The antennules fold transversely or obliquely transversely. The antennal flagella are long and slender. The buccal cavity is quadrate and broader than long. The fifth pereopods are almost always modified for swimming, with at least two joints compressed and paddlelike. [See illustration page 320.]

This large family of brachyuran crabs is represented by 38 genera and more than 230 extant species. Approximately 175 species occur in the Indo-West Pacific, with the tropical western Atlantic portunid fauna being much poorer. Members of this family are commonly called swimming crabs for their ability to swim using modified paddlelike fifth pereopods. Species of this family are found on a variety of bottoms in brackish and shallow marine waters up to 100 m. The commercially important species *Callinectes sapidus*, with an adult carapace width of approximately 200 mm, is a member of this family.

References. E. A. Norse, Aspects of the zoogeographic distribution of *Callinectes* (Brachyura: Portunidae), *Bull. Mar. Sci.*, 27:440-447, 1977; A. B. Williams, Marine decapod crustaceans of the Carolinas, *Fish. Bull.*, 65(1):1-298, 1965.

Bythograeidae. Monotypic family represented by *Bythogrea therydon*. The carapace is distinctly wider than long, with the anterolateral margins unarmed but granulate. The frontal region is of moderate width, and a supraorbital border is present. The antennae are inserted below the

eyestalks, and the articles of the peduncle are slender. The carpus of the third maxilliped articulates near the anteromesial corner. The endognath of the first maxilliped has a mesial lobe. The male genital openings are coxal, and the female's are sternal.

This unusual crab species was collected from the vicinity of submarine thermal vents of the Galapagos Rift at a depth of approximately 2480 m. The crabs lack pigment in the cornea and are predominantly white, with dark to black chelae.

References. A. B. Williams, A new crab family from the vicinity of submarine thermal vents on the Galapagos Rift (Crustacea: Decapoda: Brachyura), *Proc. Biol. Soc. Wash.*, 93(2):443–472, 1980.

Xanthidae. The carapace is almost always broader than long and transversely oval, hexagonal, subrectangular, or only rarely subcircular. The orbits are complete. The first antennae fold slanting or transversely. The carpus of the third maxillipeds articulates at or near the anteromedial angle of the merus. The third maxillipeds do not cover the anterior margin of the buccal cavity. The fingers of the chelae are almost always black. The male genital opening is coxal or sternal in location, whereas the female genital opening is always sternal. [See illustration page 320.]

The mud crabs occur in virtually all marine habitats, and some species (for example, *Rhithropanopeus harrisi*) extend into freshwater. Although the name implies a mud habitat, xanthids are perhaps most common on tropical reefs. In fact the "trapezia" group are all obligate symbionts of corals.

This is the largest family of crabs and probably consists of more than 100 genera and 1000 species. The family is a heterogeneous assemblage that has been divided into a number of either families or subfamilies. There appear to be at least 6 major groups within the family: the Carpiliinae, Menippinae, Pilumninae, Panopeinae, Trapeziinae, and Xanthinae.

References. D. Guinot, Crustacés Décapodes Brachyours (Xanthidae) des campagnes de la *Cabyso* en Mer Rouge (1952), dans le Golfe Persique et à l'île Aldabra (1954), *Mem. Mus. Nat. Hist. Natur. Paris*, ser. Z, Zool., 32(1): 1–108, 1964; M. J. Rathbun, The cancroid crabs of America of the families Euryalidae, Portunidae, Atelecyclidae, Cancridae and Xanthidae, *U.S. Nat. Mus. Bull.*, 152:1–609, 1930.

Platyxanthidae. The carapace is wider than long, with a very narrow interorbital area. The angle of the posterior and anterior lateral margins is marked by a distinct tooth, and the anterolateral margins may be armed with blunt teeth or not. The regions of the carapace are indistinct. The chelipeds, especially in the male, are large and robust. The walking legs are short and heavy. The basal antennal article does not extend beyond the anterior margin of the carapace. The medial margin of the merus of the third maxillipeds is arcuate. The gonopods are simple and armed with both large and minute spines distally.

This family of xanthoid crabs consists of 3 genera and approximately 5 species. Members of the platyxanthids (*Platyxanthus*, *Pelaeus*, and *Homalaspis*) tend to be large, having carapace widths exceeding 50 mm, and some species are eaten regularly by humans. The family occurs in southern South America.

References. D. Guinot, Recherches préliminaires sur les groupements naturels chez les Crustacés Décapodes Brachy-

ours, IV: Observations sur quelques genres des Xanthidae, *Bull. Mus. Nat. Hist. Natur. Paris*, ser. 2, 39(4)(1967): 695–727, 1968.

Goneplacidae. The carapace is rectangular, not transversely oval, with the sides more or less parallel. The orbits are not clearly divided into two fossae. The palp of the third maxillipeds articulates at or near the anterointernal angle of the merus; the exognath is of normal size, and not concealed. The gonopores of the male usually perforate the base of the last pair of legs, often passing through a groove into the sternum.

This family of brachyuran crabs is represented by 54 genera and 70 species. The carapace width of most species ranges from 15 to 29 mm. Members of the family are bottom dwellers, inhabiting shallow to deep depths. *Frevillea hirsuta* occurs from North Carolina to Brazil in 80–160 m.

References. M. J. Rathbun, The grapsoid crabs of America, *U.S. Nat. Mus. Bull.*, 97:1–461, 1918.

Hexapodidae. The carapace is wider than long, with rounded lateral margins and a narrow front. The male abdomen does not cover the sternum at the base of the fourth pereopods. The male gonoducts open on the sternum. The fifth pair of pereopods are absent.

This family of xanthoid crabs has at least 5 genera and approximately 13 species. This family is very similar in appearance to both the Goneplacidae and Pinnotheridae. Although the habits of most species are unknown, at least some are known to live in the tubes of annelids and on hydroids.

References. J. J. Tesch, Goneplacidae and Pinnotheridae, *Siboga Exped.*, Decapoda F., 27:149–296 [cited as Monogr. 39^{ct}], 1918.

Belliidae. A family of brachyrhynchous crabs consisting of 4 genera and 7 species. The morphological diversity among the 4 genera makes simple diagnosis difficult, but the evidence presented by D. Guinot suggests that the genera are related. The morphological differences seem to be the result of adaptations to different habitats. *Bellia* and *Corystoides* have the carapace length greater than the width, slightly spooned dactyli on the walking legs, and elongated third maxillipeds, all apparently adaptations to a burrowing habit. In contrast, *Acanthocyclus* and *Heterozius* have the carapace wider than long, acute dactyli on the walking legs, and subrectangular third maxillipeds, and species in these genera apparently do not burrow. In all genera the antennae are greatly reduced and form a portion of the reduced orbits, the locking mechanism of the male abdomen is located on the fifth sternal segment, and the male gonopod is simple and robust.

Species in the family range in size from about 55 mm in carapace length in *Bellia picta* to about 12 mm in species of the other genera. Representatives in the family occur in southern South America (Peru, Chile, Paraguay) and New Zealand.

References. D. Guinot, Constitution de quelques groupes naturels chez les Crustacés Décapodes Brachyours, I: La superfamille des Bellioidea et trois sous-famille de Xanthidae (Polydectinae Dana, Trichiinae de Haan, Actaeinae Alcock), *Mem. Mus. Nat. Hist. Natur. Paris*, ser. A, Zool., 97:1–308, 1976.

Grapsidae. The carapace is usually quadrilateral, with the front wide and the sides generally straight or slightly

arched. The orbits are located at or near the anterolateral angle of the carapace. The buccal cavity is generally square, with a gap between the third maxillipeds. The palp of the third maxilliped articulates either at the anteroexternal angle or at the middle of the anterior border of the merus; the exognath is either very slender or very broad. The interantennular septum is very broad. The male genital openings are sternal. [See illustration page 318.]

This large family of brachyuran crabs consists of 40 genera and approximately 340 species. Members are usually marine littoral, living among rocks and driftwood. Species also occur in estuaries, marshes, and rivers. The majority of species occur in the tropics, where some species of *Sesarma* have become terrestrial.

References. M. J. Rathbun, The grapsoid crabs of America, *U.S. Nat. Mus. Bull.*, 97:1-461, 1918.

Gecarcinidae. The carapace is transversely oval, with the anterolateral borders strongly arched. The antennular fossae are narrow. The palp of the third maxilliped articulates either at the anteroexternal angle or at the middle of the anterior border of the merus, sometimes hidden by the merus. The male genital openings are sternal. [See illustration page 319.]

This terrestrial family of brachyuran crabs is represented by 6 genera and approximately 20 species. Members enter the sea during reproductive periods. All are omnivorous, inhabiting burrows throughout tropical America, West Africa, and the Indo-Pacific. *Cardisoma guanhummi*, weighing about 500 g, and having a carapace width of 11 cm, inhabits the tide level to 8 km inland.

References. M. J. Rathbun, The grapsoid crabs of America, *U.S. Nat. Mus. Bull.*, 97:1-461, 1918.

Mictyridae. A small family of brachyuran crabs represented by a single genus, *Mictyris*, with relatively few species. The carapace is elongate and globular, with the cervical and cardiobranchial grooves well defined. The orbits are small and indistinct. The basal article of the antennules is large and exposed, while the flagellum is rudimentary and concealed beneath the front. The antennae are small but well developed. The buccal field is very large and oval in outline. The third maxillipeds are very large and foliose. The chelipeds are elongate and slender. The walking legs are compressed, with the first pair the longest. The male genital openings are sternal.

Members of the family are called soldier crabs for their habit of walking in large numbers in close formation at low tide. Most members of the family, if disturbed, will bury themselves in soft sand or mud. The few described species all occur in the Indo-Pacific from China and Australia to Andaman Islands.

References. A. Alcock, Materials for a carcinological fauna of India, No. 6: The Brachyura Catometropa or Grapsoidea, *J. Asiatic Soc. Bengal*, 69-2:280-456, 1900.

Pinnotheridae. The carapace is often weakly calcified and membranous, with the regions often indistinct. The anterolateral margins are entire or very slightly dentate. The buccal field is wide. The orbits and eyestalks are small. The merus of the third maxilliped is wide; the palp is never at the anterinternal angle. The pereopods may be weak and poorly developed, or strong and well developed. The male abdomen is very narrow. [See illustration page 320.]

This curious family of brachyuran crabs is represented by 26 genera and 222 species. Members are called pea crabs owing to their occurring as commensals or parasites of bi-

valves, worm tubes, oysters, and echinoderms. The carapace width varies from 1.4 to 15 mm. Free-living and migratory stages are often taken in open water. Species of *Pinnixia* are found in pairs in *Chaetopterus* tubes on the western shores of the North Atlantic.

References. M. J. Rathbun, The grapsoid crabs of America, *U.S. Nat. Mus. Bull.*, 97:1-461, 1918.

Potamidae. The carapace is usually broader than long, with well-defined regions. The anterolateral margins are usually arcuate, and range from being almost smooth to strongly toothed. The mandibular palp has three segments, the terminal one being undivided. The ultimate segment of the male gonopod is tapered and acute; it is shorter than the penultimate segment and directed laterally.

This is an Old World family of freshwater crabs consisting of 2 subfamilies, 9 genera, and 66 species. The subfamily Potaminae occurs in Europe, western Asia, and the Himalayas; the subfamily Potamiscinae occurs in Nepal and along the northern coast of India.

References. R. Bott, Die Susswasserkrabben von Europa, Asien, Australien und ihre Stammesgeschichte, *Abh. Senkenberg. Naturf. Ges.*, 526:1-338, 1970.

Deckenidae. Old World family of freshwater crabs consisting of a single genus, *Deckenia*, and 3 species. The carapace is slightly broader than long, with the dorsal regions indistinctly indicated. The efferent branchial canals are extremely elongated, similar to those found in some oxystomatous crabs.

Two species of *Deckenia* occur along the eastern coast of Africa, while a third is known from the Seychelles.

References. M. J. Rathbun, Les crabes d'eau douce (Potamonidae), *Nowv. Arch. Mus. Hist. Natur. Paris*, ser. 4, 8: 33-122, 1906.

Isolapotamidae. The carapace is broader than long, with the regions indistinctly indicated. The anterolateral margins are arcuate and weakly to strongly serrate. The male gonopod has the terminal section distinct from the basal section, with the distal end truncate and oblique; it is often expanded basally, and sometimes the terminal segment is longer than the basal.

This Old World family of freshwater crabs consists of 3 genera (*Isolapotamon*, *Nanhaipotamon*, and *Malayopotamon*) and approximately 17 species. Species are known from Sumatra, Java, Borneo, the Philippines, Formosa, Hainan (China), and neighboring regions.

References. R. Bott, Potamiden aus Sud-Asien (Crustacea, Decapoda), *Senkenberg. Biol.*, 49(2):119-130, 1968.

Potamonautidae. The carapace tends to be broader than long; the protogastric and epigastric regions are continuous. There is a distinct postfrontal crest, which is usually strong and continuous across the dorsal surface of the carapace. There is one, two, or rarely three anterolateral teeth posterior to the outer orbital angle. The mandibular palp has two segments.

This Old World family of freshwater crabs consists of 3 genera (*Sinopotamon*, *Parapotamon*, and *Candidiopotamon*) and approximately 60 species. The Potamonautidae occur only in Africa. The approximately 51 species of *Potamonautes* are widely distributed; *Sudamonautes*, with 8 species, and *Liberonautes*, with 1 species, occur in West Africa.

References. R. Bott, Die Susswasserkrabben von Afrika (Crust., Decap.) und ihre Stammesgeschichte, *Ann. Mus. Roy. Congo Belge, C-Zool.*, ser. 3, 1(3):209-349, 1955.

Sinopotamidae. The carapace is usually wider than long, with well-defined regions. The terminal portion of the male gonopod is bent medially; it is very short and blunt.

This Old World family of freshwater crabs consists of 3 genera and about 11 species in Burma and China.

References. R. Bott, Die Süsswasserkrabben von Europa, Asien, Australien und ihre Stammesgeschichte, *Abh. Senkenberg. Naturf. Ges.*, 526:1–338, 1970.

Trichodactylidae. The carapace tends to be subcircular to slightly wider than long. The regions are not clearly defined. The efferent branchial canal is not prolonged beyond the anterior border of the carapace. The merus of the third maxillipeds is much longer than wide, and this distinguishes this family from other freshwater crabs.

This is a family of New World freshwater crabs consisting of approximately 3 genera and 35 species. *Trichodactylus*, *Dilocarcinus*, and *Valdivia* occur in the New World tropics. A few species of *Trichodactylus* are known from Central America (2 from Mexico and 1 from Nicaragua), while the remaining trichodactylids occur in the Atlantic drainages of South America.

References. M. J. Rathbun, Les crabes d'eau douce (Potamonidae), *Nouv. Arch. Mus. Hist. Natur. Paris*, ser. 4, 8: 33–122, 1906.

Pseudothelphusidae. The carapace is flat, with the regions not clearly defined. The antennules are folded laterally, and the base of the antenna forms a portion of the orbit. The mandibular palp is biramous. The male gonopod is twisted around on itself.

This family of New World freshwater crabs consists of 4 genera and approximately 25 species and subspecies. *Pseudothelphusa*, *Spirothelphusa*, and *Epithelphusa* occur in Mexico and Central America, and *Epilobocera* occurs in the West Indies. All species have direct development and varying degrees of parental care. Some of the species are known to stridulate using the mouthparts. Some species are known hosts of lung flukes.

References. G. Pretzmann, Die Pseudothelphusidae (Crustacea Brachyura), *Zoologica* (Stuttgart), 42:1–182, 1972.

Potamocarcinidae. The carapace is broader than long, with the regions defined. The anterolateral margins are arcuate and weakly serrate or strongly toothed. The furca of the gonopods is straight or set perpendicular to the main axis. [See illustration page 319.]

This is a New World family of freshwater crabs closely related to the pseudothelphusids; there are 11 genera and approximately 116 species and subspecies. Potamocarcinids occur in Central and South America. There is some disagreement as to the status of this family, since some authors would unite the pseudothelphusids and potamocarcinids into a single family.

References. M. J. Rathbun, Les crabes d'eau douce (Potamonidae), *Nouv. Arch. Mus. Hist. Natur. Paris*, ser. 4, 7: 159–321, 1905.

Gecarcinucidae. The carapace is slightly to distinctly wider than long. The anterolateral margins may be arcuate and smooth or armed with teeth. The frontal region is straight, not triangular, and little, if any, wider than the orbit. The chelipeds are dimorphic and robust. The last segment of the mandibular palp has a cleft. The male gonopod has four segments, the ultimate and penultimate usually separated but sometimes fused.

This is an Old World family of freshwater crabs consisting of 3 subfamilies, about 14 genera, and approximately 50 species. The subfamily Blobonautinae occurs in West Africa, the Gecarcinucinae in West Africa and India, and the Liotelphusinae in Burma, Borneo, and India.

References. R. Bott, Die Süsswasserkrabben von Europa, Asien, Australien und ihre Stammesgeschichte, *Abh. Senkenberg. Naturf. Ges.*, 526:1–338, 1970.

Sundathelphusidae. These are medium-sized (with a carapace breadth of approximately 50 mm) crabs, with the carapace broader than long. The anterolateral margins are arcuate with oblique striae. The frontal region is indistinctly triangular, the upper border slight or absent. The terminal segment of the male gonopod is short and not fused.

This is an Old World family of freshwater crabs consisting of 9 genera and about 40 species. Sundathelphusids occur in Sri Lanka, Sumatra, Java, southern Borneo, New Guinea, and northern Australia.

References. R. Bott, Die Süsswasserkrabben von Europa, Asien, Australien und ihre Stammesgeschichte, *Abh. Senkenberg. Naturf. Ges.*, 526:1–338, 1970.

Parathelphusidae. Parathelphusids are fairly large crabs, with strongly toothed anterolateral margins. The last segment of the mandibular palp is deeply cleft. The male gonopod is fused and usually armed with terminal spines.

This Old World family of freshwater crabs consists of 4 subfamilies, Spiralothelphusinae, Ceylonthelphusinae, Somanniathelphusinae, and Parathelphusinae, about 12 genera, and approximately 38 species. They occur along the eastern coast of India, southern Asia, and Malaysia.

References. R. Bott, Die Süsswasserkrabben von Europa, Asien, Australien und ihre Stammesgeschichte, *Abh. Senkenberg. Naturf. Ges.*, 526:1–338, 1970.

Ocypodidae. The front of the carapace is usually of moderate width. There is often a somewhat deflexed narrow lobe present from the middle of the frontal region extending to the epistome. The orbits occupy almost the entire anterior border of the carapace. The buccal field is usually large and somewhat narrower in the front than the behind. The third maxilliped has a palp and articulates at or near the antero-external angle of the merus; the exognath generally is slender and often concealed. The abdomen of the male is narrow. The male genital openings are sternal. [See illustration page 319.]

This is a semiterrestrial family of brachyuran crabs represented by 19 genera and 231 species. Most species are amphibious, inhabiting intertidal regions and estuaries. The familiar genus *Uca* (fiddler crabs), with a carapace width ranging from 0.8 to 3.5 cm, contains over 65 species which are found predominantly in warm and tropical seas.

References. M. J. Rathbun, The grapsoid crabs of America, *U.S. Nat. Mus. Bull.*, 97:1–461, 1918.

Retroplumidae. Small family containing the single genus *Retropluma* and 5 species. The carapace is transversely oval and flat, with oblique crests. The front is narrow, with the antennular fossae indistinct. The antennal flagella are long, and the third maxillipeds are slender and subpediform and do not cover the buccal area. The abdomen of the male is narrow. The last pair of pereopods are rudimentary and dorsal, with the last segment of the sternum also rudimentary. The male gonopores open on the coxae of the fifth pereopods with sternal ducts. The female gonopores are sternal on the third pereopods. Species occur only in the

Indian Ocean at a depth of 200–500 m.

References. A. Alcock, Materials for a carcinological fauna of India, No. 6: The Brachyura Catometopa or Grapsoidea, *J. Asiatic Soc. Bengal*, 69–2:280–456, 1900.

Palicidae. The carapace is broadly transverse and subquadri-lateral, with the anterolateral margin dentate. The orbits and eyes are large. The third maxillipeds do not cover the buccal cavity, and the ischium is produced forward on the inner side; the merus is small and subtriangular, and has a notch on the inner distal side for articulation of the palp. The chelipeds are of moderate size; the second to fourth peraeopods are long and slender, with the fifth short and subdorsal. The female genital openings are sternal and located between the coxae of the second peraeopods; the male openings are sternal.

This is a primitive family of brachyuran crabs consisting of 3 genera (*Pleurophricus*, *Palicus*, and *Crossotonotus*) and approximately 39 species. Members occur on *Sargassum*, rock pilings, mangrove roots, and sand shores. *Palicus alternatus*, with a carapace width of 9 mm, is found from North Carolina to the western coast of Florida, in depths ranging from 2 to 30 m.

References. M. J. Rathbun, The grapsoid crabs of America, *U.S. Nat. Mus. Bull.*, 97:1–461, 1918.

Hapalocarcinidae. The carapace is elongate-convex and narrow. The front is usually emarginate, without a central tooth. The antennules are not retractile into sockets. The third maxillipeds are separated at the base by a sternal lobe. The ischium is broad, and the merus is small, with the palp articulating in a notch. The chelipeds are weak, and the peraeopods are similar, with short, hooked claws for strong adhesion. The body is somewhat oblong. [See illustration page 318.]

This is a curious family of brachyuran crabs represented by 8 genera and 27 species. Members are found living among corals producing "galls" on the branches. The female gall crab settles in the axils of young coral branches, and its activities cause the coral to grow up and around enclosing the crab in a purse-shaped gall. *Hapalocarcinus marsupialis* is common on 3 genera of pocilloporid corals and occurs from the Red Sea across to the eastern Pacific. The carapace length ranges from about 1.2 to 5.5 mm. Most species in the family occur in the Indo-West Pacific Region.

References. P. Castro, Brachyuran crabs symbiotic with Scleractinian corals: A review of their biology, *Micronesia*, 12(1):99–110, 1976; A. Fitz and R. Serene, Les Hapalocarcinides du Viet-Nam, *Arch. Mus. Hist. Natur. Paris*, (7)5: 3–202, 1957.

UNIRAMIA

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Subphylum of arthropods with mandibles and one pair of antennae. Included here are Insecta, Chilopoda, Symphyla, Diplopoda, and Pauropoda. These were until recently, together with the Crustacea, considered part of the subphylum Mandibulata.

S. M. Manton, considering arthropods polyphyletic, established the phyla Uniramia, Chelicerata, and Crustacea. This is controversial since distinct ancestral polychaetes more closely related to each of these taxa are unknown. Manton includes Onychophora, Myriapoda, and Insecta in the Uniramia. Also, since in zoological nomenclature a name change is not required when a taxon is removed or added (if a type taxon has been designated), the name Uniramia may be considered a synonym of Mandibulata. There is good evidence for removing Crustacea from the Mandibulata and placing them closer to the Chelicerata. Onychophora are here considered a separate phylum.

All Uniramia have unbranched (uniramous) limbs. Mandibles are believed to be formed from a whole limb which

bites with the tip. Mandibles bite transversely. All Uniramia have a sclerotized, hard head capsule with tentorial apodemes forming the endoskeleton. The Myriapoda include the dignathan Pauropoda and Diplopoda, having mandibles and one pair of maxillae, which in the Diplopoda form the platelike gnathochilarium; the Chilopoda, Symphyla, and Insecta are trignathan, having mandibles and two pairs of maxillae. Insecta have preoral unjointed mandibles and two pairs of maxillae, the second pair fused into a labium.

The groups included in the Uniramia are worldwide and mainly terrestrial, with some freshwater but very few marine representatives. A broad size range extends from tiny beetles, 0.25-mm body lengths, to giant walking sticks, 33-cm body length, and the Atlas moth of India, with 30-cm wingspan.

References. R. R. Hessler and W. A. Newman, A trilobitomorphic origin for the Crustacea, *Fossils and Strata*, 4: 437–459, 1975; S. M. Manton, *The Arthropoda*, Clarendon Press, Oxford, 1978.

INSECTA

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This class of arthropods contains such overwhelming variety that virtually every statement meant to define the characteristics of the taxon must admit important exceptions. With this in mind, the adult, imago, or reproductive stage of insects can be characterized as generally having a tracheate respiratory system, a single pair of antennae, and the body somites grouped into three functional tagmata: the head, thorax, and abdomen.

The head is thought to consist of an acron (=prostomium) fused together indistinguishably with six following somites, although the details, and even the number of somites, are still the subject of much dispute. A pair of compound, faceted eyes and a triad (or pair) of ocelli

apparently belong to the acron and its neuromere, the archicerebrum. The first somite bears the labrum, a single shield derived from former paired appendages; its neuromere is the prosocerebrum (archicerebrum + prosocerebrum = protocerebrum of textbooks). The second somite bears the pair of multisegmented antennae, with a neuromere represented by the deutocerebrum. (The antennae differ from those of other arthropods in lacking intrinsic muscles beyond the basal segment, or scape.) The third somite forms the "intercalary segment," which has lost its appendages; its neuromere is the tritocerebrum, through which the esophagus passes from the mouth. The last three somites of the head (fourth, fifth, and sixth in this interpre-