

FIGURE 77.—*Scyllarides nodifer* (Stimpson). Female in dorsal view, approximately $\times 0.5$. Bob Simpson photo.

distally becoming fine near edge. Uropods broad, sculptured as telson. Sternum of second segment in males bearing a sharply raised, serrate, heavily sclerotized ridge.

Measurements.—Length of carapace: female, 127 mm. Larger specimens have been observed but not measured.

Variations.—Smaller specimens are smoother than adults.

Color.—Body covered with irregular small brown spots on a grayish brown to yellowish background; many orange-red tubercles on edges, across ridge near rear edge of carapace, base and edges of antennal lobes; darker red spots at sides of gastric region, on anterior lobes of carapace and at middle of first abdominal segment; underparts yellow with darker yellow and brown spots; legs banded with red and purple; flagella of antennules purple.

Habitat.—Mud, shell, coral, and sandy bottoms; 16 to 40 fathoms.

Type locality.—Florida Keys.

Known range.—Bermuda; Cape Lookout, N.C., to Cuba; off Pensacola, Fla.

Remarks.—Little is known of these lobsters. They are sometimes used for food or bait.

Superfamily **Thalassinidea**

Exoskeleton often more or less membranous. Carapace compressed. Last articles of second to fourth legs not curved and flattened. Abdomen large, symmetrical, extended, sometimes with well-developed pleura; appendages of sixth segment usually adapted for swimming.

Family **Callianassidae**

Body shrimplike. Carapace with a "*linea thalassinica*." Antennal peduncle five-jointed;

antennal scale vestigial, no antennal acicle. First pair of legs unequal or subequal, perfectly or imperfectly chelate; third and fourth pairs simple; others variable. Abdomen extended; pleura small or absent; sixth abdominal appendages with no sutures; tail fan well developed; broad appendages on third to sixth abdominal segments (after Hay and Shore, 1918; Schmitt, 1921).

KEY TO GENERA AND SPECIES IN THE CAROLINAS

- a. Rostrum small; first two pairs of pleopods different from following three pairs; chelipeds dissimilar and unequal.....*Callianassa* (p. 100).
- b. Uropodal endopods narrow, about 4 times longer than broad.....*C. major* (p. 100).
- bb. Uropodal endopods not much longer than broad.....*C. atlantica* (p. 102).
- aa. Rostrum large; second pair of pleopods like following three pairs; chelipeds alike and subequal.....*Upogebia affinis* (p. 103).

Genus *Callianassa* [Leach, 1814]

Leach, [1814], p. 400.—Hemming, 1958b, p. 142.

The genus *Callianassa* has a fossil record extending back to the Jurassic (Rathbun, 1926).

Subgenus *Callichirus* Stimpson, 1866

Stimpson, 1866, p. 47.

***Callianassa (Callichirus) major* Say**

Figure 78

Callianassa major Say, 1818, p. 238.—Schmitt, 1935b (rev.).
Callichirus major: Hay and Shore, 1918, p. 407, pl. 29, fig. 10.—
 de Man, 1928, p. 30 (rev.).

Recognition characters.—Integument more or less thin and membranous; chelipeds and an oval plate covering anterior three-fourths of carapace, being most hardened portions. Rostrum minute, somewhat obtuse; a similar projecting lobe at each side on margin of front. Cornea of eyes minute, situated at about middle of outer margin of flattened and pointed ocular peduncles. Antennular peduncles about two-thirds as long as carapace, stout, densely hairy below; each with two flagella about as long as distal article of peduncle. Antenna slender, longer than carapace, peduncle bent between second and third article.

Chelipeds unequal, showing sexual dimorphism. Males with major cheliped rather large; granular along proximal lower edge of carpus, lower edge of merus and over entire ischium; propodus and carpus about equal in length, twice as broad as merus and more than three times as broad as

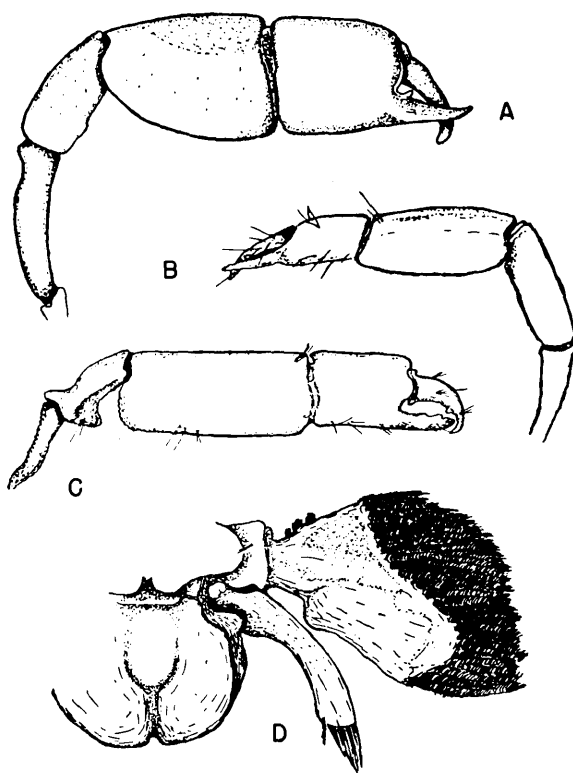


FIGURE 78.—*Callianassa (Callichirus) major* Say. A, major cheliped of female, approximately $\times 2$; B, minor cheliped of male, approximately $\times 2$; C, major cheliped of male, approximately life size; D, right uropod and portion of telson in dorsal view, approximately $\times 3$ (after Lunz, 1937b).

ischium; merus with a strong tooth on lower proximal border; fingers strong, dactyl hooking over outside fixed finger, a strong tooth near base. Major cheliped of female weaker, not granular; propodus and carpus proportionately shorter than in male; merus without tooth on lower proximal border; dactyl hooking over inside fixed finger. Minor cheliped of male and female similar, small; fingers weak, meeting only at tips; carpus as long as hand and somewhat wider. Chelipeds and first three pairs of walking legs much compressed; margins of distal articles on first two pairs especially sharp; first walking legs chelate, with long cilia on lower margin; second legs with propodus transverse, it and small triangular dactyl densely ciliate; third and fourth walking legs with last two articles hairy, last legs subcylindrical.

Abdomen long, gradually widening from anterior end to third segment, then narrowing

slightly to sixth; sixth segment deeply grooved above. First two pleopods small and slender in male, larger and definitely biramous in female; remaining pleopods broad and overlapping. Uropods with exopod broad, rounded distally; distal half covered with mat of dense short hair becoming longer on border; endopod narrow, obliquely truncate, hairy at tip only. Telson with an inflated area on each side giving notched or fissured appearance.

Measurements.—Length of body: males, 95 mm.; females, 92 mm.; ovigerous females, 80 mm. (Lunz, 1937b).

Color.—Transparent gray except for porcelain white chelipeds and hardened portion of carapace (Lunz, 1937b).

Habitat.—Burrows in sandy shores on or near open ocean; intertidal zone to 1 fathom.

Type locality.—Coasts of Southern States and east Florida [St. Johns River].

Known range.—Beaufort Inlet, N.C., to eastern Florida; Grand Terre Island to Timbalier Island, La.

Remarks.—For many years this species was known only from a single specimen from Beaufort, N.C., and early descriptions of specimens from South Carolina and Florida. The rarity of occurrence in collections is due to the secretive burrowing habits of the form, for it easily escapes detection of the casual observer using conventional methods of collection. (Collections can be made by removing the mouth of the burrow, dropping pebbles or debris down the hole, waiting for the animal to appear at the exposed surface, then jabbing a shovel into the sand below the animal, thus cutting off escape into the burrow.) Such habits no doubt also enhance chances for fossilization, for the genus is abundant in the Cretaceous and Eocene of the Gulf coastal plain, and somewhat less abundant in later deposits down to the present time (Rathbun, 1935).

Lunz (1937b) was the first recent student to determine the habitat and abundance of the species in South Carolina and his studies were closely followed by those of Willis (1942) in Louisiana, and Pearse, Humm, and Wharton (1942), and Pohl (1946) in North Carolina.

The animal lives in deep burrows on sandy beaches that either face the open ocean or are close to it. In Louisiana, the burrows occupy a

band from the intertidal zone to a distance of over 100 feet from shore in 5 to 6 feet of water. The tubular burrows, usually vertical to the surface, are divided into three portions. The mouth, about 5 mm. in diameter, opens into the upper portion, 5 to 20 cm. long and 5 to 8 mm. in diameter. From this the middle portion, 10 to 15 cm. long and often angled, widens gradually to approximately 20 mm. The third portion, 20 mm. wide, is the longest. An approximate average depth of the whole burrow is 146 cm. with variations from 60 to over 210 cm. Branches are common and arise most often from the middle portion. Characteristically, the burrows are lined with a brown material, thinnest in the upper portion and thickest (3 to 7 mm.) in the lower portion. The burrows often end in an enlarged pocket lined with crushed shell, and in some the lined tube extends below the pocket.

Burrow mouths are often surrounded by fecal pellets of *C. major*, which resist rapid disintegration in water. On some South Carolina beaches, such pellets were washed together in patches measuring up to 10 by 50 feet and piled to a depth of 0.25 inch. Mouths of burrows are not uniformly scattered but tend to be clumped in patches or tracts, often as dense as three or four openings per square foot. Chimneylike structures at the mouths of burrows noted by Say have not been confirmed, but a small raised ridge of sand often surrounds burrow mouths. Other mouths are not marked or may be located in a depression.

In captivity, the animals burrow in sand headfirst with the anterior appendages until a shallow pit is constructed, then the animals reverse themselves and continue to burrow tailfirst. Though the shrimp do at times emerge voluntarily from their burrows, such behavior is probably infrequent and may be confined to the breeding season (Lunz, 1937b). The species is well fitted for a fossorial life by virtue of the slender, elongate body, thin exoskeleton, and flattened hairy appendages adapted for burrowing, carrying sand, sifting food, and pumping water for feeding and respiratory currents. Examination of gut contents has shown an amorphous mass containing sand grains, diatoms and other algae, and many bacteria.

Ovigerous females have been reported from South Carolina in July and August, and they are

known from North Carolina in June and July. Pohl (1946) counted 8,170 attached eggs on one female. *Pinnixa cristata* has been found as a commensal in the burrows.

***Callianassa (Callichirus) atlantica* Rathbun**

Figure 79

Callianassa stimpsoni Smith, 1873c, p. 549, pl. 2, fig. 8.—Hay and Shore, 1918, p. 406, pl. 29, fig. 5.

Callianassa atlantica Rathbun, 1926, p. 107.—de Man, 1928, p. 37 (rev.).—Rathbun, 1935, p. 104.—Schmitt, 1935b, p. 4.

Recognition characters.—Integument smooth, shining, thin, almost membranous. Carapace about one-third length of abdomen, thin but with oval thickened plate on gastric region. Rostrum small, acute, flanked by a small triangular prominence at each side on frontal margin. Eyestalks small, flat, contiguous medially; pointed tips slender, curved outward and upward; cornea small, situated on outer border. Antennular peduncles about one-half length of carapace; flagella about as long as distal article of peduncle, densely hairy below. Antenna slender, longer than carapace; peduncle much shorter than that of antennules, bent between second and third articles. Third maxilliped operculiform; dactyl slender.

Chelipeds unequal, showing sexual dimorphism. Larger cheliped of male with fingers about equal in length, hairy, tips incurved; cutting edge of dactyl with a long, low, truncate tooth at base, smaller teeth distally; immovable finger with small teeth; palm hairy below, upper border ridged along proximal two-thirds; carpus as wide as but shorter than palm, upper and lower border ridged; merus articulating with carpus by extreme upper angle, a prominent, denticulate tooth on lower border proximally; ischium with six or seven subacute teeth on lower border. Smaller cheliped of male with fingers a little longer than palm; carpus four times as long as broad distally, a little longer than palm, half again as long as merus; merus twice as broad as long. Larger cheliped of female less toothed than in male; smaller cheliped as in male.

Abdomen with third to fifth segments of about equal width, each with a small patch of fine hairs on posterolateral angle; sixth segment broader than long. Male with no pleopods on first and second segments. Female with uniramous pleopods on first segment; slender, biramous pleopods on second segment; remainder well developed in

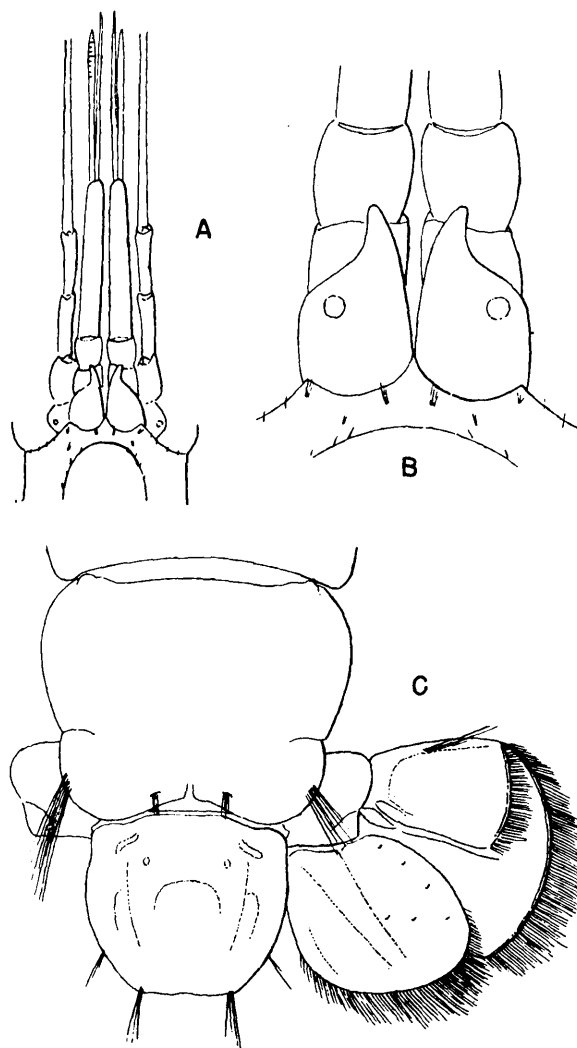


FIGURE 79.—*Callianassa (Callichirus) atlantica* Rathbun. A, frontal region in dorsal view; B, frontal region, eyestalks and antennules in dorsal view; C, sixth abdominal segment, right uropod and telson in dorsal view (after de Man, 1928).

both sexes. Telson nearly as long as broad; subtruncate distally, corners rounded. Exopods of uropods broader than endopods, both rami densely fringed with hairs distally.

Measurements.—Length of body: male, 59 mm.; female, 68 mm.

Habitat.—Muddy shores and bottoms in shallow water (Sumner, Osburn, and Cole, 1913a, b); shoreline to approximately 21 fathoms.

Type locality.—“Our species ranges from the coast of the Southern [United] States north to Long Island Sound” (Smith, 1873c).

Known range.—Bass River, Nova Scotia, to South Carolina; Franklin County, Fla.

Remarks.—Both de Man (1928) and Schmitt (1935b) pointed out that Rathbun renamed this species because the name *stimpsoni* was preoccupied by a fossil species of *Callinassa* named by Gabb in 1864. *Callinassa atlantica* itself has a fossil record extending from a first appearance in the upper Miocene of North Carolina and Virginia, and a later occurrence in the Pleistocene of Maryland to the present (Rathbun, 1935).

Ovigerous females have been taken in Massachusetts and South Carolina in July. Juveniles 4 mm. long have been collected on the surface in September in Massachusetts (de Man, 1928). This form is rarely taken in the Carolinas but has been collected in areas ranging from salty estuaries to offshore fishing banks.

Genus *Upogebia* [Leach, 1814]

Leach, [1814], p. 400.—Hemming, 1958b, p. 143.

Upogebia affinis (Say)

Figure 80

Gebia affinis Say, 1818, p. 241.

Upogebia affinis: Hay and Shore, 1918, p. 408, pl. 29, fig. 9.—Schmitt, 1935a, p. 196 (rev.).

Recognition characters.—Integument, except dorsal part of carapace and of legs, more or less membranous. Carapace about half as long as abdomen; cephalic portion about twice as long as thoracic, nearly flat above, anteriorly rugose and covered with short, rigid hairs. Rostrum large, flanked on each side at base by a large spine, spiny beneath in midline. A small upcurved spine behind eye on anterior margin, and a minute lateral spine behind cervical groove. Eyestalks concealed, pubescent above; corneal surface small. Antenna a little less than twice as long as carapace.

Chelipeds stout, a fringe of long hairs below; hands with an external, dentate ridge above, a median row of acute spines and an internal line of stiff hairs; immovable finger curved, movable finger much longer, denticulate above at base, cutting edges of both toothed near base; carpus grooved on outer face with a row of small spines and a strong marginal spine below, a row of small teeth on inner margin, and six acute spines along distal margin above; merus with a small spine above and a row of spines beneath. First pair of

walking legs hairy at tips and along lower margin; merus with a strong spine at base. Remaining legs hairy at tips.

Abdomen gradually increasing in width from first to fourth segment, fifth narrower posteriorly, sixth subquadrate; lateral portions of third and fourth segments densely pubescent and all with pleura marked off by an impressed line. Tail fan densely hairy distally. Uropodal endopods truncate and with a median rib and costate outer border; exopods rounded distally and with two ridges. Telson broad, subquadrate, with an impressed median line.

Measurements.—Length of body: males, 61 mm.; females, 63 mm.

Variations.—Schmitt (1935b) mentioned the variability in spination of the lower border of the rostrum and multiple spination or lack of spines behind the cervical groove. Young specimens often lack these spines.

Color.—Gray, blue, or yellowish gray dorsally, tinged with light blue medially on tail fan and on fifth segment of abdomen, interlaced with uniform light lines; an oblique blue spot on side of

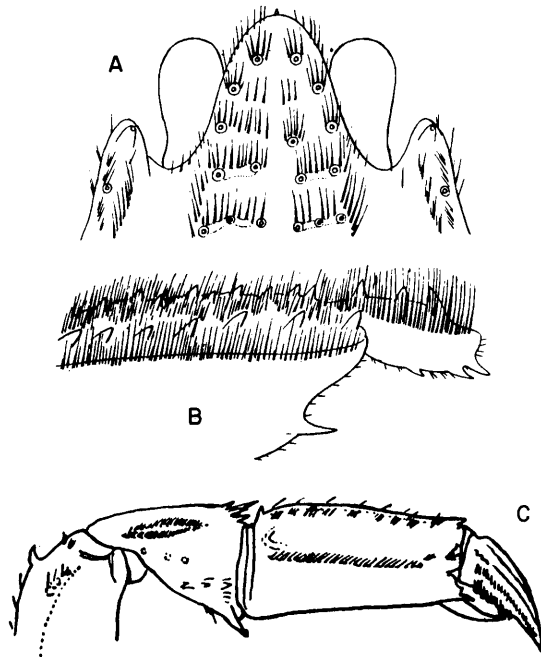


FIGURE 80.—*Upogebia affinis* (Say). A, rostral region and eyes of semiadult female in dorsal view; B, rostral region of semiadult female in lateral view; C, major chela (after de Man, 1927).

carapace at base of antenna extending postero-dorsally; underparts light (various authors).

Habitat.—Burrows on estuarine mud flats and in shallow estuaries; intertidal to 15 fathoms.

Type locality.—Georgia.

Known range.—Wellfleet, Mass., to Rockport, Tex. (Hedgpeth, 1950); through West Indies to Maceió, Alagoas, Brazil (de Man, 1927).

Remarks.—A species of *Upogebia* is known from the Eocene of Alabama (Rathbun, 1935).

Ecological notes on *U. affinis* in North Carolina were reported by Pearse (1945). The species inhabits muddy situations in estuaries where salinities are fairly high. Its burrowing habits are similar to those of *Callinassa*. Wass (1955) found burrows prevalent in Florida where the marine grass *Halodule wrightii* stabilizes muddy substrates. Burrows examined by Pearse were 30 to 50 cm. deep with openings about 30 cm. above low-tide mark. They were often branched, containing several individuals each in its own branch, and showed one to eight small openings at the surface. In communal burrows he often found two or three ovigerous females and one or two juveniles. Like the burrows of *Callinassa*, those of *U. affinis* are narrowest in the upper portion. Pearse concluded that the animals seldom leave their confines.

In captivity, *U. affinis* made only feeble attempts to burrow. In nature, however, the animals are active and pump water vigorously from the anterior to posterior end of the body by flapping movements of the pleopods. Food is apparently strained from the water by the hairy mouth parts and walking legs, and probably consists largely of organic materials swept in the water current.

Ovigerous females were studied in detail in August, though Hay and Shore (1918) pointed out that the breeding season lasts throughout the summer, and juveniles have been collected in Bogue Sound, N.C., in plankton tows from early April to late October. Fish (1925) reported larvae at Woods Hole from mid-July to the latter part of October, but they were most abundant in early August. A single female may produce about 10,000 eggs at a time. They are borne on the first four pairs of pleopods. In captivity, more zoeae were hatched at night than in daytime. Pearse cited MacGinitie (1934) for evidence that *U. affinis*, like members of the related genus *Callinassa*,

may live several years, though there is no evidence supporting this idea for the former.

Upogebia affinis is commonly parasitized in North Carolina by the bopyrid, *Pseudodione upogebiae* Hay. Pearse (1952a) described a parasitic isopod, *Phyllodurus robustus*, from a Florida specimen.

Section **Anomura**

Abdomen well developed, either symmetrical and flexed beneath thorax, exceptionally extended in a straight line usually flexed on itself, or asymmetrical, coiled and imperfectly armored, almost always with biramous appendages on sixth segment. Carapace usually depressed, free from epistome, traversed on either side in longitudinal or obliquely longitudinal direction by distinct suture (*linea anomurica*) more or less marking off side-wall of carapace from dorsal and dorsolateral portion. Last thoracic sternum free (or atrophied). First pair of legs well developed and chelate; second and third pairs well developed, not chelate; fifth pair markedly different from third.

Superfamily **Galatheidea**

Carapace more or less depressed. Abdomen relatively well developed, not closely folded beneath cephalothorax, symmetrical, and with well-developed pleura, but to some extent not capable of complete extension. Eye scales absent. Antennal peduncle with third article indistinct. Last thoracic sternum distinct. Second to fourth legs with dactyl not curved and flattened. Males with at least a pair of sexual appendages.

Family **Galatheidae**

Carapace longer than wide, often ornamented with transverse, ciliated lines. Rostrum distinct and strongly pointed, projecting beyond eyes. Antennular peduncle elongate. Antennae with four-jointed peduncle. Chelipeds greatly elongated, slender. First, second, and third walking legs well developed; fourth leg feeble, reduced in size. Abdomen bent upon itself but not folded under thorax; males with a pair of sexually modified pleopods on segment two, a pair of uniramous pleopods on segments three, four, and five; females with rudimentary pleopods on second abdominal segment, fully developed pleopods on three, four, and five.

KEY TO GENERA AND SPECIES IN THE CAROLINAS

a. Rostrum rather broad, margins toothed

Galathea rostrata (p. 105).

aa. Rostrum slender, toothless except for supraocular teeth at extreme base-----*Munida irrasa* (p. 105).

Genus *Galathea* Fabricius, 1793

Fabricius, 1793, p. 471.—Milne Edwards and Bouvier, 1897, p. 13.—Hemming, 1958b, p. 143.

Galathea rostrata Milne Edwards

Figure 81

Galathea rostrata Milne Edwards, 1880, p. 47.—Hay and Shore, 1918, p. 402, pl. 29, fig. 4 (rev.).—Chace, 1942, p. 30.

Recognition characters.—Carapace somewhat flattened; transverse ciliated ridges prominent, at least four continuous for entire width of carapace; lateral margins with a number of acute spines. Front prolonged into a broad, acute rostrum armed with four strong, anteriorly pointing spines on each side. Third maxilliped with inner margin of merus armed with three or four spines.

Chelipeds nearly twice as long as body, comparatively heavy; with rows of spines or spiniform granules along margins and appressed,

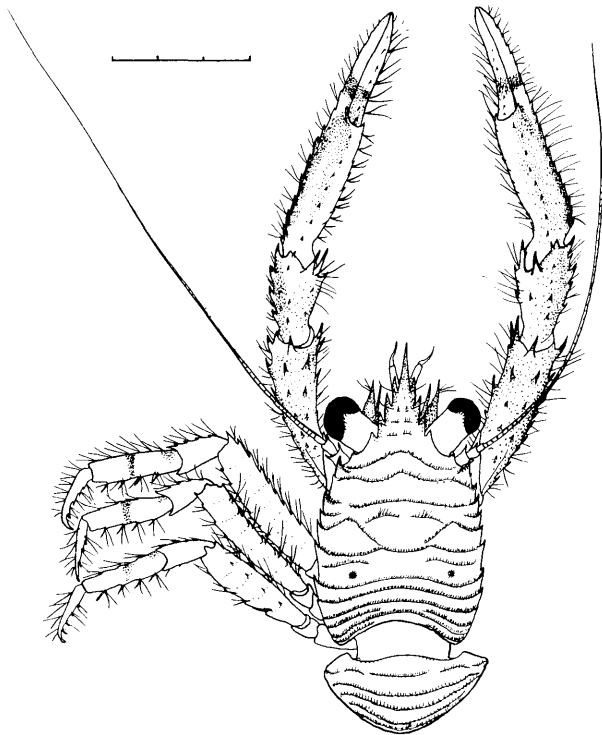


FIGURE 81.—*Galathea rostrata* Milne Edwards. Animal in dorsal view, walking legs of right side not shown, 3 mm. indicated.

squamiform, ciliated granules on surfaces; a few larger spines on carpus and distal end of merus; hand a little shorter than body; fingers gaping at base.

Abdomen with transverse striae like those on carapace but without spines.

Measurements.—Length of body: male, 18 mm.

Color.—Ground color off white, cream, and light yellow; mottled with orange and reddish orange especially on legs, less evident on body; spines red or tipped with red; a single small circular reddish spot in center of each branchial region; a white band on propodi of walking legs; distal half of fingers white (from specimen recently preserved in formalin).

Habitat.—Ten to 50 fathoms; (rarely to 1,178 fathoms south of Block Island, R.I.?).

Type locality.—Sixteen miles north of Jolbos Islands [Yucatan Peninsula] at 14 fathoms.

Known range.—Off Cape Hatteras, N.C., to off Mississippi River Delta, and Yucatan, Mexico; (Rhode Island?).

Remarks.—Reports of this species are rare in the literature and only a few specimens have been taken off Beaufort, N.C.

Ovigerous females have been reported off western Florida in March and April (Milne Edwards and Bouvier, 1897, and U.S. National Museum records).

Genus *Munida* Leach, 1820

Leach, 1820, p. 52.—Milne Edwards and Bouvier, 1897, p. 20 (rev.).

Munida irrasa Milne Edwards

Figure 82

Munida irrasa Milne Edwards, 1880, p. 49.—Hay and Shore, 1918, p. 402, pl. 28, fig. 8.—Chace, 1942, p. 46 (rev.).

Recognition characters.—Carapace narrowed anteriorly, adorned with iridescent pubescence, spiny. Rostral spine much longer than supraocular spines, latter not extending so far as cornea. A row of 10 spines across gastric region in addition to 1 or 2 on each hepatic region, 2 to 4 on each triangular area, and 1 to 4 on either side behind cervical groove on inner portion of each branchial region; anterolateral spine long, followed by 6 distinct lateral spines. Merus of third maxillipeds with three spines on lower margin.

Chelipeds three or four times as long as carapace, covered with squamiform, ciliated tubercles;

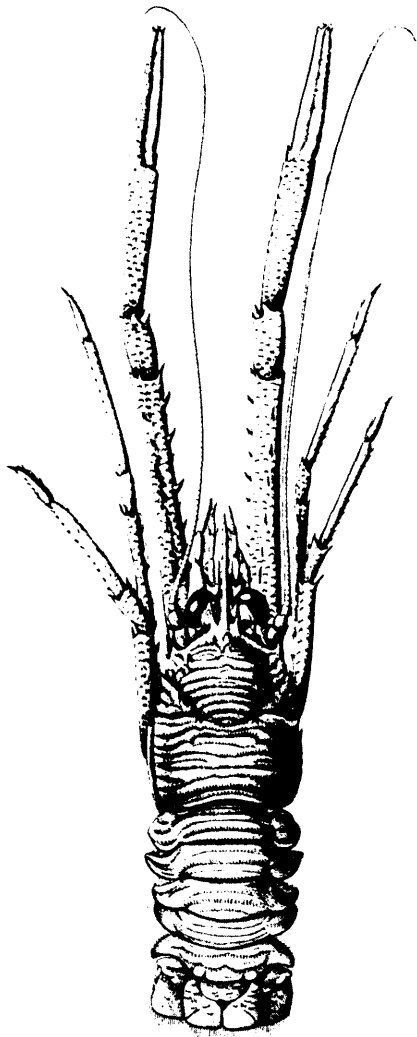


FIGURE 82.—*Munida irrasa* Milne Edwards. Animal in dorsal view (after Milne Edwards and Bouvier, 1897).

fingers agape at base; merus with rows of spines continued on carpus and hand. First pair of walking legs reaching proximal end of hand.

Abdomen without spines.

Measurements.—Length of carapace: males, 11 mm.; females, 14 mm.; smallest ovigerous female, 4 mm. (Chace, 1942).

Habitat.—Thirty to 260 fathoms.

Type locality.—Not designated with certainty.

Known range.—Off Cape Lookout, N.C.; Florida through West Indies to Grenada; Gulf of Mexico to Colombia and Venezuela; “600 mi. off St. Davids, Bermuda.”

Remarks.—Ovigerous females have been taken off southeast Florida in July, and off North Carolina in September. The rhizocephalans *Cyphosaccus chacei* and *Boschmaia munidicola* were reported from *M. irrasa* by Reinhard (1958).

Family Porcellanidae

General form crablike. Carapace well calcified, depressed, regions usually not well defined; front often prominent but never with rostrum greatly projecting beyond eyes. Antennae inserted external to eyes, with three movable articles and a flagellum. Basal articles of antennules broad. Outer maxillipeds too large to be contained in buccal cavity. Chelipeds moderately elongate, usually broad and depressed. First, second, and third walking legs well developed; last leg feeble, reduced in size, inflexed and resting on carapace. Abdomen broad, symmetrical, composed of seven segments, bent under and held closely against thorax; males with a pair of pleopods on segment two, sometimes rudimentary or absent, females with a pair of pleopods on segments three, four, and five, those on three sometimes reduced or absent. Telson composed of five or seven well-calcified pieces (Haig, 1960).

KEY TO GENERA AND SPECIES IN THE CAROLINA

(Modified after Chace, 1942)

- a. Form elongate, “hippalike”; telson much longer than broad.....*Euceramus praelongus* (p. 109).
- aa. Form less elongate; telson usually broader than long, never much longer than broad.
 - b. Lateral wall of carapace broken up into two or more pieces, separated by membranous interspaces; front triangular or transverse in dorsal view, never with projecting teeth; carapace subquadrate.
 - c. Carapace with numerous transverse tufts of setae; chelipeds and legs hairy
Pachycheles pilosus (p. 108).
 - cc. Carapace relatively smooth, not hairy; chelipeds deeply ridged and eroded, not hairy
Pachycheles rugimanus (p. 108).
 - bb. Lateral wall of carapace nearly always entire; if not, front distinctly tridentate in dorsal view; carapace not subquadrate.
 - c. Basal antennal article small, not joining margin of carapace, so that movable articles have free access to orbit.....*Petrolisthes galathinus* (p. 107).
 - cc. Basal antennal article strongly produced forward and broadly in contact with margin of carapace, movable portion far removed from orbit.
 - d. Dactyls of walking legs armed with from two to four strong, fixed spines; carapace distinctly broader than long.....*Polyonyx gibbesi* (p. 113).

dd. Dactyls of walking legs ending in a simple spine usually with small, movable accessory spinules on lower margin; carapace longer than broad.

e. Front strongly tridentate in dorsal view; carapace slightly longer than broad; chelipeds not grossly sculptured.

f. Cervical groove terminating anterolaterally in shallow marginal indentation at edge of carapace-----*Porcellana sayana* (p. 110).

ff. Cervical groove terminating anterolaterally in a distinct longitudinal cleft at edge of carapace----*Porcellana sigsbeiana* (p. 111).

ee. Front strongly trilobate in frontal view; carapace usually broader than long; chelipeds thick and grossly sculptured

Megalobrachium soriatum (p. 112).

Genus *Petrolisthes* Stimpson, 1858

Stimpson, 1858, p. 240.—Haig, 1960, p. 21.

Petrolisthes galathinus (Bosc)

Figure 83

Porcellana galathina Bosc, 1801 (or 1802), p. 233, pl. 6, fig. 2.

Petrolisthes galathinus: Hay and Shore, 1918, p. 404, pl. 29, fig. 1.—Haig, 1956, p. 22 (rev.).—1960, p. 36.

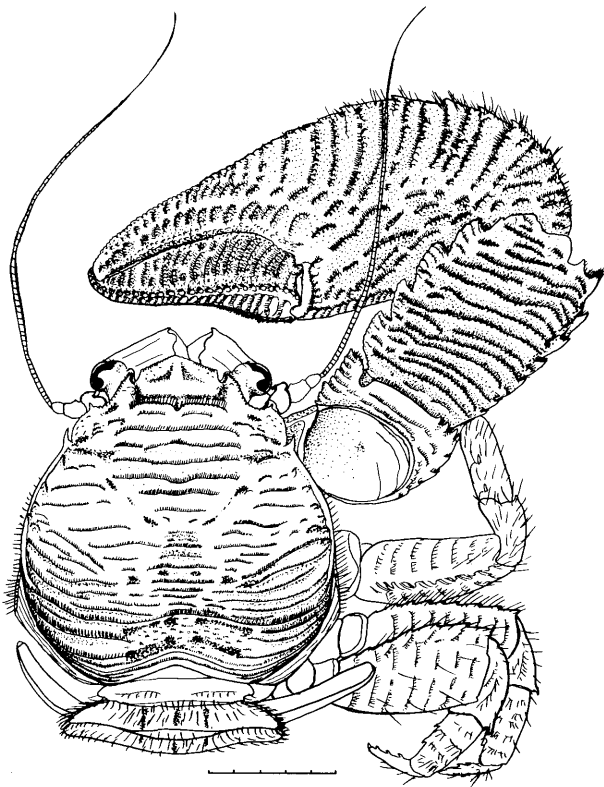


FIGURE 83.—*Petrolisthes galathinus* (Bosc). Animal in dorsal view, fifth leg only of left side shown, 5 mm. indicated.

Recognition characters.—Carapace a little longer than wide, covered with strong, transverse, ciliated rugae, scarcely interrupted at grooves separating well-marked regions; frontal region granulate, metabranchial regions plicate. Front produced into a broad, triangular, sinuous-sided rostrum with a broad median groove usually covered with short pubescence. Supraorbital spine present, not distinct in large specimens; postorbital angle produced into a small spine-tipped tooth; epibranchial spine strong. Eyes well developed. Antenna with first movable article bearing an anteromedian, spine-tipped, lamellar lobe; second and third articles lightly rugose.

Chelipeds large, covered with strong, ciliated rugae continuing obliquely and almost unbroken across carpus and hand, broken into series of shorter rugae on fingers; merus with a strong rugose lobe at inner distal angle; carpus about twice as long as wide, anterior margin with four to six strong serrate spines, a row of spines on posterior margin; hand broad, flattened, rugae on outer margin spiniform in smaller specimens, outer margin often fringed with plumose hairs; dactyl sinuous, fingers closing closely, a thick tuft of pubescence below. Walking legs rugose; anterior margin of meri with fringe of plumose hairs; all articles covered with long, nonplumose setae; anterior margin of first and second legs with six to nine spines, third with five to seven; merus of first and second with a posterodistal spine.

Sternum, sternal plastron, abdomen, ventral surface of outer maxillipeds, chelipeds, and walking legs covered with strong striations.

Measurements.—Length of carapace: males, 7 to 17 mm.; non-ovigerous females, 6 to 11 (15?) mm.; ovigerous females, 7 to 14 mm. (Haig, 1960; Holthuis, 1959).

Color.—Grayish brown without markings in life; in alcohol, light brown with purple or dark-red lines and dots on rugae (Hay and Shore, 1918). Spaces between rugae yellow; lower surface, including abdomen, deep red (Faxon *in* Haig, 1960).

Habitat.—Under stones and associated with sponges, corals, and anemones in littoral; in somewhat deeper water, from sand and sand-shell bottom (Haig, 1960); low-water mark to 27 fathoms.

Type locality.—Unknown.

Known range.—Cape Hatteras, N.C., through Gulf of Mexico and Caribbean area to Rio de Janeiro, Brazil; Ilha Trindade off Brazil; Pacific Ocean from region around Panama City; Isla San Lucas, Costa Rica; off La Libertad, Ecuador.

Remarks.—A full review of this species has been given by Haig (1956, 1960). Oviparous females are known from the Caribbean area from January to May, and from North Carolina and the Gulf of Mexico from June to September (Haig, 1956, 1960; Holthuis, 1959, in part).

Rathbun (1926) described a fossil species, *P. avitus*, from the Pliocene of Central America which is similar to the recent *P. galathinus*.

Genus *Pachycheles* Stimpson, 1858

Stimpson, 1858, p. 228.—Haig, 1960, p. 131 (rev.).

Pachycheles pilosus (H. Milne Edwards)

Figure 84

Porcellana pilosa H. Milne Edwards, 1837, p. 255.

Pachycheles pilosus: Haig, 1956, p. 11 (rev.).

Recognition characters.—Carapace slightly broader than long, flattened but somewhat more convex from front to back than side to side, lightly rugose along sides, with numerous short, transverse tufts of setae except scattered setae on frontal region. Frontal margin sinuous, slightly produced in middle, with a submarginal row of stout setae. Anterolateral margins emarginate. Epimeral pieces of metabranchial regions separated by membranous interspaces, posterior por-

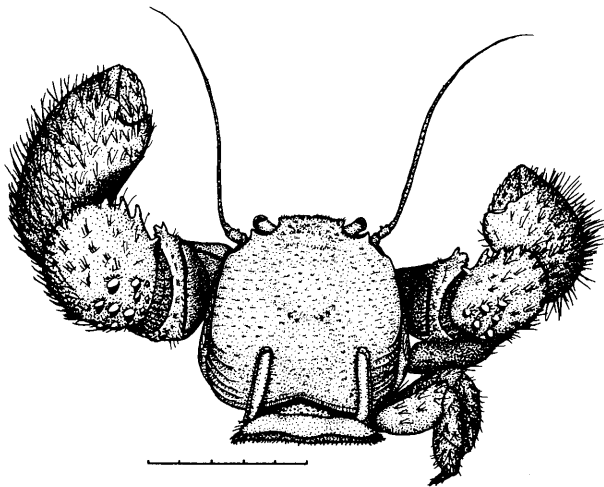


FIGURE 84.—*Pachycheles pilosus* (Milne Edwards). Animal in dorsal view, second, third, and fourth leg of left side not shown, 5 mm. indicated.

tion consisting of one or more pieces. Orbits deeply excavated, postorbital angle spiniform; eyes short, stout. Antenna with first movable article bearing a buttressed spine on anterior margin; second article with a spine near middle of anterior border; third article short, smooth.

Chelipeds unequal, stout, ornamented with numerous long, dark setae with shorter ones between; merus outlined dorsally with long setae, a stout spine and large white tubercle at inner distal angle; carpus with a number of prominent white tubercles on proximal portion, anterior border with about three spines; hand inflated, outer margin spined and tuberculate below and at base of immovable finger, fingers short, immovable finger with a single blunt tooth on cutting edge, inner edge of hand and dactyl with obsolescent spines. Walking legs with hairy covering similar to chelipeds, a few spines below on dactyls and propodi.

Telson of males and females with five elements.

Measurements.—Length of carapace: males, 7 mm.; oviparous females, 5 to 7 mm. (Haig, 1956).

Habitat.—In corals; to 4 fathoms (Schmitt, 1935a).

Type locality.—Vicinity of Charleston, S.C.

Known range.—Charleston, S.C.; Key West to Sarasota Bay, Fla.; through West Indies to Tobago and Aruba.

Remarks.—Oviparous females have been taken in the West Indies from February to May (Haig, 1956, in part). Rathbun (1926) reported a Pliocene species of *Pachycheles* from Central America.

Pachycheles rugimanus Milne Edwards

Figure 85

Pachycheles rugimanus Milne Edwards, 1880, p. 36.—Hay and Shore, 1918, p. 404, pl. 29, fig. 2.—Haig, 1956, p. 12 (rev.).

Recognition characters.—Carapace slightly longer than wide except in mature females, flat from side to side, convex from front to back, rugose along sides; anterolateral margins emarginate; epimeral pieces of metabranchial regions separated by membranous interspaces, posterior portion consisting of one or more pieces. Front broad, frontal margin projecting downward, slightly produced in middle, hardly visible from above. Orbits deeply excavated, margins slightly raised, postorbital angle spiniform; eyes short, stout, retractile. Antenna with first movable article bearing a serrate spine on anterior margin;

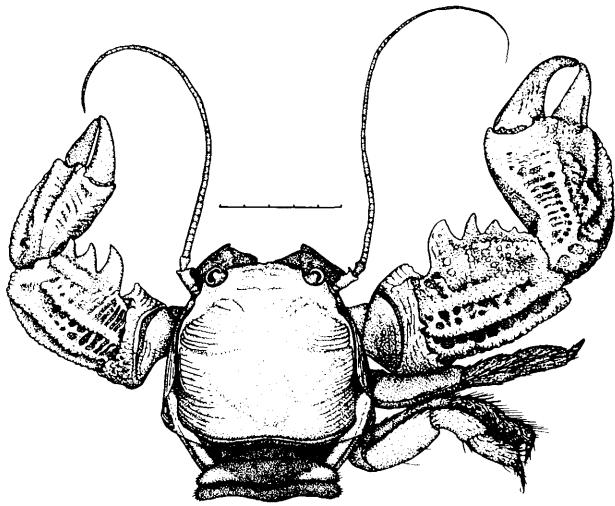


FIGURE 85.—*Pachycheles rugimanus* Milne Edwards. Animal in dorsal view, second, third, and fourth legs of left side not shown, 5 mm. indicated.

second article with a row of unequal spines on anterior border; third article short, smooth.

Chelipeds subequal, stout; merus crossed by a row rugae distally, a rugose and serrate spine at inner distal angle; carpus with four anterior spines, graded in size, proximal one largest, and upper surface with four prominent longitudinal, tuberculate ridges, with deep channels between, channels crossed by irregular septae forming rows of oblong pits between ridges; ridges and pitted channels continued on hand but with less regularity in arrangement; fingers tuberculate almost to tips. First three pairs of walking legs stout and with distal articles hairy; last legs weak and reflexed dorsally.

Telson of male and female with five elements; male pleopods present.

Measurements.—Carapace: male, length, 8 mm.; width, 7 mm.; ovigerous female, length, 8 mm., width, 9 mm.

Color.—Brownish red, fingers vermilion.

Habitat.—To depth of 79 fathoms (Schmitt, 1935a).

Type locality.—Contoy, and west of Florida.

Known range.—Off Cape Lookout, N.C., through Florida to St. Thomas, V.I., and Contoy Island, Mexico.

Remarks.—Only a few collections of this species have been recorded, from widely scattered localities. Ovigerous females have been taken in

February and March from the Carolinas and west Florida, and in September in North Carolina and east Florida.

Genus *Euceramus* Stimpson, 1860

Stimpson, 1860b, p. 445.—Haig, 1960b, p. 187.

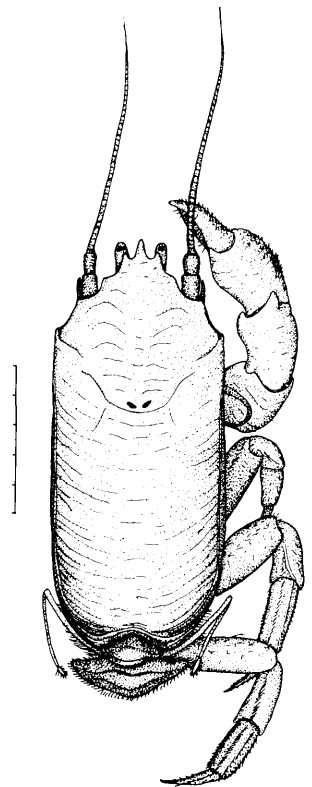
Euceramus praelongus Stimpson

Figure 86

Euceramus praelongus Stimpson, 1860b, p. 444.—Hay and Shore, 1918, p. 405, pl. 29, fig. 3.—Haig, 1956, p. 7 (rev.).

Recognition characters.—Carapace subcylindrical, elongate; sides slightly arcuate, with minute, irregular, transverse rugae; anterolateral margins with two more or less obtuse spines on each side behind antennae. Front tridentate, median spine about twice length of lateral spines, a broad V-shaped depression at rear edge of carapace. Eyes well developed. Antennule short. Antenna about three-fourths length of body, flagella sparsely covered with fine hairs; basal article short, not produced forward; movable articles not far removed from orbit. Third maxilliped large, forming subquadrate shield extending laterally almost to edge of carapace.

FIGURE 86.—*Euceramus praelongus* Stimpson. Animal in dorsal view, fifth leg only of left side shown, 5 mm. indicated.



Chelipeds stout, subequal; hand slightly roughened and hairy, somewhat stouter in males than in females; fingers about as long as palm, more gaping in males than in females. First pair of walking legs shorter than second and third pairs; last pair reduced and turned dorsally.

Abdomen small, distal segments narrow. Uropods reduced. Telson longer than broad, composed of seven elements.

Measurements.—Length of carapace from tip of rostrum to center of rear notch: males, 14 mm.; females, 14 mm.

Color.—Background of carapace greenish gray to greenish tan with lighter and darker lines of color delineating striae and marginal furrow; a light longitudinal stripe, broadest anteriorly, along middorsal line; purplish markings along lines separating major regions of carapace; legs mottled with greenish gray or tan as on carapace; a suggestion of iridescence on body and legs (from specimen collected by L. McCloskey, Morehead City Harbor, N.C., August 7, 1962).

Habitat.—Sandy beaches below waterline, and on broken-shell bottoms; low-water mark to 21 fathoms.

Type locality.—Beaufort, N.C.

Known range.—Chesapeake Bay, off South Marsh Island, to Aransas area of Texas coast.

Remarks.—Hay and Shore (1918) and Haig (1956) remarked that this is a rare species and it is true that it has seldom been collected, but the habits described by Pearse, Humm, and Wharton (1942) suggest that it is like a number of similar decapod crustaceans which are rare in collections chiefly because they live where they escape the attention of most collectors. Pearse, Humm, and Wharton described *E. praelongus* as a dweller of sandy beaches, similar in habit to *Emerita*, *Lepidopa*, and *Ogyrides*. It is also found on rubble-covered bottom. The animal is a highly adapted burrower which burrows backward. It scrapes food caught in the hairy antennae with setose mouth parts. Juvenile specimens are occasionally taken at night in plankton tows near inlets in North Carolina, and ovigerous females have been taken in May.

Haig (1960) placed *Euceramus* between the group of porcellanid "genera in which the basal antennal segment is short and not broadly in contact with the anterior margin of the carapace, and

the group of genera in which the basal segment is strongly produced forward so that the movable segments are far removed from the orbit."

Genus *Porcellana* Lamarck, 1801

Lamarck, 1801, p. 153.—Haig, 1960, p. 196 (rev.).

Porcellana sayana (Leach)

Figure 87

Pisidia sayana Leach, 1820, p. 54.

Porcellana sayana: Hay and Shore, 1918, p. 403, pl. 29, fig. 7.—Haig, 1956, p. 31 (rev.).

Recognition characters.—Carapace usually a little longer than wide, depressed; dorsal surface slightly convex, meeting lateral parts in a slight shoulder a little behind base of antenna; surface minutely granulate and with fine oblique dorsal plications along sides, especially on posterolateral portions; a few scattered small clumps of hairs. Rostrum triangular, concave above, tip abruptly decurved, margins spinulate or tuberculate. Orbit with a strong tooth near inner angle, separated from orbit by a wide and rather deep notch; outer angle produced into a broad, low tooth. Eyes well developed. Cervical groove lightly impressed. Antennae slender, smooth, longer than carapace; basal article strongly produced forward into a spinelike projection; movable articles far removed from orbit.

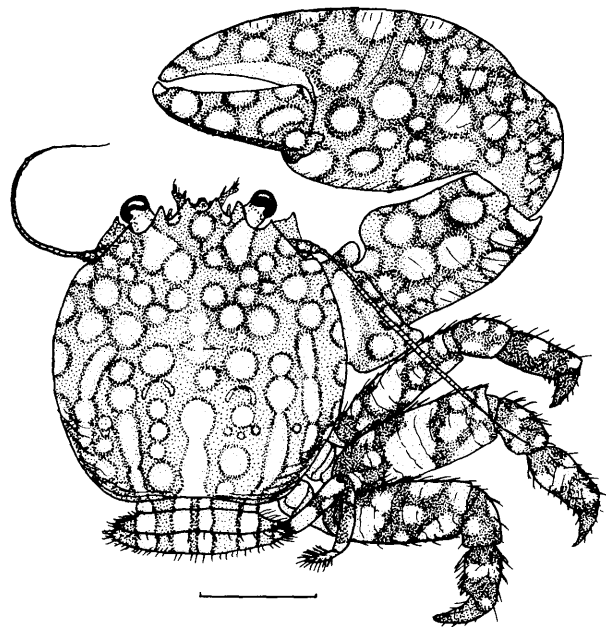


FIGURE 87.—*Porcellana sayana* (Leach). Animal in dorsal view, legs of left side not shown, 5 mm. indicated.

Chelipeds strong, heavy, finely plicate, nearly smooth in old individuals; hand as long as or longer than carapace, outer margin fringed with long hairs except in old individuals; fingers short, curved, and bent; proximal inner angle of carpus and distal inner angle of merus produced, forming lobes, both articles with scattered hairs near dorsolateral border, posterodistal angle of carpus ending in a spine. First three pairs of walking legs normal, with scattered hairs; last pair reduced and carried above others.

Telson composed of seven elements.

Measurements.—Carapace: males, length, 4 mm. (Wass, 1955), width, 12 mm.; nonovigerous females, length, 8 mm., width, 8 mm.; ovigerous females, length, 5 mm. (Haig, 1956) to 10 mm., width, 10 mm. Specimens with length and width equal are unusual.

Color.—Ground color reddish or rusty brown; covered on all dorsal surfaces and abdomen with complicated irregular pattern of yellowish white, yellow, and some bluish-white spots or longitudinal stripes; stripes more prominent on rear center part of carapace and on abdomen. Pattern quite variable in shape and shade, some specimens being predominantly light.

Habitat.—This species is often taken in the dredge in various parts of Beaufort Harbor, N.C., and along the neighboring coast. It has also been taken from among rocks of the jetties near Fort Macon. It is often found in crevices in clusters of oyster shells or as a commensal of the hermit crabs *Pagurus pollicaris* or *Petrochirus diogenes* in the shell of some gastropod. Hildebrand (1954) found specimens attached to the decorator crab, *Stenocionops furcata*. Shallow water to 48 fathoms; (390 fathoms(?), Schmitt, 1935a).

Type localities.—Coast of Georgia and Florida.

Known range.—Cape Hatteras, N.C., around Gulf of Mexico and Caribbean Sea to Bahia Caledonia, Panama; through West Indies to Venezuela and Surinam (Haig, 1956; Holthuis, 1959).

Remarks.—This species is rather abundant off the Carolinas and in the western Gulf of Mexico (Hildebrand, 1954, 1955). Ovigerous females are known to occur from January to November in various localities throughout the range. In North Carolina, they are known in January and from June to November. Brooks and Wilson (1883) described the first zoeal stage of *P. sayana*. A long

breeding season is indicated, as is true of a close relative in the Pacific, *Porcellana cancrisocialis*. Haig (1960) suggested that these forms may be conspecific.

Porcellana sigsbeiana Milne Edwards

Figure 88

Porcellana sigsbeiana Milne Edwards, 1880, p. 35.—Benedict, 1901, p. 137.—Milne Edwards and Bouvier, 1923, p. 292, pl. 1, fig. 6.—Haig, 1956, p. 33 (rev.).

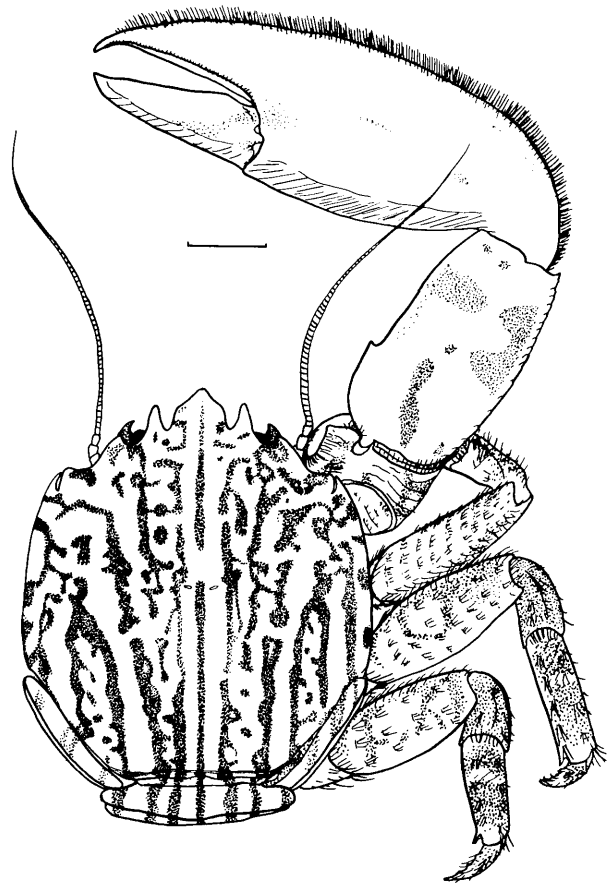


FIGURE 88.—*Porcellana sigsbeiana* Milne Edwards. Animal in dorsal view, fifth leg only of left side shown, 5 mm. indicated.

Recognition characters.—Carapace longer than wide, evenly convex in posterior half, broadly ridged in gastric region; lateral margins thin, produced, and slightly upturned; surface faintly rugose. Front strongly tridentate; rostrum exceeding narrower lateral teeth, irregularly pentagonal with sides adjacent to base subparallel. Orbit with outer angle produced into a broad, oblique tooth; eyes well developed. Anterolateral

borders concave, ending in a shoulder separated from acute marginal tooth by an elongate notch at terminus of cervical groove. Antennae slender, smooth, about as long as carapace; basal article strongly produced forward in a spinelike projection; movable articles far removed from orbit.

Chelipeds strong, heavy, smooth; hand longer than carapace, outer margin fringed with hairs; fingers less than half as long as palm, nearly straight, hooked at tips; length of carpus more than 1.5 times width, a single small spiniform tooth on anterior border; merus with a single broad tooth on lobe at internal angle. First three pairs of walking legs with scattered tufts of hairs; last pair reduced and carried above others.

Telson composed of seven elements.

Measurements.—Male carapace: length, 24 mm., width, 22 mm.

Color.—Colored with an irregular pattern of reddish longitudinal mottlings on a white background (specimens preserved in alcohol).

Habitat.—The species occurs near the edge of the Continental Shelf in North Carolina, and is usually found in deeper water than the related and similar species, *Porcellana sayana*; 27 to 215 fathoms.

Type localities.—Blake Stations: 49, off delta of Mississippi River, 118 fathoms; 36, north of Yucatan, 84 fathoms; 142, Flannegan Passage [V.I.], 27 fathoms.

Known range.—Off Marthas Vineyard, Mass., to northern Gulf of Mexico and southern Gulf of Mexico off Yucatan; West Indies to Virgin Islands.

Remarks.—Ovigerous females have been taken in April, May, June, and November off northwest Florida, Alabama, Mississippi, and Louisiana, and in midwinter off Yucatan. Benedict (1901) was correct in stating that this is the largest porcellanid species in the region.

Genus *Megalobrachium* Stimpson, 1858

Stimpson, 1858, p. 228.—Haig, 1960, p. 212.

Megalobrachium soriatum (Say)

Figure 89

Porcellana soriata Say, 1818, p. 456.—Hay and Shore, 1918, p. 404, pl. 29, fig. 6.

Porcellanopsis soriata: Haig, 1956, p. 35.

Megalobrachium soriatum: Haig, 1960, p. 227 (rev.).

Recognition characters.—Carapace somewhat hexagonal, slightly wider than long; margins

more or less hairy; areolations well marked, some tuberculate. Front rounded in dorsal view, trilobate in frontal view; rostrum little, if any, longer than lateral teeth. Orbits well defined; eyes well developed. Antennae about as long as carapace; basal article strongly produced forward and broadly in contact with margin of carapace; movable articles slender and removed from orbit.

Chelipeds long and heavy, roughly tuberculate; hand fringed with long hair along lower margin and with tubercles in rather well-defined rows; fingers with white, strongly hooked tips; carpus with one strong spine and some smaller spines on anterior border, dorsal aspect with tubercles irregularly arranged and appearing granulate under slight magnification; merus ornamented like carpus distally. First three walking legs stout, hairy, and with sharp, curved dactyls; last legs weak and placed above others.

Telson divided into five elements.

Measurements.—Carapace: length of male, 5 mm., width, 5.5 mm.; ovigerous females, length, 4 to 5 mm., width, 4 to 5.5 mm.

Color.—In life a dirty gray; in alcohol a rusty or grayish red.

Habitat.—Free living among corals, rocks, and sponges; in North Carolina found especially in canals of sponges taken from fishing banks offshore near Beaufort Inlet (Hay and Shore, 1918;

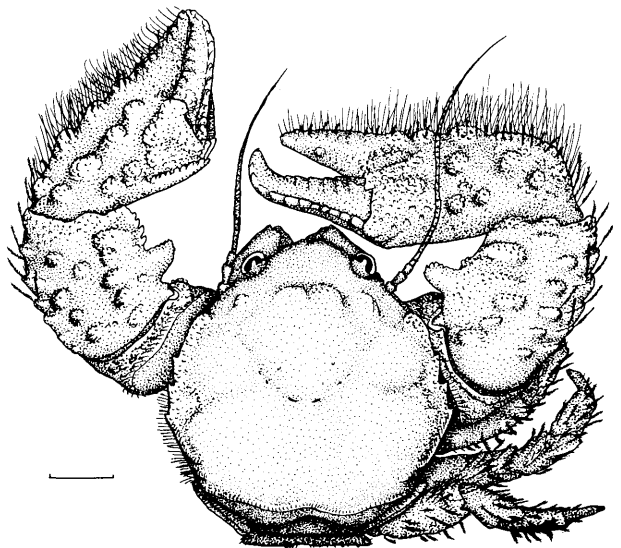


FIGURE 89.—*Megalobrachium soriatum* (Say). Animal in dorsal view, second, third, and fourth legs of left side not shown, 1 mm. indicated.

Pearse and Williams, 1951). Wass (1955) found the species in sponges of the genus *Ircinia* in Florida. Near low-water mark to 37 fathoms.

Type locality.—St. Catherines Island, Ga.

Known range.—Off Cape Hatteras, N.C., to Port Aransas, Tex.; West Indies to Barbados; Contoy, Mexico; Bahia Caledonia, Panama.

Remarks.—This small porcellanid crab has had a varied taxonomic history. First, Say's trivial name was misspelled by subsequent authors (*sociata* for *soriata*), as pointed out by Benedict (1901), and second, the generic designation has been changed four times as understanding of relationships has been variously interpreted. Chace (1942) shifted *soriata* from *Porcellana* to *Porcellanopsis*. The most recent reviser (Haig, 1960), after reviewing all species referred to *Megalobrachium* and *Porcellanopsis*, deemed it best to combine all forms in a single genus.

A close congener of the eastern Pacific is *M. tuberculipes* (Lockington), and Haig suggested that they may not be distinct.

Ovigerous females have been taken off the Carolinas in June, July, and August, and in July in Florida (Wass, 1955).

Genus *Polyonyx* Stimpson, 1858

Stimpson, 1858, p. 233.—Haig, 1960, p. 232.

Polyonyx gibbesi Haig

Figure 90

Porcellana macrocheles Gibbes, 1850, p. 191.

Polyonyx macrocheles: Hay and Shore, 1918, p. 405, pl. 29, fig. 8.

Polyonyx gibbesi: Haig, 1956, p. 28 (rev.).

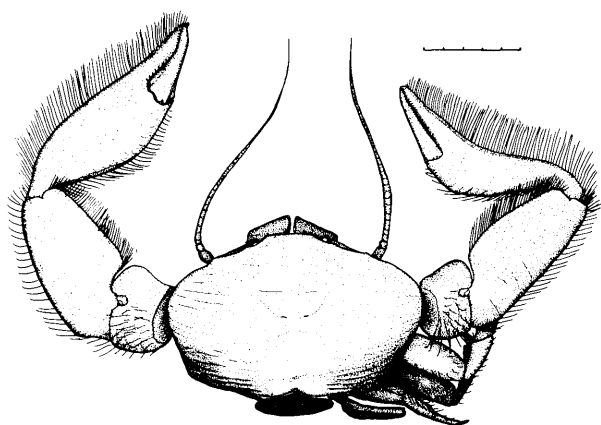


FIGURE 90.—*Polyonyx gibbesi* Haig. Female in dorsal view, second, third, fourth, and fifth legs of left side not shown, 5 mm. indicated.

Recognition characters.—Carapace smooth, finely plicate, transversely oval, about one-fourth to one-third wider than long; front hardly produced, margin slightly sinuous; posterolateral portions with scattered, feathered hairs; infolded lateral portions separated from rest of carapace by a deep fissure. Orbits small, eyes small, cornea reduced. Antenna slender, about 1.5 times as long as body; basal article strongly produced forward; movable articles far removed from orbit.

Chelipeds unequal, long and distorted; larger hand nearly twice as long as carapace; superior margin of hands convex, with thin fringe of plumose hairs, inferior margin nearly straight, with fringe of long plumose hairs; distal two-thirds of propodus with single row of fine, close-set, subtruncate teeth, larger and less closely set distally (row longer on small hand); fingers short, hooked at tip, toothed on cutting edges, dactyl falciform, sparsely hairy (straighter on small hand); carpus as long as palm, thick, anterior margin produced into a thin crest, proximal end markedly subrectangular, entire margin with fringe of fine plumose hairs, a thinner fringe of shorter hairs on outer margin; merus subcubical, finely rugose above, upper margin produced in front, plumose-hairy dorsolaterally. First three pairs of walking legs sparsely hairy, last pair with long tuft on chela and distal end of carpus; merus of second and third legs spinulose below, dactyls of first to third legs with four corneous spines on internal margin closing against weaker spines on distal portion of propodus.

Measurements.—Carapace: male, width, 11 mm.; nonovigerous female, length, 9 mm., width, 13 mm.; ovigerous female, width, 16 mm.

Color.—Grayish white, sometimes stained with brown.

Habitat.—A common commensal of the annelid *Chaetopterus variopedatus* [= *pergamentaceus*], seldom found outside tubes of this worm; intertidal to 8 fathoms.

Type locality.—Coast of South Carolina.

Known range.—Woods Hole, Mass.; Rhode Island; Beaufort, N.C., to Alligator Harbor, Fla.; Puerto Rico; Bahia Caledonia, Panama. Notes in Haig's (1956) account for *P. gibbesi* indicate that the species may range to Brazil.

Remarks.—It is unfortunate that this distinctive species, known so long under the name *Poly-*

onyx macrocheles (Gibbes), should have to undergo a name change, but Haig (1956) has shown that *Porcellana macrocheles* Gibbes, 1850, is a homonym of *Porcellana macrocheles* Poeppig, 1836, hence unavailable. The substitute name is quite appropriate, however, for it not only honors the original describer but is applied to a species common in the area where he worked.

Unlike other porcellanids occurring in the Carolinas, *Polyonyx gibbesi* has been the subject of some ecological observations. Enders (1905), at Beaufort, N.C., and Pearse (1913), at Woods Hole, Mass., studied commensal inhabitants of the tubes of *Chaetopterus variopedatus*, finding *P. gibbesi* to be common commensals in both areas. Both authors found usually a male and a female crab in the same tube, but Enders found six isolated ovigerous females in the course of a summer. Pearse found the species to be strongly thigmotactic, and crabs, seemingly too large to enter *Chaetopterus* tubes, entered and left an artificial tube at will in the laboratory.

Individuals usually moved backward or sideways on open sand, using the chelipeds as an aid in walking, or at times swam clumsily upside down by flapping the abdomen. Individuals showed little ability to burrow. The respiratory mechanism seemed well adapted to life in confinement, for the respiratory currents were strong and capable of being directed, changing with the change in direction of waterflow in the worm tube. Crabs in an experimental tube tolerated considerable fouling of the water.

Pearse gave an excellent figure of the detailed structure of the chelate and tufted fourth walking legs which are used extensively in the meticulous preening characteristic of this species. The plumes of hairs on the appendages, especially those on the third maxillipeds, are used as nets for capturing food from water currents.

Gray (1961) reviewed the life history and ecology of the species. He found that the breeding season at Beaufort, N.C., extends at least from April to December, and ovigerous females are otherwise known in February and March from Florida. Usually when a pair of *P. gibbesi* is found in a tube, adult crabs of no other species are present at the same time. The smallest female with eggs was 8.4 mm. in width. Gray concluded

that the crabs enter worm tubes by chance, not in response to attractants.

In the years since Enders' and Pearse's studies, the proportion of *Pinnixa chaetoptera* to *Polyonyx gibbesi* at Woods Hole and Beaufort has changed. Woods Hole; *Polyonyx-Pinnixa*; 1913, 22:78; 1959, 66:34. Beaufort; 1905, 83:17; 1958-59, 39:61. Gray (1961) postulated that the more southerly species, *P. gibbesi*, has increased in the Woods Hole area due to amelioration of climate. In the Beaufort area, decline may be due to recent hurricane damage which destroyed many *Chaetopterus* tubes. Gray also found that *P. gibbesi* prefers less muddy bottoms than *P. chaetoptera*. He considered *P. gibbesi* an obligate commensal of *Chaetopterus*.

Faxon (1879) discussed the last stage zoea of *P. gibbesi* and determined that it molts directly into the first crab stage with no intervening megalops as in brachyurans. Smith (1880b) reported swarms of zoeae of *P. gibbesi* at the edge of tidal currents near the mouth of Narragansett Bay in summer.

Superfamily Paguridea

Carapace elongate and subcylindrical, or broad and crablike; front not fused with epistome. Abdomen soft, asymmetrical, and spirally coiled, merely bent or flexed against thoracic sternum as in Brachyura, or rarely symmetrical, straight and well calcified dorsally. Tail fan usually present and asymmetrical, occasionally symmetrical. Eyes never in orbits. Antennal peduncle five jointed; second article almost always with a movable acicle. First pair of legs chelate and usually large; fifth pair always, and fourth pair commonly, much less developed than preceding pairs. Abdominal appendages usually unpaired on second to fourth, or second to fifth segments, and usually present only on left side (Alcock, 1905).

Family Paguridae. Hermit crabs

Carapace usually somewhat elongate and broadened posteriorly, sides membranous, and covered with a network of very thin lines ordinarily limited above by *linea anomurica*. Abdomen generally soft and spirally coiled in adaptation to gastropod shells (abdomen secondarily symmetrical in a few forms using other kinds of

housing). Eye scales triangular. Thoracic sternites, corresponding to third, fourth, and fifth legs, free and mobile. Legs four and five reduced and modified. Middle terga of abdomen separated more or less by membrane (adapted from Alcock, 1905; Bouvier, 1940).

Remarks.—A most useful bibliography of this group was published by Gordan (1956). The family Paguridae has a long fossil record in North America. Species of *Paguristes*, *Petrochirus*, and *Pagurus* are known from the Cretaceous, and *Dardanus* from the Eocene (Rathbun, 1935).

KEY TO SUBFAMILIES IN THE CAROLINAS

- a. Third maxillipeds approximated at base; chelipeds subequal, or left much larger than right, rarely with right slightly larger than left....*Diogeninae* (p. 115).
- aa. Third maxillipeds widely separated at base by a sternum; right cheliped usually much larger than left, left never larger than right, occasionally subequal
Pagurinae (p. 125).

Subfamily *Diogeninae*

The chief distinguishing characters are given in the above key.

KEY TO GENERA AND SOME SPECIES OF DIOGENINAE IN THE CAROLINAS

- a. Paired appendages present on first two abdominal segments of male, and first abdominal segment of female; fingers of chelipeds opening and closing horizontally
Paguristes (p. 115).
- aa. No paired appendages on anterior abdominal segments in either sex.
 - b. Fingers of chelipeds opening and closing horizontally.....*Clibanarius vittatus* (p. 120).
 - bb. Fingers of chelipeds opening and closing obliquely or nearly vertically.
 - c. Chelipeds not markedly unequal, right usually slightly larger than left
Petrochirus diogenes (p. 122).
 - cc. Chelipeds markedly unequal, left much larger than right.....*Dardanus* (p. 123).

Genus *Paguristes* Dana, 1852

Provenzano, 1959, p. 381 (rev.).

KEY TO SPECIES IN THE CAROLINAS

- a. Rostrum broadly rounded, or pointed, but not advanced beyond level of lateral projections on front.
 - b. Anterolateral sides of anterior shield of carapace not spiny.....*moorei* (p. 115).
 - bb. Anterolateral sides of anterior shield of carapace definitely spiny.....*lymani* (p. 116).

- aa. Rostrum slender, and definitely advanced beyond level of lateral projections on front.
 - b. Anterior shield of carapace not noticeably longer than broad.
 - c. Frontal and lateral margins meeting at almost a right angle.....*sericeus* (p. 117).
 - cc. Frontal and lateral margins meeting at broadly obtuse or rounded angle.....*triangulatus* (p. 118).
 - bb. Anterior shield of carapace noticeably longer than broad.
 - c. Eye scales acuminate.....*spinipes* (p. 118).
 - cc. Eye scales with three or four (occasionally two) terminal spines.....*tortugae* (p. 119).

Paguristes moorei Benedict

Figure 91

Paguristes moorei Benedict, 1901, p. 144, pl. 4, fig. 3.—Hay and Shore, 1918, p. 409, pl. 30, fig. 3.

Recognition characters.—(Taken from holo-
typic female.) Anterior shield of carapace slightly longer than broad; upper surface of carapace with a few scattered hairs and irregular punctations, more or less iridescent. Rostrum short, obtusely pointed, slightly less advanced than more acute lateral projections. Eyestalks slender, slightly dilated distally, slightly longer

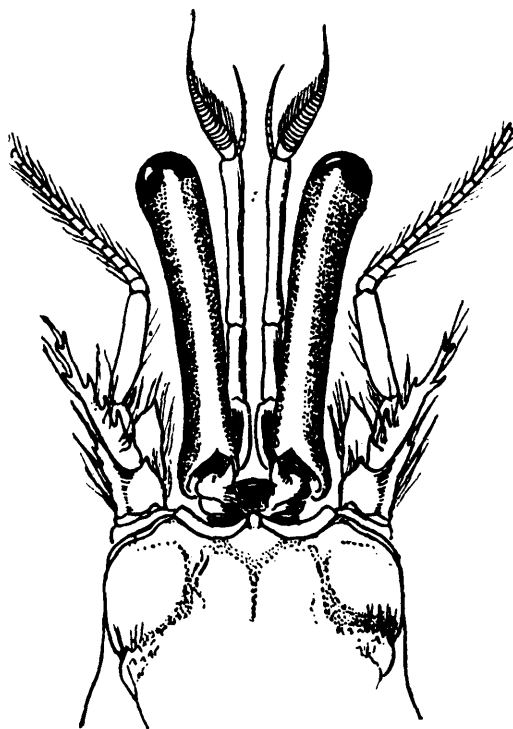


FIGURE 91.—*Paguristes moorei* Benedict. Type female, anterior part of body in dorsal view, approximately $\times 5$ (after Benedict, 1901).

than width of anterior shield (8.6 mm.); eye scales not adjacent, anterior process acute. Antennular peduncle slightly exceeding eyestalk when extended. Antennular peduncle extending slightly beyond middle of eyestalk; flagellum not exceeding tips of legs, with scattered setae; acicles bispinose at tip (right spine on right acicle broken), a row of four strong spines on proximal two-thirds of inner side (right acicle with a single external spine).

Chelipeds subequal but of similar form, medial margins nearly straight; hands short and thick, covered dorsally with many tubercles and hairs, but nearly smooth ventrally, a row of strong spines on upper medial border of palm, edges of fingers fitting closely; carpus similar to hands but with fewer tubercles in two rows, largest tubercles on medial upper border; merus prismatic with tubercles on angles. First pair of walking legs with a row of spines along upper margin of carpus and propodus.

Measurements.—Carapace (holotypic female): length in midline, 13.2 mm., width, 11.8 mm.; anterior shield, length, 8.5 mm., width, 8.3 mm.

Color.—Yellowish, eyestalks deep orange or crimson below, and white above (Hay and Shore, 1918).

Habitat.—From near edge of continental shelf in North Carolina.

Type locality.—Puerto Rico.

Known range.—Gulf Stream about 30 miles south of Cape Lookout, N.C.; Puerto Rico.

Remarks.—The species is known from only two specimens. The type only is extant.

Paguristes lymani Milne Edwards and Bouvier

Figure 92

Paguristes lymani Milne Edwards and Bouvier, 1893, p. 49, pl. 4, figs. 13–22.—Benedict, 1901, p. 145, pl. 4, fig. 8.—Alcock, 1905, p. 157.

Recognition characters.—Anterior shield of carapace slightly broader than long, sides a little hairy and roughened by spiny granules; posterolateral corners notched. Rostrum often a rounded lobe falling far short of pointed lateral projections; front rounding gradually to lateral margins from lateral projections. Eyestalks somewhat dilated at base and longer than distance between apices of lateral projections of front; eye scales singly acuminate or with up to three unequal spines on anterior border, long hairs some-

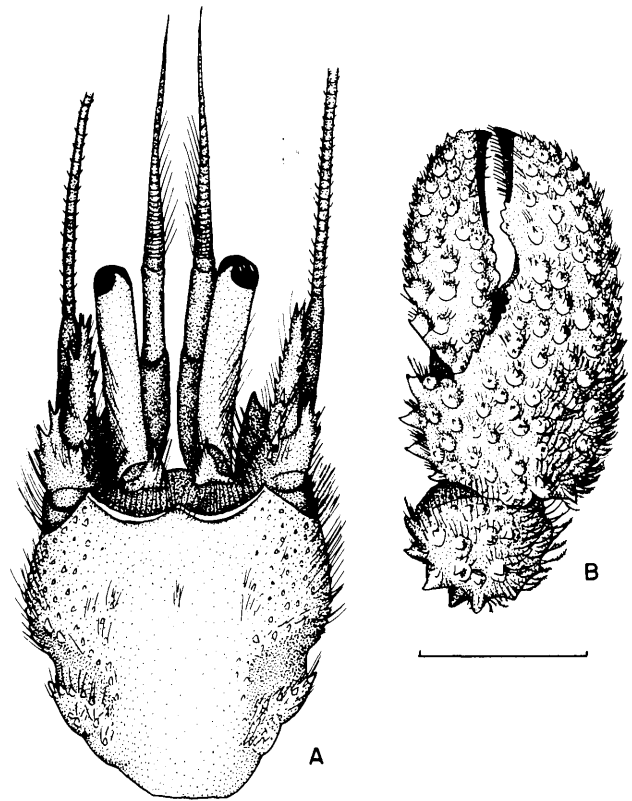


FIGURE 92.—*Paguristes lymani* Milne Edwards and Bouvier. A, anterior part of body in dorsal view; B, right chela, outer surface; 5 mm. indicated.

what obscuring tip. Antennular peduncles highly variable, exceeding eyestalks from less than half to entire length of terminal article. Tips of antennular peduncles extending to base of cornea, or slightly beyond eyes; acicles extending to three-fourths length of eyestalks, terminated by a spiny fork and often with three to five spinules on internal or external borders, external spine at base of acicle also spinulose on outer margin.

Chelipeds small, subequal, and similar; hands about twice as long as broad, upper surface covered with rather large tubercular granules, many with corneous tips, and four spines on internal margin of palm; lower margin of palm concave at base of immovable finger; fingers slightly agape, terminated by corneous tips preceded by finely denticulate cutting edges, dactyl with four or five small teeth behind corneous portion; carpus with three rows of spines on upper surface, four or five large ones on inner margin, about six on outer margin (with distalmost largest), and

about six more on upper surface near inner margin; superior border of merus armed with more or less pointed projections, feebly rugose externally; spines of palm, carpus, and merus obscured by feathered hairs. Walking legs with long hairs, particularly on upper and lower borders of dactyls; spines on crest of carpus, propodus, and base of dactyl, and somewhat reduced ones on inner and outer sides of propodus and carpus where rows appear mixed with hairs; dactyls arched, somewhat shorter than combined length of two preceding articles, and terminated by a conical claw.

Measurements.—Length of carapace: males, 13 mm.; ovigerous females, 11 mm.

Variations.—The spination of the chelipeds may vary in strength and density. The length of the antennular peduncles, in relation to the eyestalks, is highly variable. The eye scales become more dentate with age [implied]. The rostrum may reach the level of the lateral projections of the front, and small individuals tend to be hairier than large ones (Milne Edwards and Bouvier, 1893).

Habitat.—Literature and museum records show that this species has been found housed in small to medium-sized shells belonging to the families Cassididae, Dentaliidae, Nassariidae, Ovulidae, Muriidae, Trochidae, Turridae, and Volutidae; 15 to 878 fathoms.

Type locality.—Sand-Key, [Fla.], 15 fathoms.

Known range.—Southeast of Cape Lookout, N.C. (82–100 fathoms); Florida Keys to Swan Island off Honduras; through West Indies to British Guiana.

Remarks.—Ovigerous females have been taken in February from North Carolina and Florida, in May and June from Florida, and in November from British Guiana.

***Paguristes sericeus* Milne Edwards**

Figure 93

Paguristes sericeus Milne Edwards, 1880, p. 44.—Milne Edwards and Bouvier, 1893, p. 46, pl. 3, figs. 14–22.—Provenzano, 1961, p. 155.

Paguristes rectifrons Benedict, 1901, p. 145, pl. 4, fig. 7.

Recognition characters.—Anterior shield of carapace nearly as broad as long, flattened, with several spines on each side; frontal margin as long as ocular peduncles, making nearly a right angle with lateral margins; lateral projections

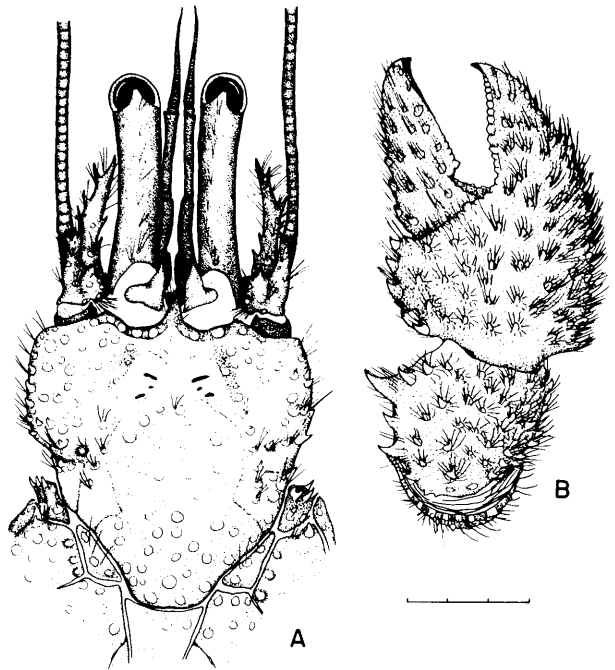


FIGURE 93.—*Paguristes sericeus* Milne Edwards. A, anterior part of body in dorsal view; B, right chela, outer surface; 3 mm. indicated.

low but terminating in a small spine. Rostrum with acute tip reaching along approximately half length of eye scales. Ocular peduncles slightly narrowed in middle; eye scales small, acuminate at tip. Antennular peduncles extending almost to tips of eyestalks. Antennal peduncles slightly exceeding acicles, terminal article armed with two spines; acicles straight, terminated by a spiny fork and with two or three spines on internal and external borders.

Chelipeds subequal, and rather short and broad; upper surface of hands and carpi with soft, silky, yellow hairs nearly obscuring surface, many strong granulations becoming corneous at tips scattered over upper surface. Walking legs not reaching much beyond extended chelipeds; dactyls regularly curved, dactyl of first walking leg 1.5 times length of propodus, of second as long as propodus and carpus combined.

Measurements.—Length of carapace: approximately 20 mm. (Milne Edwards and Bouvier, 1893).

Variations.—There is apparently some variation in straightness of the front and length of the eyestalks, as judged by the accounts of Milne

Edwards and Bouvier (1893) and Benedict (1901).

Color.—Body reddish with white spotting; eyestalks not spotted but solid orange red (from recently preserved specimen and from Provenzano, 1959, 1961).

Habitat.—Coral rubble and sand; found in *Strombus*, *Murex*, and *Oliva* (Provenzano, 1961, and various authors); 5 to 36 fathoms.

Type locality.—Lat. 24°34' N. long. 83°16' W. [near Dry Tortugas, Fla.], 36 fathoms.

Known range.—Off Cape Lookout, N.C.; Florida Keys to Virgin Islands.

Remarks.—Ovigerous females are known from the Virgin Islands in April (Provenzano, 1961).

***Paguristes triangulatus* Milne Edwards and Bouvier**

Figure 94

Paguristes triangulatus Milne Edwards and Bouvier, 1893, p. 40, pl. 4, figs. 6–12.—Benedict, 1901, p. 146, pl. 4, fig. 9.—Alcock 1905, p. 157.

Recognition characters.—Carapace somewhat hairy toward sides, and with scattered hairs on anterior shield; shield a little longer than broad; front with a thickened margin and a pointed rostrum reaching well beyond broadly angular lateral projections. Eyestalks long, slightly dilated, but obliquely compressed at tips, a line of hairs along dorsal side; eye scales acuminate, a little rugose on internal border. Antennular peduncles with about half of terminal article extending beyond eyestalks. Antennal peduncles extending to base of cornea or as little as three-fourths length of eyestalks; acicles reaching about to middle of eyestalks, spinose on internal and external borders, tip often bifurcate.

Chelipeds subequal, similar, upper surfaces tuberculate and hairy; inner margin of hands, carpi, and bases of dactyls with strong spines corneous at tips; upper surfaces of carpi and meri with a few spines and spiniform tubercles corneous at tips. First walking legs with spiny crest on carpi, propodi, and base of dactyls, crest obsolescent on second pair, both pairs hairy dorsally; dactyls curved, about as long as two preceding articles together; dactyls of right side a little weaker than left and laterally compressed; proximal end of first left dactyl with cross section in form of curvilinear triangle, broadly rounded internal face serving as base and obtusely pointed

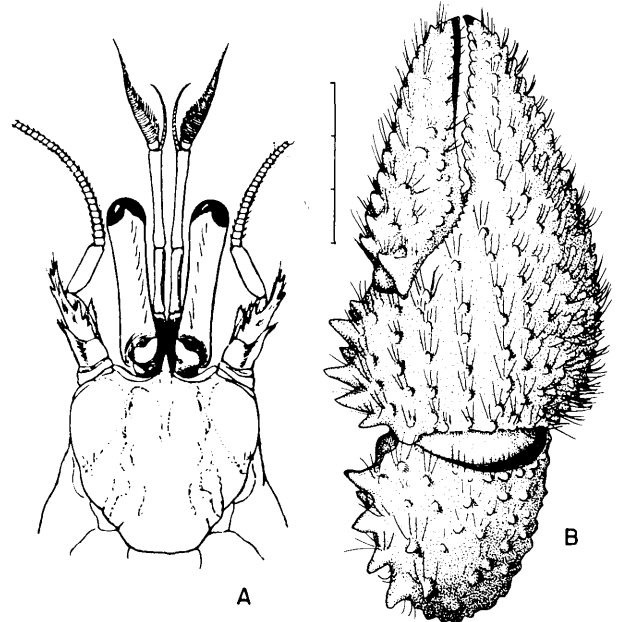


FIGURE 94.—*Paguristes triangulatus* Milne Edwards and Bouvier. A, anterior part of body in dorsal view, approximately $\times 3$ (after Benedict, 1901); B, right chela, outer surface, 3 mm. indicated.

external face serving as apex; second left dactyl a little stronger.

Measurements.—Length of carapace: male, 11 mm.; ovigerous female, 12 mm.

Color.—Legs and anterior part of cephalothorax tinted pink (Milne Edwards and Bouvier, 1893); eyestalks pink (Benedict, 1901).

Habitat.—One specimen has been reported from a shell of *Murex* (Milne Edwards and Bouvier, 1893); 6.5 to 82 fathoms.

Type locality.—Barbados, 73 fathoms.

Known range.—Off Oregon Inlet, N.C. (6.5 fathoms); Tortugas, Fla.; Barbados; Trinidad.

Remarks.—Ovigerous females have been taken from Florida in August and October.

***Paguristes spinipes* Milne Edwards**

Figure 95

Paguristes spinipes Milne Edwards, 1880, p. 44.—Milne Edwards and Bouvier, 1893, p. 33, pl. 3, figs. 1–13.—Benedict, 1901, p. 145, pl. 4, fig. 6.—Alcock, 1905, p. 157.—Boone, 1927, p. 76.

Paguristes visor Henderson, 1888, p. 78, pl. 8, fig. 3.

Paguristes armatus Hay, 1917, p. 73.—Hay and Shore, 1918, p. 409, pl. 30, fig. 7.

Recognition characters.—Anterior shield of carapace convex, considerably longer than broad; frontal margin thickened and drawn out into an almost straight-sided, acute rostrum, with tip con-

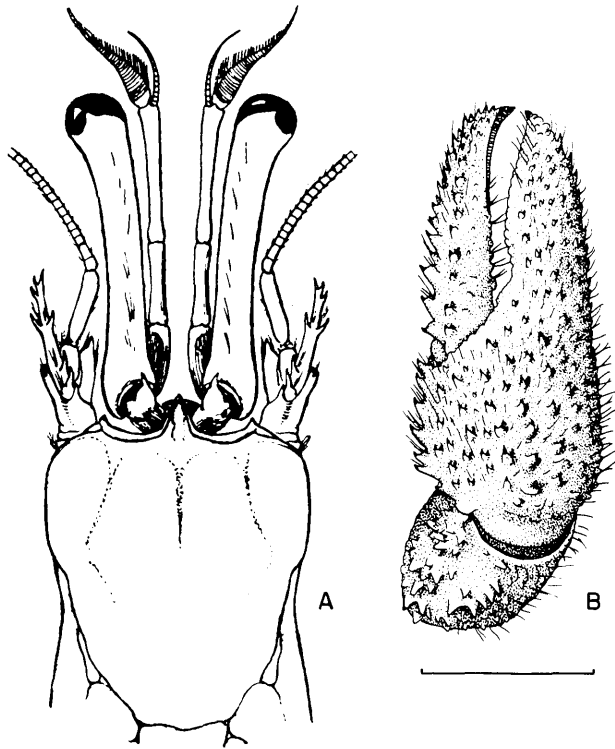


FIGURE 95.—*Paguristes spinipes* Milne Edwards. A, anterior part of body in dorsal view, approximately $\times 4$ (after Benedict, 1901); B, right chela, outer surface, 5 mm. indicated.

siderably exceeding rather obtuse lateral projections. Eyestalks considerably longer than greatest width of front but not quite so long as length of anterior shield, somewhat contracted in middle and slightly bent laterally, not much dilated distally; eye scales acuminate. Antennular peduncles extending to tips of, or a little beyond, eyestalks. Antennal peduncles extending about two-thirds length of eyestalks; acicles straight, terminated by a spiny fork, and with two or three spines on internal and external borders.

Chelipeds subequal and similar in form, narrow but massive; hands less than half as broad as long; upper surface of hands and carpi covered with conical spines, many with corneous tips, strongest on superointernal border; fingers more than half as long as whole of propodus and terminating in corneous tips, opposed edges with numerous teeth. Walking legs extending a little beyond chelipeds, ornamented with tufts of hair most numerous and rigid on dactyls; dactyls regularly curved and half again as long as pro-

podus; crest of spines on carpus and propodus extending along a portion of dactyl of first walking legs, but reduced, and present on carpus only of second walking legs.

Measurements.—Length of carapace: adults, 17 mm.; immatures, approximately 5 mm. (Milne Edwards and Bouvier, 1893, in part).

Variations.—The eyestalks are somewhat shorter than the front in young individuals but much longer in adults; they are frequently unequal in length. The cardiac region is calcified but the areas lateral to it are variably calcified (Milne Edwards and Bouvier, 1893).

Color.—A spot of orange red on external and internal faces of first walking legs, less definite on two following pairs; occasionally, traces of red coloration on anterior part of cephalothorax (Milne Edwards and Bouvier, 1893). In alcohol, nearly white, each cheliped with a conspicuous orange-yellow band across merus and a faint trace of a similar band on each walking leg (Hay and Shore, 1918).

Habitat.—This essentially deep-water hermit has been taken from shells of *Cassia* and *Xenophora*; 73 to 350 fathoms.

Type locality.—Grenada, 92 fathoms.

Known range.—Gulf Stream south of Cape Lookout, N.C., off Cape Canaveral and Sarasota, Fla.; Barbados to Pernambuco, Brazil.

Remarks.—This species has rarely been collected north of Barbados.

Paguristes tortugae Schmitt

Figure 96

Paguristes tortugae Schmitt, 1933, p. 7, fig. 4.—Provenzano, 1959, p. 388, fig. 11 (rev.).

Recognition characters.—Anterior shield of carapace longer than broad; rostrum triangular, in advance of lateral projections of front. Eyestalks slender, straight, as long as greatest width of anterior shield; eye scales separated by rostrum, anterior process armed with three or four spines (occasionally two) decreasing in size from median spine outward. Antennular peduncles reaching to base of cornea or slightly beyond. Antennal peduncles reaching to three-fourths length of eyestalks; flagella not reaching to tips of chelipeds, sparsely setose; acicles obscured by hairs, armed with two spines on inner edge and at least three on outer edge.

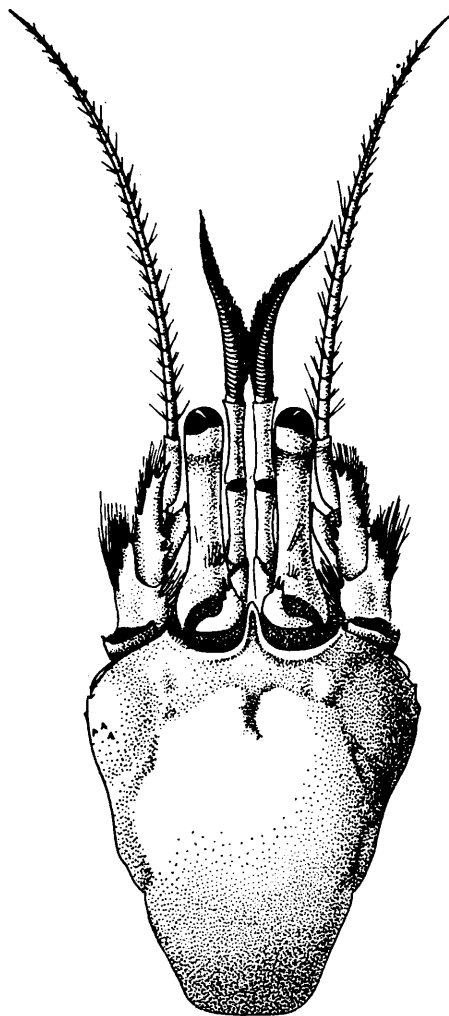


FIGURE 96.—*Paguristes tortugae* Schmitt.
Anterior part of body in dorsal view,
× 10 (after Holthuis, 1959).

Chelipeds equal, thickly covered with hairs, medial margins of chelae and carpi straight, fitting closely together when retracted; hands with forwardly directed, hooked spines on median upper surface, inner margin, outer half, and outer margin of immovable finger, hairs arising along anterior part of base of tubercles giving a squamose appearance; dactyl with seven more or less distinct, transverse rows of small, horny-tipped tubercles, largest on upper margin; fingers with tips corneous, more or less spooned; lower surface of chela smooth except for some tufts of hairs. First and second walking legs with heavy fringes of hairs along upper and lower margins and some tufts on lateral surfaces, outer surface smooth;

dactyls somewhat longer than propodi, tips dark, corneous, a row of similar colored spinules on ventral border; inner surface of dactyls and propodi with squamiform tubercles near upper and lower margins, more pronounced where bases of hairs coincide with squamous tubercles. First walking legs with upper surface of propodus serrate, and a few denticles at base of dactyl. Second legs with two rows of spines on carpus, one on upper margin and one on upper portion of inner surface, a shallow groove on upper part of inner surface extending distad from carpus. Third legs with a single row of spines on carpus; merus of second and third legs with an anteroventral spine.

Measurements.—Length of carapace: male, 10 mm.; ovigerous female, 7 mm. (Provenzano, 1959).

Variations.—Holthuis (1959) described a somewhat longer rostrum, a longer antennular peduncle, a somewhat spinier acicle, and a less spiny merus on the cheliped for Surinam specimens.

Color.—Whitish, with large spines on inner margin of hand and carpus red; occasionally, hard parts lightly tinted with green or purple; eyestalks with a single band of black on white, and antennules with similar rings on ends of articles (Provenzano, 1959). In preserved material, these dark bands appear red (Holthuis, 1959).

Habitat.—Usually taken on hard or shelly bottom; shallow water to 20 fathoms.

Type locality.—Off Fort Jefferson Dock, Garden Key, Dry Tortugas, Fla.

Known range.—Reefs off Beaufort, N.C., to southern Florida; through West Indies to Surinam.

Remarks.—Ovigerous females have been reported from February to October in Florida (Provenzano, 1959, in part), in June in North Carolina, August in South Carolina, October in Puerto Rico, and in May from Surinam (Holthuis, 1959).

Genus *Clibanarius* Dana, 1852

Dana, 1852, p. 6.

Clibanarius vittatus (Bosc). Striped hermit crab

Figure 97

Pagurus vittatus Bosc, [1801 or 1802], p. 78, pl. 12, fig. 1.
Clibanarius vittatus: Hay and Shore, 1918, p. 410, pl. 30,
fig. 9.—Provenzano, 1959, p. 371, fig. 5 D.

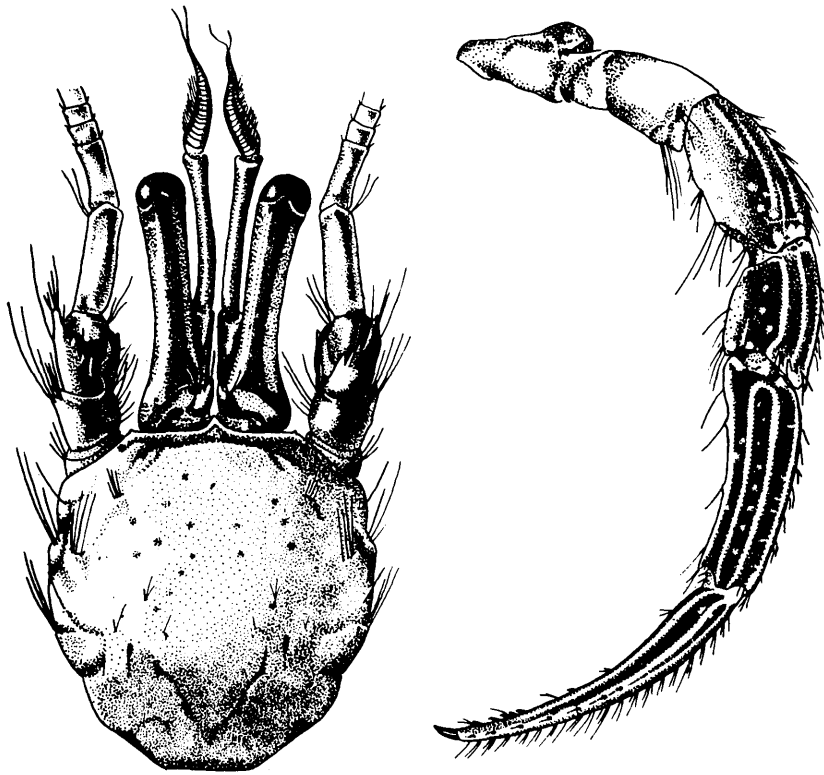


FIGURE 97.—*Clibanarius vittatus* (Bosc). A, anterior part of body in dorsal view, $\times 1.6$; B, third leg, $\times 3.2$ (after Holthuis, 1959).

Recognition characters.—Anterior shield of carapace subquadrate, a few fine hairs along lateral margin. Front with rostrum acute, triangular, slightly more prominent than lateral projections. Eystalks almost as long as width of anterior shield, nearly cylindrical, cornea not dilated, right eystalk occasionally slightly shorter than left; eye scales narrow, approximated at tips, but well separated at bases, margin with one to four spines, terminal largest. Antennular peduncles as long as eystalks. Antennal peduncles reaching to at least three-fourths length of eystalks; acicles acute, with three to five terminal spines, flagella reaching tips of walking legs.

Chelipeds equal, sparsely hairy; hands thick, inflated, twice as long as broad, covered thickly above, sparingly below, with somewhat blunted spines darker than color of hands and with bundles of stiff hairs springing from bases; fingers opening horizontally, heavy, toothed and somewhat gaping at base, cutting edges corneous, extending along upper side; carpus as long as

palm. First and second walking legs exceeding chelipeds by over half length of dactyls, tips corneous; two distal articles with numerous bundles of hairs. Third and fourth walking legs reduced; third subchelate; fourth very small, chelate, and turned on back.

Measurements.—Length of carapace: male, 32 mm.; female, 29 mm.

Color.—Greenish to dark brown with longitudinal stripes of gray to white; antennular peduncles light above, dark laterally, with orange flagella; propodus of walking legs with four pairs of light, longitudinal stripes continuous with similar stripes on dactyl and carpus, one of ventral stripes usually somewhat diffuse (Provenzano, 1959).

Habitat.—Common on harbor beaches, especially on borders of mud flats (Pearse, Humm, and Wharton, 1942); often on rock jetties or high on bay shores (Whitten, Rosene, and Hedgpeth, 1950); waterline to a few feet.

Type locality.—Coasts of Carolina.

Known range.—Potomac River, Gunston, Va., to Rio de Janeiro, Brazil.

Remarks.—This large species is one of the commonest conspicuous hermit crabs of the shore region of the Carolina bays. It has a broad range along the western Atlantic, and Holthuis (1959) has given new distribution records, as well as a history of its early recognition in this hemisphere.

Ovigerous females have been reported from Surinam in July and August (Holthuis, 1959) and from Florida in October (Provenzano, 1959).

Genus *Petrochirus* Stimpson, 1858

Stimpson, 1858, p. 233 (71).

Petrochirus diogenes (Linnaeus)

Figure 98

Cancer Diogenes Linnaeus, 1758, p. 631.

Petrochirus bahamensis: Hay and Shore, 1918, p. 410, pl. 30, fig. 6.—Schmitt, 1935a, p. 206, fig. 66.—Provenzano, 1959, p. 378, fig. 8.—1961, p. 153 (rev.).

Petrochirus diogenes: Holthuis, 1959, p. 151 (rev.).

Recognition characters.—Anterior shield of carapace flattened, as broad as long, rough, uneven, and with scattered tufts of hairs; front trilobate, rostrum about as long as lateral projections. Eystalks straight, dilated distally, with a tuft of hair above corneal surfaces and scanty tufts near base; eye scales broad basally, acute anteriorly with indistinct serrations. Antennular peduncles reaching or exceeding eystalks. Antennal peduncles shorter than eystalks; acicles slender, hairy, and minutely spined.

Chelipeds massive, subequal, right slightly larger; hands and carpi coarsely roughened with grouped tubercles separated by appressed setae on upper and, to some extent, lower surfaces, becoming spinose along inner margin; fingers opening obliquely, major chela with fingers tuberculate on crushing edges, minor chela with fingers somewhat spooned, cutting edges sharp, tips corneous. First two pairs of walking legs with carpus ornamented above like chelae; propodi similar with clusters of hairs beneath; dactyls with slightly twisted rows of spines and dense setae; propodi and carpi, especially of first walking legs, with dorsal row of dark-tipped spines. Third legs subchelate; last legs chelate and turned up against side.

Measurements.—Length of carapace: male, 75 mm.; female, 44 mm.

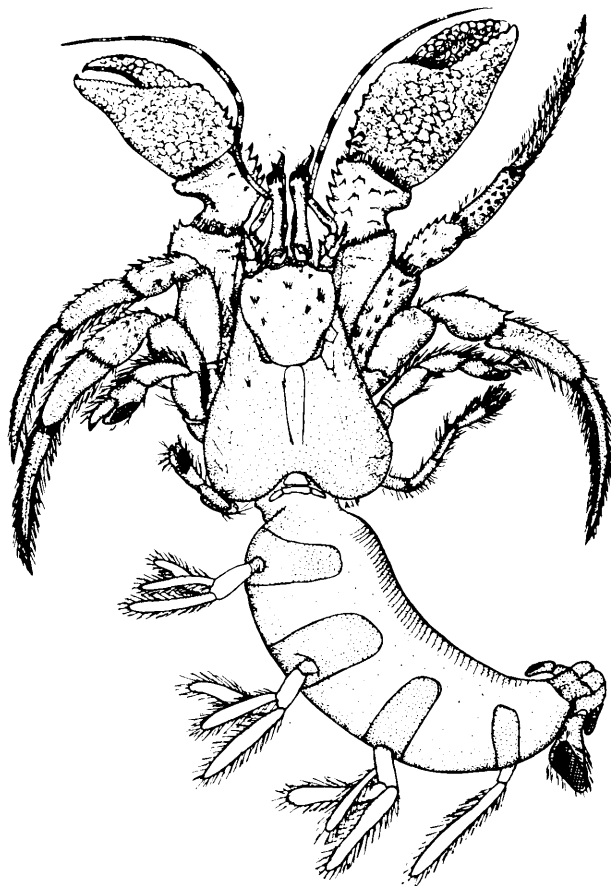


FIGURE 98.—*Petrochirus diogenes* (Linnaeus). Female in dorsal view showing well-developed triramous pleopods, $\times 0.35$ (after Provenzano, 1959).

Color.—Generally reddish; chelipeds reddish except between fingers, and white spots on carpal articles; antennal and antennular peduncles longitudinally striped with red and white, antennal flagella transversely banded with red and white (Provenzano, 1959).

Habitat.—Mud, mud and shell, and sand bottoms. Common on shrimping grounds near Tortugas, Fla. (Provenzano, 1959), in the western Gulf of Mexico (Hildebrand, 1954, 1955), and on fishing grounds southeast of Cape Lookout, N.C., in about 18 fathoms; to 50 fathoms (Provenzano, 1959; Holthuis, 1959).

Type locality.—Near shores of Bahama Islands (Catesby, in Holthuis, 1959).

Known range.—Off Cape Lookout, N.C., to Brazil; West Indies.

Remarks.—The genus *Petrochirus* has a fossil record extending from the Cretaceous to the pres-

ent in North America (Rathbun, 1935). Toulou (1911) considered the Miocene form from Panama to be conspecific with the living species in the West Indies region, but Rathbun (1918a) considered this form as distinct (*P. bouvieri*) and possibly ancestral to the modern species.

Petrochirus diogenes is the largest hermit crab in the Carolinian fauna and this feature, plus its coarsely tuberculate, ruddy appendages, makes it conspicuous. A common commensal is the porcelainid crab, *Porcellana sayana*, and other commensals on the shells carried by the crab, such as *Crepidula plana* (Say), bryozoans (*Scrupocellaria* sp.), tubicolous worms (*Hydroides* sp. and *Spirorbis* sp.) and other species, are mentioned by Pearse (1932b). Ovigerous females have been reported in March from the Virgin Islands (Provenzano, 1961).

Pearse (1932a) determined the freezing point of *P. diogenes* blood (range -1.90° to -2.32° C.).

Holthuis (1959) reviewed the complex nomenclatural history of the species, designated the type, restricted the type locality, and delimited the geographic range.

Genus *Dardanus* Paulson, 1875

Paulson, 1875, p. 96 (translation).—Hemming, 1958b, p. 163.—Provenzano, 1959, p. 372.

KEY TO SPECIES IN THE CAROLINAS

- a. Propodus of second left walking leg conspicuously hairy, with a lateral longitudinal ridge paralleled by a groove, ridge crossed by rugae.....*venosus* (p. 123).
- aa. Propodus of second left walking leg not hairy, without a lateral longitudinal ridge or groove, rugae arranged in herringbone pattern.....*insignis* (p. 124).

Dardanus venosus (H. Milne Edwards)

Figure 99

Pagurus venosus H. Milne Edwards, 1848, p. 61.

Dardanus venosus: Verrill, 1908, p. 441, text-figs. 58-59; pl. 26, figs. 4a, 5a.—Provenzano, 1959, p. 374, fig. 6 (rev.).

Recognition characters.—Anterior shield of carapace slightly longer than width of front, smooth, with few hairs and some deep lines near sides; anterior margin with rostrum wanting, lateral projections between bases of eyestalks and antennae prominent. Eyestalks stout, slightly constricted in middle, extending to tips of antennal peduncles or slightly beyond, a tuft of setae just behind cornea; eye scales widely separated, inner margins straight, blunt tips bearing

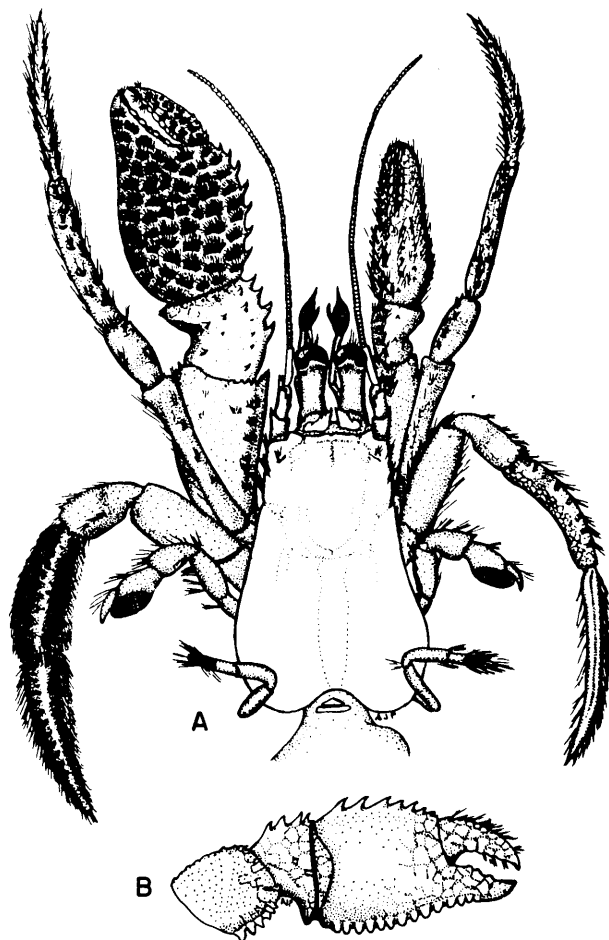


FIGURE 99.—*Dardanus venosus* (H. Milne Edwards). A, anterior part of body in dorsal view showing ridge on second left walking leg; B, inner surface of major chela showing "veins" which specific name describes; A-B approximately $\times 1.5$ (after Provenzano, 1959).

several spines. Antennular peduncles exceeding cornea by one-third of terminal peduncular article. Acicles short, reaching midlength of eyestalks, armed with small, sharp spines.

Chelipeds unequal, left much larger than right; fingertips black, corneous, spooned. Major chela with outer surface covered by scalelike tubercles separated by fan-shaped fringes of appressed hairs, inner surface smooth, medial margin bearing row of seven sharp, horny-tipped spines continued as row of smaller spines on dactyl and as well-developed spines on carpus; carpus with smaller sharp spines scattered over surface. Minor chela narrower, lacking scalelike tubercles on outer surface, and with long setae rather than appressed bristles. Walking legs with dactyls

longer than propodi, longest in first pair; second left leg markedly different from others, with dactyl and propodus broadened, fringed with hairs, and with a lateral longitudinal ridge paralleled by a groove, ridge crossed with numerous rugae.

Measurements.—Length of carapace (medium sized individual): 31 mm. (Verrill, 1908).

Color.—Walking legs with broad, transverse bands of red; legs, fingers of hands, and inside surfaces of chelipeds reticulated with fine red lines (hence, descriptive specific name); scalelike tubercles of hand and rugae of second left leg blue to purple; eye scales sometimes white (Provenzano, 1959).

Habitat.—Often found on sand and grass flats, on mud bottom, and in baited traps (various authors). Shells inhabited sometimes bear sponges or coelenterates (Holthuis, 1959). Shallow water near shore to 50 fathoms; rarely to 200 fathoms.

Type locality.—Guadeloupe.

Known range.—Off Beaufort Inlet, N.C. (Cerame-Vivas, Williams, and Gray, 1963); through West Indies to northeastern Brazil; Bermuda.

Remarks.—Ovigerous females have been reported from northeastern Florida in June, from the Virgin Islands in March and May (Provenzano, 1961), and from northeastern South America in April, May, July, and September.

***Dardanus insignis* (Saussure)**

Figure 100

Pagurus insignis Saussure, 1858, p. 453, pl. 3, figs. 20, 20a.
Dardanus insignis: Verrill, 1908, p. 446, text-fig. 60; pl. 26, figs. 4 b, c, 5b.

Recognition characters.—Anterior shield of carapace longer than width of front, with scattered clumps of setae, and roughened slightly near anterior and anterolateral margins. Anterior margin with rostrum wanting; lateral projections on front triangular, thickened, prominent, and hairy on frontal edge. Eyestalks stout, slightly constricted in middle, extending almost to tips of antennal peduncles, a pencil of hairs at base of dilated cornea; eye scales prominent, well separated, serrated distally with a strong medial pair of spines separated from a smaller more lateral series of four spines by a notch obscured by a pencil of setae. Antennular peduncles with base of terminal article exceeded by eyestalks. Acicles

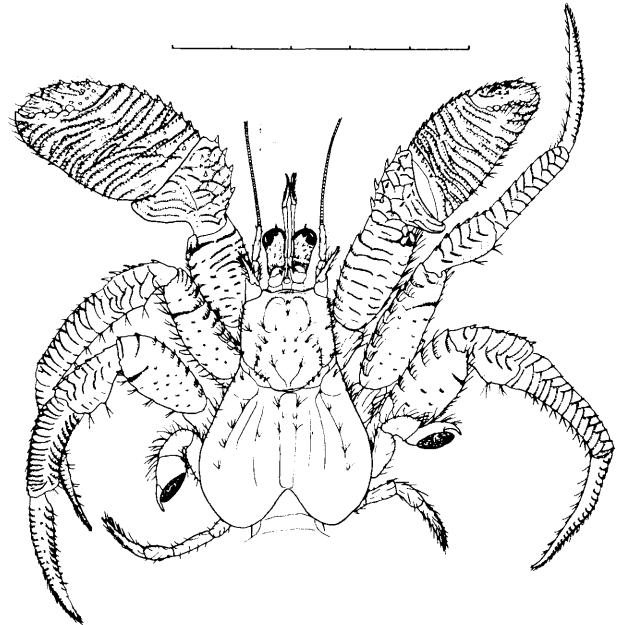


FIGURE 100.—*Dardanus insignis* (Saussure). Anterior part of male in dorsal view; 50 mm. indicated.

long, reaching to base of cornea, with a few spines and hairs arranged in a spiral line originating on inner surface at base and curving across dorsal surface to termination on lateral surface near tip.

Chelipeds heavy, left larger than right, covered with ciliated, tuberculate rugosities becoming bolder and more diagonal distally on hands and immovable fingers; movable finger of major chela with ciliated rugosities somewhat diagonal, those on minor dactyl irregularly arranged; opposed edges of fingers with heavy white teeth, tips black; spine on crest of meri, outer surface of carpi, and hands, largest spines on upper medial border; a row of spines on lower medial border of merus and ischium. First two pairs of walking legs strong, with rugose pattern similar to chelipeds and forming herringbone pattern on outer surface of propodus of large second left walking leg; dactyls of these walking legs with crest of spines dorsally, that of second left leg with crest of spines dorsally and ventrally, and continued below on propodus. Third and fourth walking legs reduced and specialized.

Measurements.—Male: length of carapace, 38 mm.; anterior shield, length, 17.5 mm., width, 15.5 mm.

Color.—Ground color yellowish; rugosities tan near body, becoming maroon on chelipeds and

first two pairs of walking legs distally, proximal rugae on hands with reticulate maroon pattern on yellowish background; anterior shield mottled tan; eyestalks banded alternately with maroon, yellow, and tan.

Habitat.—Fifteen to 124 fathoms.

Type locality.—Guadeloupe.

Known range.—Off Oregon Inlet, N.C., 17 fathoms (Cerame-Vivas, Williams, and Gray, 1963), to Port Aransas, Tex.; through West Indies to Guadeloupe.

Remarks.—Until recently this species was known only from beyond the 100-fathom curve in the Carolinas, but it has been collected in shallow water north of Cape Hatteras (Cerame-Vivas, Williams, and Gray, 1963).

Subfamily Pagurinae

The chief distinguishing characters for this group are given in the Key to Subfamilies of Hermit Crabs.

KEY TO GENERA OF PAGURINAE IN THE CAROLINAS

- a. Fingers opening and closing horizontally; no paired appendages on abdomen of either sex.
 - b. Vas deferens of male not protruding in form of a tube.....*Pagurus* (p. 125).
 - bb. Vas deferens of left side protruding, and coiled in a spiral.....*Spiropagurus dispar* (p. 133).
- aa. Fingers opening and closing obliquely; vas deferens of male not protruding; a pair of appendages on first abdominal segment of female only
 - Pylopagurus* (p. 133).

Genus *Pagurus* Fabricius, 1775

Provenzano, 1959, p. 393.—Hemming, 1958b, p. 163.

KEY TO SPECIES IN THE CAROLINAS

- a. Eye scales unarmed or with single subterminal spine.
- b. Length of eyestalk not more than 3.5 times its greatest width.
 - c. Width of major chela less than one-half length.
 - d. Chelipeds subcylindrical, relatively smooth on outer surface; eye scales somewhat rounded distally, dorsal surface shallowly excavated.....*longicarpus* (p. 125).
 - dd. Chelipeds not subcylindrical, relatively spiny on outer surface; eye scales rounded distally but not excavated on dorsal surface.....*defensus* (p. 127).
 - cc. Width of major chela more than one-half length, one or both chelae broad and flattened.
 - d. Dactyl of major chela with sharply produced angle on medial margin; no depressed spot at base of immovable finger of either chela.....*pollicaris* (p. 128).

dd. Dactyl of major chela without sharply produced angle on medial margin; a depressed spot (or spots) at base of immovable fingers of chelae.....*impressus* (p. 129).

bb. Length of eyestalk at least 4 times its greatest width.....*annulipes* (p. 130).

aa. Eye scales armed with two or more spines.

b. Rostrum acute.....*pygmaeus* (p. 131).

bb. Rostrum obsolete.....*brevidactylus* (p. 132).

Pagurus longicarpus Say

Figure 101

Pagurus longicarpus Say, 1817, p. 163.—Hay and Shore, 1918, p. 411, pl. 29, fig. 3.—Provenzano, 1959, p. 394, fig. 13 (rev.).

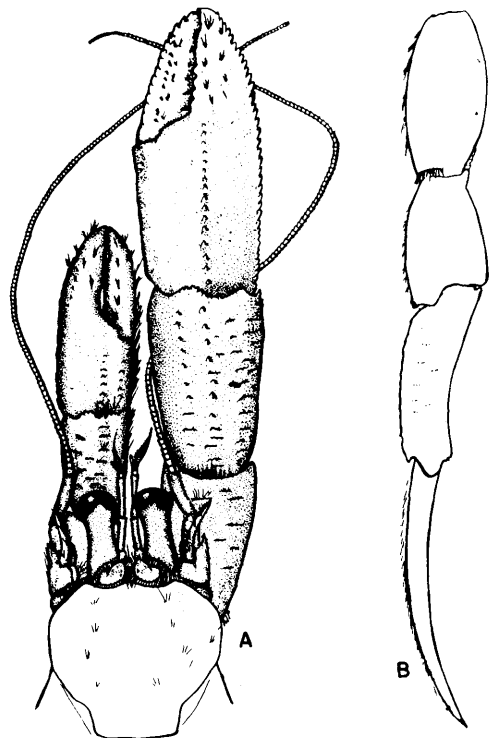


FIGURE 101.—*Pagurus longicarpus* Say. A, anterior part of body and chelipeds in dorsal view; B, second left walking leg in lateral view; A-B $\times 4$ (after Provenzano, 1959).

Recognition characters.—Anterior shield of carapace subcordate, truncate posteriorly, about as broad as long. Rostrum obsolete, hardly as advanced as lateral projections of front. Eyestalks stout, 2–3 times longer than broad, much shorter than width of anterior shield, cornea dilated; eye scales with concave, oval anterior lobe armed with a subterminal spine. Antennular peduncles exceeding eyes by about half length of terminal article. Antennal peduncles exceeding eyes by

about one-third length of last article; acicles slender, curved sinuously outward, reaching to tip of cornea; flagella exceeding tip of major cheliped.

Right cheliped much larger and longer than left, subcylindrical, devoid of hairs except for a few short setae along inner edges of fingers; width of hand less than one-half total length, palm lightly crested and minutely dentate along outer margin, upper surface minutely granulate and with two incomplete rows of larger granules near proximal end; fingers short, hooked at tips; carpus as long as propodus to middle of finger, with two rows of subspinous tubercles and scattered smaller ones. Left cheliped smaller, hairier, similarly formed but relatively broader; fingers with cutting edges distally, gaping at base. First and second walking legs with dactyls longer than propodi, extending about as far as chelipeds. Third and fourth pairs of legs reduced in size, fourth turned upward on back.

Measurements.—Length of carapace: male, 10 mm.; ovigerous female, 11 mm.

Color.—Color varies with locality; specimens of west Florida are lighter than those of east coast; upper surface of chelipeds and all walking legs iridescent; posterior carapace light green; hand white with median diffused pigment stripe, carpus with dorsal stripe and one on each side; walking legs with dactyl unstriped, propodus with lateral stripe, merus with single lateral muddy brown stripe and transverse stripe from lower anterior margin to broad pigmented area on upper surface; antennae with dark bands alternating with shorter white bands. Young may have transverse band on each article of walking legs rather than stripe; lateral stripes of major cheliped with V-shaped appearance in dorsal view (Provenzano, 1959, from west Florida specimen).

Habitat.—Common on harbor beaches, in harbor channels, and in shallow littoral on a variety of bottoms; to 27.5 fathoms (possibly beyond).

Type locality.—"Inhabits Bay Shores" [east coast of United States].

Known range.—Minas Basin, Nova Scotia (Rathbun, 1929) to northern Florida; Sanibel Island, Fla., to coast of Texas (Provenzano, 1959; Whitten, Rosene, and Hedgpeth, 1950).

Remarks.—*Pagurus longicarpus* is one of the commonest decapod crustaceans in shallow water

along the coast of the Eastern United States. Like other similarly available crustaceans, it has been the subject of a number of ecological and physiological studies, and these have been accomplished mostly around Woods Hole, Mass. Provenzano (1959) suggested that the Atlantic coast and Gulf of Mexico forms, with a hiatus between their ranges, may be subspecifically distinct.

The general habitat of *P. longicarpus*, summarized above, has been commented upon by other authors (Pearse, Humm, and Wharton, 1942; Allee, 1923). Allee concluded that the ubiquity of this hermit crab prevents it from being of aid in distinguishing shallow-water communities. Diatoms, detritus, and algae make up the food of this species (Sanders, Goudsmit, Mills, and Hampson, 1962).

The breeding season of this common form extends from early May to mid-September (Bumpus in Sumner, Osburn, and Cole, 1913b) in Massachusetts, and ovigerous females have been taken in January, March, and September in Florida (Wass, 1955, in part). Thompson (1901, 1903) described four zoeae, a glaucothoe, and a first postlarval stage, as well as various adolescent stages. He compared larval development of *P. longicarpus* with that of *P. annulipes* and gave remarks on the derivation and geological age of pagurids.

Autotomy and regeneration in this species received attention from Morgan (1900, 1901) and Haseman (1907), though investigations on this subject with other species now supersede the early studies. The first three pairs of legs have a fracture joint near their bases; hence, can be autotomized, but the last two pairs lack these and cannot be autotomized. Injuries distal to the fracture plane result in autotomy and regeneration; those proximal to the plane do not result in autotomy. Injured abdominal appendages are readily regenerated. Haseman carried this work farther, showing that when the chelipeds were removed at their breaking joints they differentiated from the tip proximally, but the first two pairs of clawed (walking?) legs differentiated from the base toward the tip. Direction of differentiation in the cheliped can be reversed by injuring the developing bud.

In another vein, conditioned and natural behavior of *P. longicarpus* has been the subject of a few

studies. Spaulding (1904) found the crab able to profit by experience in vision and taste experiments, and able to learn faster than *P. pollicaris*. Fink (1941) was able to demonstrate deconditioning of fear-reflex activity over a period of 18 days, the older crabs responding more slowly than young ones. Allee and Douglis (1945) found that a shell-less *P. longicarpus* would not feed, but if it were given a shell to occupy it would feed normally. Crabs in shells fight for food, the larger often fending smaller ones from a food supply. Movement from small to larger shells is accomplished only after several trials and thorough investigations of new shells, but shell-less crabs will accept almost any shape of shell in any condition. Shell-less crabs placed in a finger bowl tend to fight continuously until one or both are dead, usually within 24 hours. If an empty shell is dropped into a container with two shell-less crabs, one will immediately enter the shell. If the larger individual does not enter first, it will extract the smaller forcibly and enter in its place. Shell-less crabs will attack housed individuals regardless of size, but attackers were never seen to be successful when the two combatants were of equal size or when the housed individual was the larger.

Kropp and Perkins (1933) showed that in *P. longicarpus* and other remotely related decapods the chromatophore activity substance in the eyestalk will induce contraction of chromatophores in other species, and postulated that the substance is genetically similar throughout the group.

Finally, Reinhard (1944, 1945) and Reinhard and Buckeridge (1950) discussed parasitism in *P. longicarpus*. An examination of 8,000 crabs showed a 1-percent infestation with a larval acanthocephalid belonging to the genus *Poly-morphus*. The worm was found in the abdominal cavity(?) usually attached to the hind gut or sometimes among tubules of the hepato-pancreas. The usual number of cysts per host was one, though as many as three occurred. Reinhard also described an entoniscid isopod, *Paguritherium alatum*, from this species. Entering the crab's body through the dorsal side of the eyestalk, and remaining in contact with this point of entry, the parasite elongates with but little damage to thoracic organs, but becomes greatly distended in the abdominal region. There it restricts the hepato-pancreas and nearly obliterates the gonads as it

grows. Infestation does not externally modify the male host. In females, the parasite reduces size of the first three pleopods, especially length of the endopod, and causes partial or complete loss of ovigerous hairs on the external surface of the endopod and protopod. Thus, secondary sexual characters of the female crab are altered. One percent of the crabs investigated were infested with this parasite.

Pagurus defensus (Benedict)

Figure 102

Eupagurus defensus Benedict, 1892, p. 7.

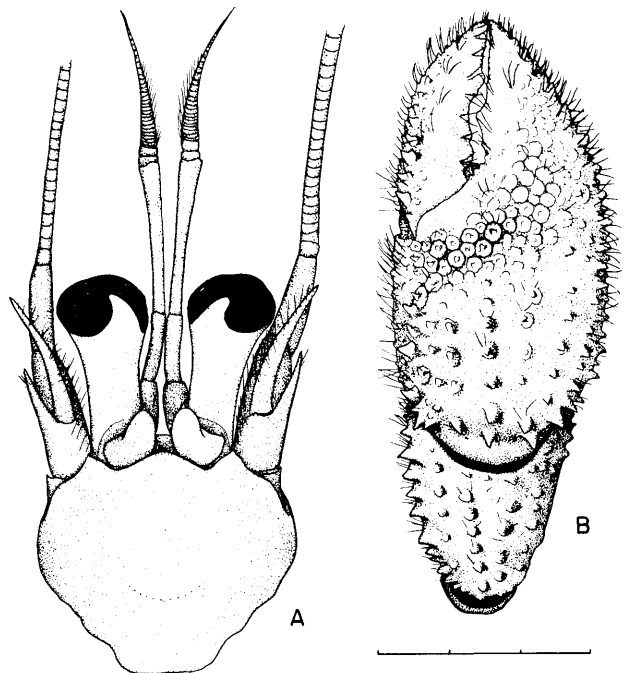


FIGURE 102.—*Pagurus defensus* (Benedict). A, anterior part of female in dorsal view; B, right chela, outer surface; 3 mm. indicated.

Recognition characters.—Anterior portion of carapace broader than long, subcordate. Rostral projection broadly rounded, lateral processes triangular, armed at apex with a short spine. Eyestalks stout, much dilated and flattened distally; eye scales broad, rounded, anterior margin forming a semicircle, armed with a subterminal spine. Antennular peduncles extending beyond eyestalks by two-thirds or more length of terminal article. Antennal peduncle extending beyond eyestalks by one-half length of terminal article; acicle curving outward and extending somewhat beyond eyestalk.

Chelipeds unequal, right larger than left. Major chela a little wider than carpus, fingers agape, margins set with comb of long, slender spines; upper surface with more or less diagonal rows of spines on palm and spines irregularly but closely set near base of dactyl and on immovable finger; dactyl with several rows of irregularly placed plates, and a small spine arising from center of each; carpus with three rows of sharp spines, one on outer margin, one on upper surface, and one on inner surface. Minor chela extending to base of major dactyl; hand armed with spines as in opposite member but hairier, and no spine-bearing plates on dactyl; fingers agape; carpus with a double crest of spines, outer margin convex, inner margin straight and flat; merus compressed. Walking legs long and slender, dactyls lightly setose, longer than preceding two articles together; propodus and carpus with a crest of spines.

Measurements.—Length of carapace: female, 7 mm.

Variations.—Fingers of the chelae do not gape in small individuals.

Habitat.—Sixteen to 49 fathoms.

Type locality.—Gulf of Mexico between Delta of Mississippi River and Cedar Keys, Fla., 30 fathoms.

Known range.—Cape Hatteras to Cape Lookout, N.C.; Tortugas, Fla., to Alabama.

***Pagurus pollicaris* Say**

Figure 103

Pagurus pollicaris Say, 1817, p. 162.—Hay and Shore, 1918, p. 411, pl. 30, fig. 1.—Provenzano, 1959, p. 401, fig. 16 (rev.).

Recognition characters.—Anterior shield of carapace subcordate, nearly as long as broad, truncate posteriorly. Rostrum slightly less advanced than lateral projections of front. Eystalks moderately stout, not so long as width of anterior carapace, nearly straight, cornea dilated; eye scales with round-tipped, slightly concave anterior lobe armed with inferior subterminal spine. Antennular peduncles exceeding eystalks by approximately half length of last article. Antennal peduncles exceeding eystalks; acicles slender, curved outward, reaching to or beyond base of cornea, hairy medially.

Chelipeds unequal, right much larger than left, both covered with small, closely spaced granules, outer margins with enlarged granules or small

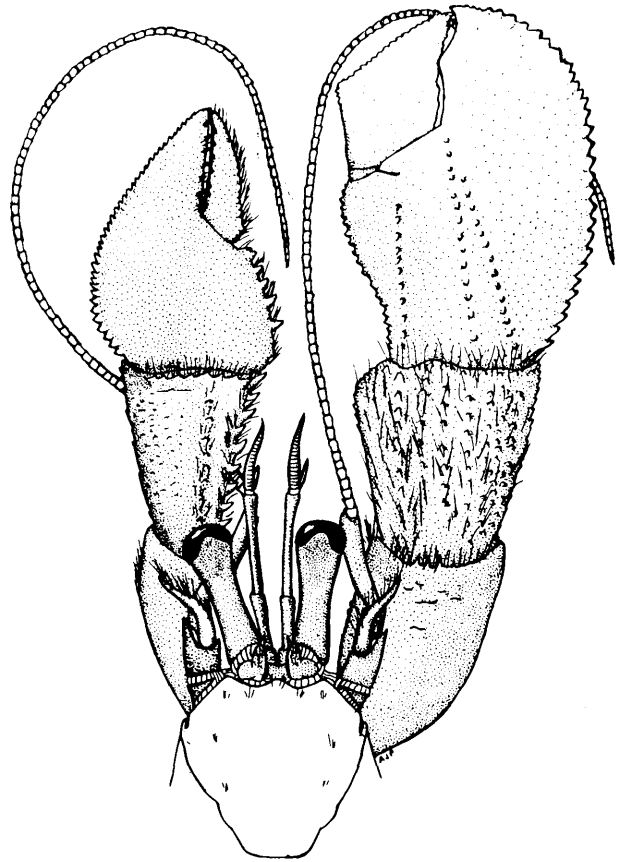


FIGURE 103.—*Pagurus pollicaris* Say. Anterior part of animal and chelipeds in dorsal view, approximately $\times 3$ (after Provenzano, 1959).

spines. Major chela stout, hand flattened; movable finger with prominent, projecting angle on medial border; tips of fingers acuminate; carpus with numerous tubercles, larger than on hand, subspinose and ciliated on upper surface; merus with a few squamiform tubercles. Minor chela with inner border dentate, movable finger not produced, dentation of inner border continued on inner dorsal border of carpus. First and second walking legs with dactyls much longer than propodi; first pair with small, well-defined spines along upper margin of propodus and carpus; second pair with spines reduced. Third legs reduced, fourth pair reduced and carried on back.

Measurements.—Length of carapace: male, 31 mm.; female, 27 mm.

Color.—Color varies with locality, those of west Florida being lighter than those of Northeastern States. Chelipeds basically white with gray margins on insides, tips of dactyls and dark area in

center of upper surface of each cheliped; remainder of body light gray-tan; eyestalks brown below cornea; hairs on antennules rusty brown (Provenzano, 1959, for west Florida form).

Habitat.—Deep channels of harbors and littoral waters; also found in shallow estuaries near ocean; near low-tide mark to 25 fathoms.

Type locality.—[East] coast of United States.

Known range.—Vineyard Sound, Mass., to northeastern Florida; Key West, Fla., to Texas (Provenzano, 1959).

Remarks.—Blake (1953) reported *P. pollicaris* from the Pleistocene of Maryland.

Ovigerous females have been reported in March from Florida (Provenzano, 1959). They have been found in January and November in North Carolina, and in April in Chesapeake Bay.

***Pagurus impressus* (Benedict)**

Figure 104

Eupagurus impressus Benedict, 1892, p. 5.

Pagurus impressus: Provenzano, 1959, p. 399, fig. 15 (rev.).

Recognition characters.—Anterior shield of carapace about as broad as long, flattened. Rostrum much rounded, in line with somewhat more angular lateral projections of front. Eyestalks slender, about three times longer than greatest width, cornea dilated and flattened; eye scales with moderately slender, acuminate, slightly excavated anterior lobe, subterminal spine large. Antennular peduncles exceeding eyestalks by at least half of last article. Antennal peduncles slightly exceeding cornea; acicles curving outward, reaching to base of cornea, hairy on medial edge.

Chelipeds unequal, right much larger than left, upper surfaces dented, both covered with small, closely crowded granules, outer margins bearing enlarged granules or small spines. Dactyl of major cheliped with a rounded angle on medial border near tip followed by marginal spines or granules, tips of fingers acuminate; carpus with five longitudinal rows of small spines often obscured by irregularly arranged additional spines, a row of well-developed spines along inner edge. Minor cheliped reaching to angle of major dactyl; a row of spines along inner margin of hand and carpus; fingers somewhat spooned at tips, cutting edges well defined, tips corneous, dactyl with medial border tuberculate; carpus with several rows of small spines. First and second walking legs with

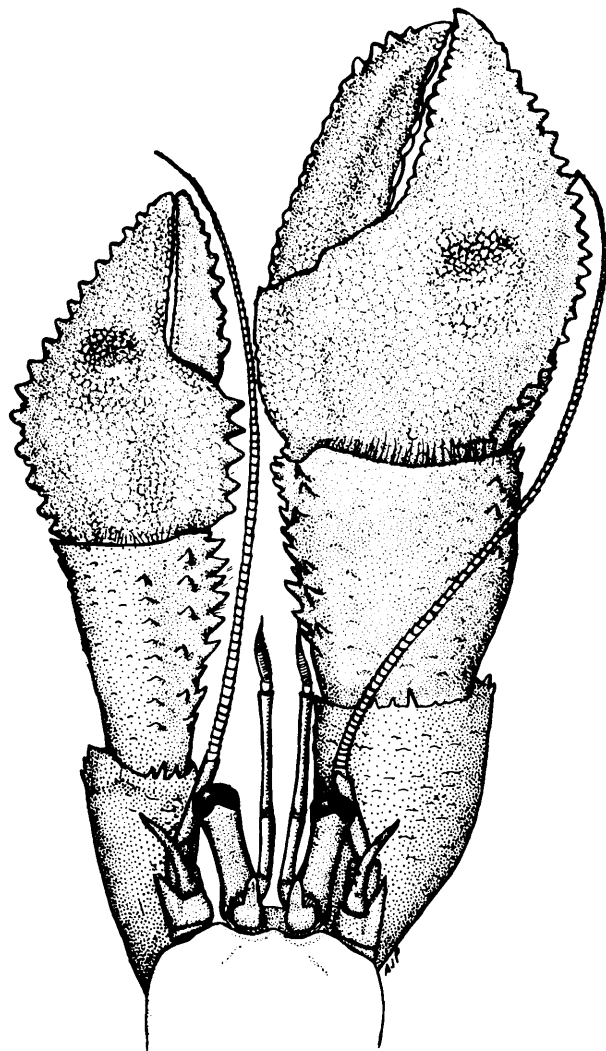


FIGURE 104.—*Pagurus impressus* (Benedict). Anterior part of body in dorsal view, approximately $\times 2.5$ (after Provenzano, 1959).

dactyls much longer than propodi; first pair with row of small, well-defined spines along upper margin of propodus and carpus; second pair with spines reduced. Third legs reduced, fourth reduced and turned on back.

Measurements.—Length of carapace: male, 25 mm.; female, 16 mm. (Provenzano, 1959).

Color.—Hands solid rust to chocolate brown, other appendages brownish with alternating thin bands of light color; antennae, antennules, and peduncles yellow; eyestalks brown above, bright blue below with bright scarlet at base of eyestalks (Provenzano, 1959).

Habitat.—On sandy bottom, grassy flats, or pilings; occasionally found in sponges (Wass, 1955); 6 to 18 fathoms.

Type locality.—Florida.

Known range.—Off Diamond Shoals, N.C., to east coast of Florida; western Florida from Sanibel Island north to vicinity of Alligator Harbor; Port Aransas, Tex.

Remarks.—Ovigerous females have been taken in January and February in the Carolinas.

Pagurus annulipes (Stimpson)

Figure 105

Eupagurus annulipes Stimpson, 1860a, p. 243.

Pagurus annulipes: Hay and Shore, 1918, p. 412, pl. 29, fig. 12 (rev.).—Provenzano, 1959, p. 407, fig. 18 (rev.).

Recognition characters.—Anterior shield of carapace subcordate, scarcely longer than wide, truncate posteriorly. Rostrum obsolete, about as long as rounded lateral projections of front. Eystalks nearly straight, shorter than front, slightly constricted in middle, cornea not dilated; eye scales flat, broad, and rounded but with one or two spines on anterior border. Antennular peduncles exceeding eystalks by about one-third of last article. Antennal peduncles reaching about to, or beyond, tip of eystalks; acicles slender, curving outward, reaching about middle of last article of antennal peduncle; flagella exceeding major cheliped.

Chelipeds unequal, right much larger than left. Major cheliped long, subcylindrical, moderately and evenly granulate and ciliate above, except subspinose in large individuals; tips of fingers hooked, dactyl less than one-half length of hand; carpus nearly twice as long as broad, spinulose along inner margin. Minor cheliped much shorter, compressed, thickly ciliate and spinulose above; hand slightly shorter than carpus; fingers shorter than palm, with cutting edges distally, gaping at base. First and second walking legs with dactyls longer than propodi, legs slender, compressed; carpus with a distal spine on upper border. Third legs much reduced; fourth pair smaller, turned on back.

Measurements.—Length of carapace: male, 5 mm.; female, 4 mm. (Provenzano, 1959); Wass (1955) found a specimen with a carapace length of 7 mm.

Variations.—This is a small species. Males tend to attain larger sizes than females, and this is

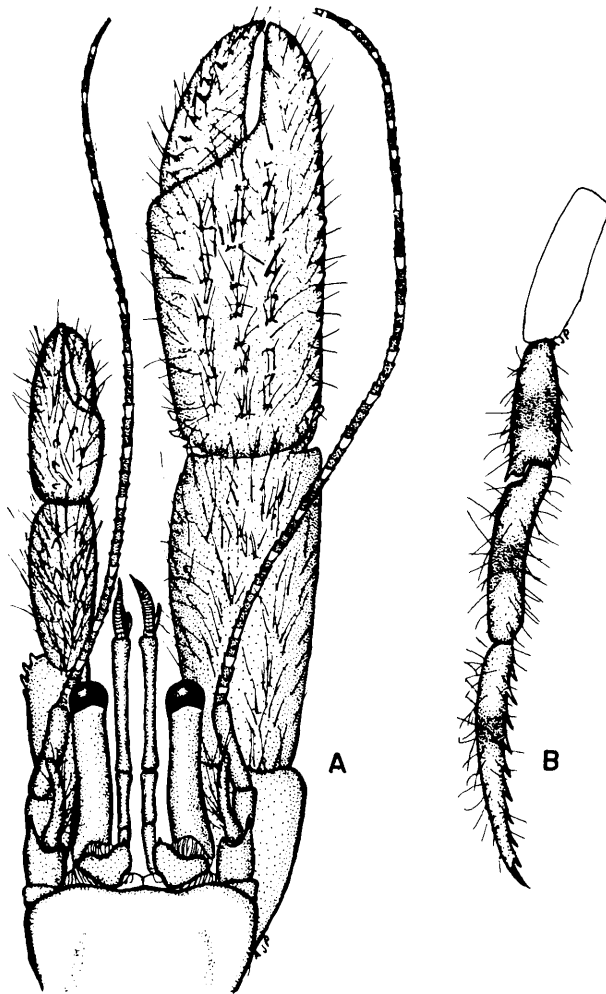


FIGURE 105.—*Pagurus annulipes* (Stimpson). A, anterior part of body and chelipeds in dorsal view; B, second left walking leg showing characteristic color bands in lateral view; A-B approximately $\times 7$ (after Provenzano, 1959).

accompanied by a proportionately larger cheliped (Provenzano, 1959).

Color.—White to gray with brown pigment band around each article of walking legs; antennae with broad purple bands alternating with narrower white bands, occasionally with poorly defined longitudinal stripes on legs (Provenzano, 1959).

Habitat.—Fairly common on a variety of bottom types in Massachusetts, but not so common in the Beaufort Harbor area of North Carolina; abundant in *Thalassia* beds in southern Florida, seemingly preferring soft, sandy bottom to other

types; tolerates somewhat lowered salinities of estuaries; near low-tide mark to 23 fathoms (Schmitt, 1935a).

Type locality.—Beaufort Harbor, N.C.

Known range.—Vineyard Sound, Mass., around Florida peninsula to Alligator Harbor; Cuba; Puerto Rico.

Remarks.—Ovigerous females have been reported in September from Massachusetts (Thompson, 1903), and from February to April, and August to September in Florida (Provenzano, 1959). Thompson described four zoeal, a glaucothoe, a postlarval, and a number of adolescent stages at Woods Hole. The only difference he found between *P. annulipes* and *P. longicarpus* in larval development was the slightly smaller size of the former.

Pagurus annulipes may occur a few miles offshore, for it has been found in the stomachs of flounders (*Paralichthys dentatus*) taken 15 miles east-southeast of Oregon Inlet, N.C., in 20-fathom water along with numerous juvenile *Cancer irroratus*.

***Pagurus pygmaeus* (Bouvier)**

Figure 106

Eupagurus pygmaeus Bouvier, 1918, p. 11, fig. 4.

Pagurus pygmaeus: Provenzano, 1959, p. 410, fig. 19.

Recognition characters.—Anterior shield of carapace longer than wide. Rostrum acute, slightly in advance of lateral projections, each bearing a terminal spine. Eyestalks shorter than width of anterior carapace, wide at base, tapering toward cornea; eye scales armed along medial margin with four or five spines. Antennular and antennal peduncles extending slightly beyond cornea; unarmed acicle reaching base of cornea.

Chelipeds unequal, right much larger than left, both with long but very fine hairs and forward-projecting spines. Major chela suboval, margin armed with strong spines, upper surface covered with smaller, nearly blunt spines; carpus with six very sharp spines on upper anteromedial surface, two additional spines more laterally placed, and a short row of spines along lateral margin. Minor chela much reduced, twice longer than broad, upper surface with many blunt spines, some forming two central rows; tips of fingers corneous, spooned; carpus with double row of large spines on upper surface. Walking legs with

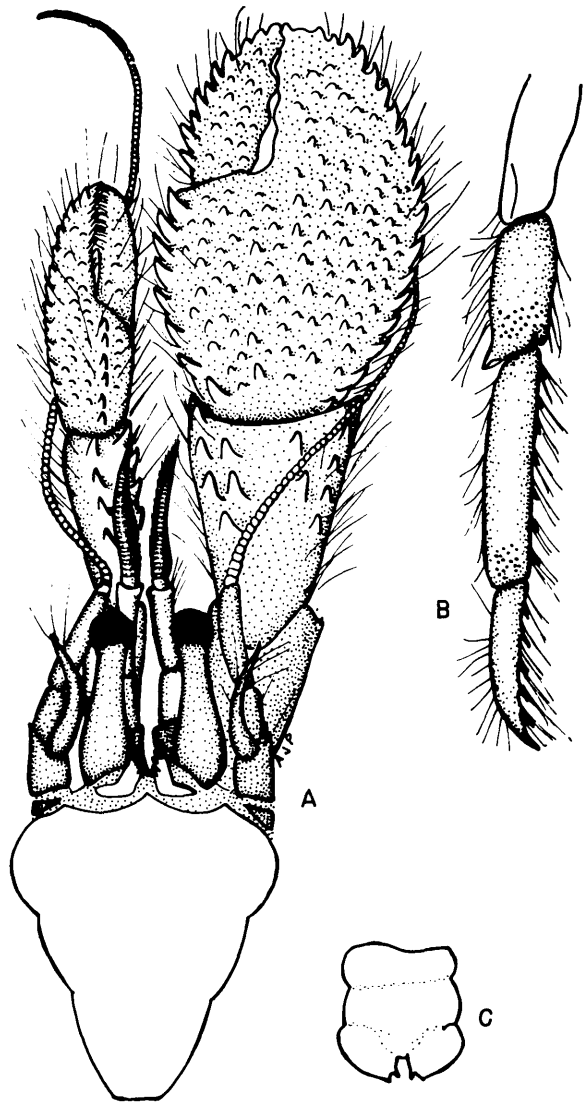


FIGURE 106.—*Pagurus pygmaeus* (Bouvier). A, anterior part of body and chelipeds in dorsal view; B, second left walking leg in lateral view; C, telson; A-C $\times 9$ (after Provenzano, 1959).

dactyls shorter than propodi, approximately five ventrally placed spines in addition to terminal point, propodus with about seven less conspicuous spines, all articles with long sparse setae.

Measurements.—Length of carapace: male, 3 mm.

Habitat.—Shallow water to 45 fathoms.

Type locality.—"La baie de la Zocappa," near Santiago, Cuba.

Known range.—Off Little River, South Carolina; southern Florida to Puerto Rico.

Remarks.—The occurrence of this species in the Carolinas is open to question because identification of the South Carolina material is not certain. Nevertheless, the species is included here. The South Carolina specimens were ovigerous females taken in August.

Pagurus brevidactylus (Stimpson)

Figure 107

Eupagurus brevidactylus Stimpson, 1859, p. 91.

Pagurus brevidactylus: Provenzano, 1959, p. 413, fig. 20 (rev.).

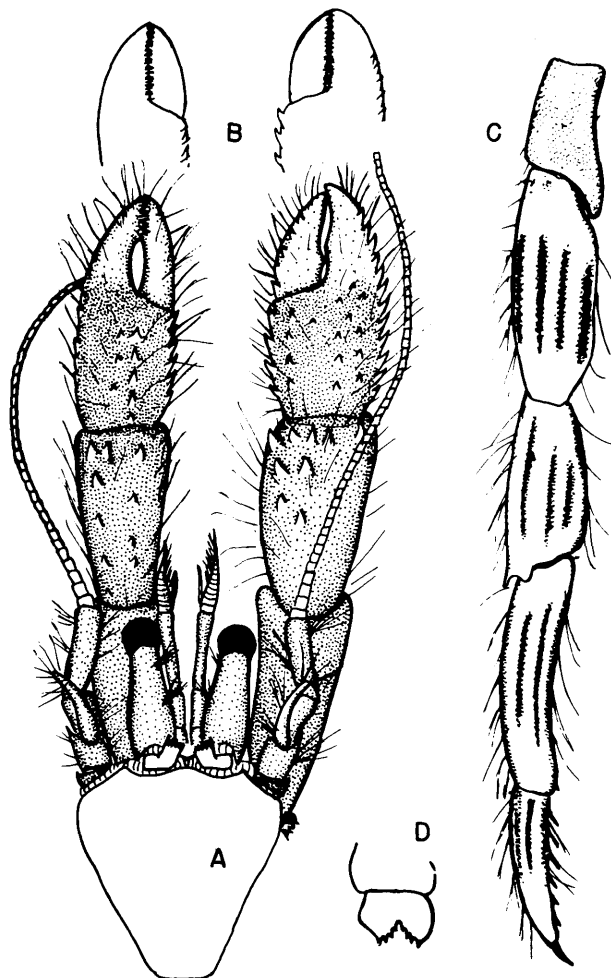


FIGURE 107.—*Pagurus brevidactylus* (Stimpson). A, anterior part of body and chelipeds, male in dorsal view; B, chelae of female in dorsal outline; C, second left walking leg in lateral view; D, telson; A-D approximately $\times 6$ (after Provenzano, 1959).

Recognition characters.—Anterior shield of carapace slightly longer than broad. Rostrum obsolete and about on line with triangular lateral

projections. Eystalks swollen at base, tapering toward cornea; eye scales armed along anterior border with three to six spines. Antennular peduncles reaching at least to tips of eystalks. Antennal peduncles slightly exceeding eystalks; acicles reaching to base of cornea or slightly beyond.

Chelipeds unequal in males, right larger than left, equal or subequal in females; finger tips corneous, spooned. Hands covered with fine hairs, outer margin edged with spines, upper surface with smaller spines in several rows; carpi with strong spines above. Walking legs with long, fine, inconspicuous hairs; dactyls shorter than propodi and with five to eight conspicuous spines along inferior margin; propodi with only one or two inconspicuous spinules along inferior margin.

Measurements.—Length of carapace: male, 3 mm.; female, 4 mm.

Color.—Walking legs each characteristically colored with six rust-red, or maroon stripes on propodus, carpus, and merus, fewer on dactyl; stripes longitudinal and interrupted at ends of each article; ground color of walking legs yellow; hands brown with almost white fingers, not striped; carapace with scattering of red and white pigment in fresh specimens (Provenzano, 1959).

Habitat.—The species seems to prefer hard bottom in areas where water circulation is fairly good (Provenzano, 1959); has been taken from the Black Rocks in North Carolina; 1 to 125 fathoms.

Type locality.—Barbados.

Known range.—Off New River, N.C.; southwestern Florida from Anclote section southward; through West Indies to Barbados.

Remarks.—Provenzano (1959) called attention to the sexual dimorphism in this species. In females the hands are nearly the same size and the right hand is spooned and serrate along the inside margin of the fingers, whereas in males the right hand is not only the larger, but the finger tips appear more acuminate and the opposing margins of the fingers each bear a tooth. The specimens listed by Pearse and Williams (1951) as *P. bonairensis* are *P. brevidactylus* (U.S. National Museum notes).

Ovigerous females have been collected from June to August in North Carolina, March to August in Florida, and in April in Cuba.

Genus *Spiropagurus* Stimpson, 1858

Stimpson, 1858, p. 236.—Milne Edwards and Bouvier, 1893, p. 110.—Alcock, 1905, p. 117.

Spiropagurus dispar Stimpson

Figure 108

Spiropagurus dispar Stimpson, 1858, p. 236 [*nomen nudum*].—1859, p. 88.—Provenzano, 1961, p. 165.

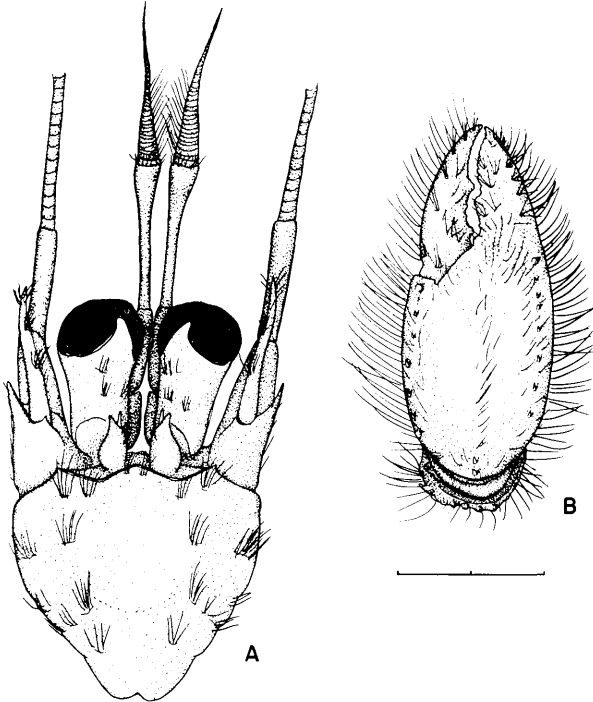


FIGURE 108.—*Spiropagurus dispar* Stimpson. A, anterior part of body in dorsal view; B, right chela, outer surface; 2 mm. indicated.

Recognition characters.—Carapace smooth but with hairy tracts on subcordate anterior shield and especially on anterior portion of membranous branchial areas; anterior margin with broadly rounded rostrum and equally advanced, acute lateral projections. Eystalks more than twice as long as basal width, slightly exceeding proximal end of terminal articles of antennal and antennular peduncles, much dilated distally, cornea large; eye scales triangular, with abruptly narrowed acute tip directed slightly laterad, and slightly exceeded by strong subterminal spine. Acicles slender, longer than eystalks.

Chelipeds elongate, setiferous, right chela larger than left. Major cheliped with fingers one-third to one-half length of palm, cutting edges of fingers toothed; palm ornamented with a dorsal,

submarginal row of distinct spines on each side; carpus shorter than palm with scattered spines dorsally; merus with a single spine on internal anterior border, and a short row of spines on corresponding external border. Minor cheliped similar but narrower; palm less spiny, and fingers with a row of fine denticles on opposed edges. Anterior two pairs of walking legs elongate, slender distally, somewhat less pubescent than chelipeds; dactyls not dilated noticeably at base; carpi with a low crest of spines.

Left vas deferens of male prominent and coiled in a loose spiral.

Measurements.—Length of carapace: male, 5 mm.

Color.—Anterior carapace with three pairs of pigment spots, anterolateral vertical flaps light brown with a large, clear or colorless spot; cornea deep brown, eystalks brown dorsally and ringed with brown near base; a narrow brown-orange ring at middle of fingers and at edge of immovable finger, hands reticulated with brown on upper surface; walking legs with a broad brown band on dactyls; propodi with a dorsal and ventral brown patch, a faint longitudinal lateral stripe, and a pair of dorsomedial brown patches; carpi with three faint stripes laterally (Provenzano, 1961, from specimen preserved in formalin).

Habitat.—The species has been found housed in *Natica canrena* Linné; 5 to 100 fathoms.

Type locality.—Barbados.

Known range.—Off South Carolina; Virgin Islands; Barbados.

Remarks.—Ovigerous females have been taken from the Virgin Islands in April and September (Provenzano, 1961).

Genus *Pylopagurus* Milne Edwards and Bouvier, 1893

Milne Edwards and Bouvier, 1893, p. 74.

KEY TO SPECIES IN THE CAROLINAS

- a. Large chela almost smooth on upper surface, border finely crenulate; abdomen straight... *discoidalis* (p. 134).
- aa. Large chela more or less tuberculate on upper surface, border definitely toothed; abdomen coiled.
- b. Outer surface of chelae nearly flat, not conspicuously tuberculate; rostrum exceeding unarmed lateral projections of front... *corallinus* (p. 134).
- bb. Outer surface of chelae conspicuously convex, conspicuously tuberculate; rostrum about equal to prominent minutely armed lateral projections of front... *rosaceus* (p. 135).

Pylopagurus discoidalis (Milne Edwards)

Figure 109

Eupagurus discoidalis Milne Edwards, 1880, p. 41.
Pylopagurus discoidalis: Milne Edwards and Bouvier, 1893,
p. 76, pl. 6, figs. 7-14.

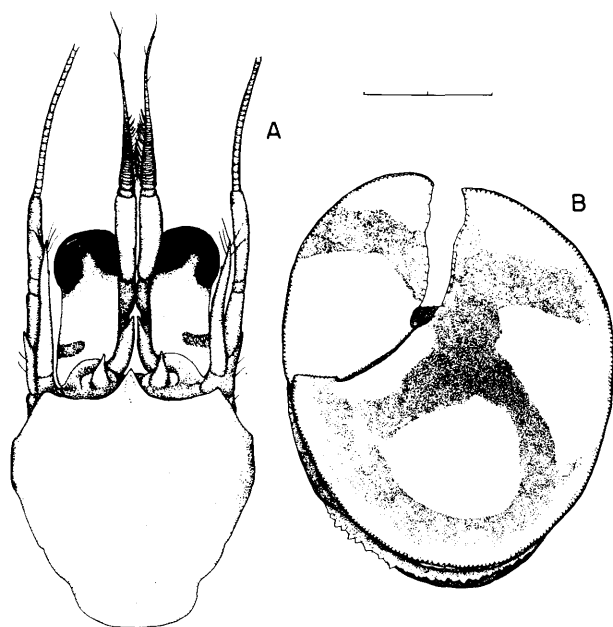


FIGURE 109.—*Pylopagurus discoidalis* (Milne Edwards).
A, anterior part of ovigerous female in dorsal view, eyestalks showing color pattern; B, right (major) chela of ovigerous female, upper surface showing color pattern; 2 mm. indicated.

Recognition characters.—Anterior shield of carapace strongly calcified, subcordate, truncate posteriorly; anterior margin with large, sharp-pointed rostrum extending beyond middle of eye scales; lateral projections low and rounded, borders lateral to them very oblique. Eyestalks short, thick, widest distally, much shorter than length of frontal border, slightly exceeding acicles but not reaching middle of terminal article of antennular and antennal peduncles, cornea large; eye scales narrow, lanceolate. Acicles without spines and deflected somewhat outward.

Chelipeds unequal, right larger than left. Major chela in form of operculum adapted to close openings in *Dentalium* shells or similar tubes. Chela flexing at right angle on carpus and incapable of complete extension; upper surface smooth, flattened, or slightly excavated, nearly discoidal in outline, surrounded by a raised, finely crenulate

border; lower surface slightly wrinkled with lines; fingers compressed, internal border of dactyl with rounded tubercles; carpus short, dilated in front, external surface ornamented with granulations following feebly squamose, irregular lines (occurring also on hand, back of edge forming operculiform portion), and with a few denticles on anterior border. Minor cheliped shorter than right one; chela oval, with very fine denticles on external border; fingers agape at base, and terminating in corneous tips; carpus with some spines on crest. Walking legs reaching tip of major chela, dactyls lanceolate with corneous terminal claw well developed.

Measurements.—Length of carapace: male, 11 mm.; female, 10 mm.; sexual maturity attained at cephalothorax length of 4-5 mm.

Variations.—The large chelae become more discoidal with advancing age (Milne Edwards and Bouvier, 1893).

Color.—Whitish but with large areas of reddish on hands, on each article of legs, and a ring of same color near base of eye; reddish color may extend over anterior portion of cephalothorax (Milne Edwards and Bouvier, 1893).

Habitat.—The species has been taken from *Dentalium* shells and from annelid tubes of similar shape; 30 to 508 fathoms.

Type locality.—Montserrat, 120 fathoms.

Known range.—Off North Carolina capes, through eastern Gulf of Mexico and West Indies to mouth of Amazon River, Brazil (Provenzano, 1963).

Remarks.—Ovigerous females have been recorded in November from southern Florida and Brazil.

Pylopagurus corallinus (Benedict)

Figure 110

Eupagurus corallinus Benedict, 1892, p. 23.
Pagurus corallinus: Hay and Shore, 1918, p. 412, pl. 30, fig. 4.

Recognition characters.—Anterior shield of carapace subcordate, truncate posteriorly. Rostrum obtuse, produced beyond rounded, unarmed, lateral projections of front. Eyestalks stout, falling far short of tip of antennular peduncle, largest distally, cornea dilated; eye scales sharp pointed, and with a prominent subterminal spine. Antennal peduncle nearly as long as that of antennule; acicle reaching nearly to tip of cornea.

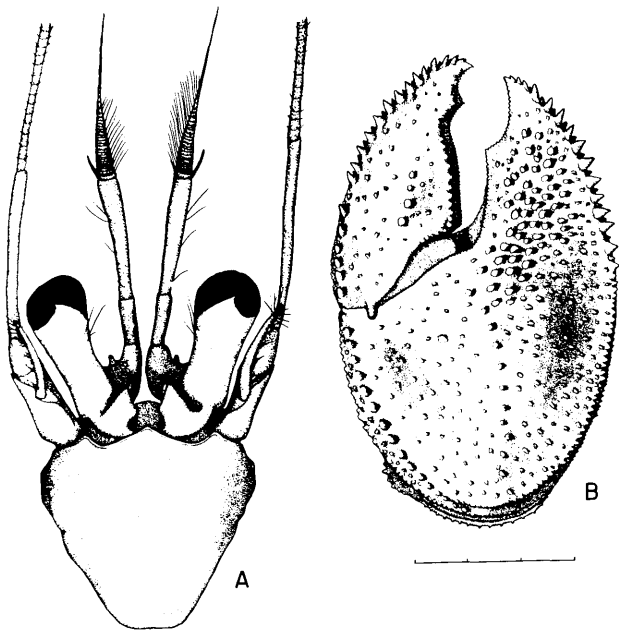


FIGURE 110.—*Pylopagurus corallinus* (Benedict). A, anterior part of body in dorsal view; B, right chela, outer surface; (from two specimens) 3 mm. indicated.

Chelipeds unequal, right larger than left. Upper surface of major chela flattened or slightly excavated, covered with small, slender spines becoming flattened and mushroom-shaped on immovable finger; hand fringed with spines, often alternately large and small, becoming longer near tips of fingers, inner surface with spinose tubercles between base of dactyl and recess receiving carpus, recess bounded by crest; carpus approximately as long as palm, upper surface thickly set with sharp, spiny granules, margin with rows of small spines; merus compressed, quadrilateral when viewed laterally. Minor chela with hand broad, compressed; fingers broad, gaping at base; carpus compressed, and surmounted by an inner row of small and an outer row of larger spines; merus compressed. Carpus and propodus of first walking leg, and carpus of second, crested with acute spines.

Measurements.—Length of carapace: male, 7 mm.; ovigerous female, 5 mm.

Color.—Large cheliped with merus and carpus blotched red and white; small cheliped and walking legs banded with same colors (Benedict, 1892).

Habitat.—In tunicates, stony corals, and bryozoans; 21 to 56 fathoms.

Type locality.—Off Key West, Fla.
Known range.—Off Cape Lookout, N.C., to Gulf of Mexico between Cedar Keys, Fla., and Mississippi Delta; off Cape Catoche, Yucatan, Mexico.

Remarks.—Ovigerous females have been taken off South Carolina in March, and southern Florida in June.

Pylopagurus rosaceus Milne Edwards and Bouvier

Figure 111

Pylopagurus rosaceus Milne Edwards and Bouvier, 1893, p. 97, pl. 7, figs. 10-17.—Hay and Shore, 1918, p. 413, pl. 30, fig. 5.

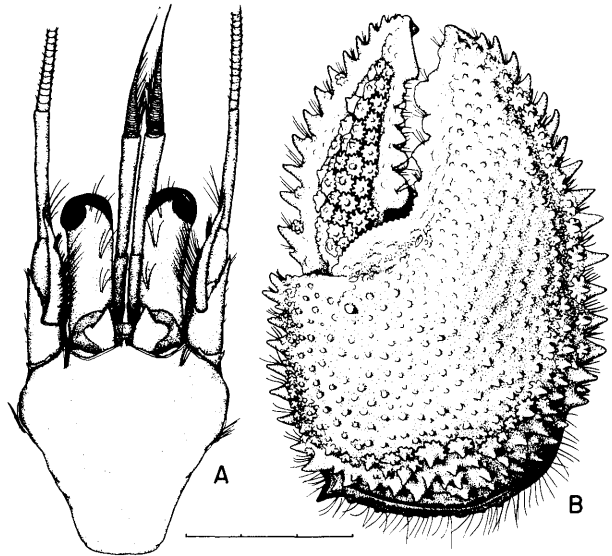


FIGURE 111.—*Pylopagurus rosaceus* Milne Edwards and Bouvier. A, anterior part of body in dorsal view; B, right chela, outer surface with detail shown only on dactyl; (from two specimens) 3 mm. indicated.

Recognition characters.—Anterior shield of carapace subcordate, somewhat truncate posteriorly; anterior margin with three projections, rostrum obtuse and slightly advanced beyond strong lateral projections, each terminating in a minute spine; sides of dorsal surface and anterior surface with a few tufts of setae. Eyestalks stout, considerably shorter than anterior shield, distinctly dilated distally, and with three or four pencils of setae in line along upper surface; eye scales acute anteriorly, each ending in an acute, subterminal spine. Antennal peduncle extending beyond eye, flagellum slender and longer than body; acicle strongly curved, reaching almost to distal edge of cornea.

Chelipeds unequal, right much larger than left. Both chelae capable of being bent down at a right angle to carpus to form, either singly or together, an operculum closing orifice of cavity inhabited by crab. Both margins of major chela, and outer margin of minor one, armed with a row of close-set, conical teeth; upper surface of both covered with closely crowded, rosettelike tubercles, each consisting of a central larger tubercle surrounded by a number of smaller ones; inner surface of major hand nearly smooth between base of dactyl and recess receiving carpus. Carpus of major cheliped with scattered sharp spines and hairs dorsally; merus with cross striae on upper surfaces and with anterior edges serrated with teeth in a single row. Minor cheliped similar but hairier and with a crest of spines on carpus. Walking legs of medium length, first and second of left side, and second of right side, exceeding large chela.

Measurements.—Length of carapace: male, 9 mm.; female, 10 mm.

Habitat.—The type was taken from an unknown species of the molluscan genus *Antillophos* (= *Phos*); 65 to 92 fathoms.

Type locality.—Grenada, 92 fathoms.

Known range.—South of Cape Lookout, N.C.; off Western Dry Rocks, Key West, Fla.; Grenada, and Surinam.

Remarks.—An ovigerous female has been taken from the Surinam locality in September.

Superfamily Hippidea

Abdomen reduced in size, bent under thorax; appendages of sixth segment not adapted for swimming. First pair of legs simple or subchelate, second to fourth legs with last article curved and flattened. Rostrum small or wanting. Third maxillipeds without epipodites.

Family Albuneidae

Carapace flattened and without wings covering legs. First pair of legs subchelate. Third maxillipeds narrow. Telson not conspicuously lengthened, almost oval.

KEY TO GENERA IN THE CAROLINAS

- a. Eyestalks narrow, triangular-----*Albunea* (p. 136).
 aa. Eyestalks broad, oval-----*Lepidopa* (p. 138).

Genus *Albunea* Fabricius, 1798

Gordon, 1938, p. 190.

KEY TO SPECIES IN THE CAROLINAS

- a. Dactyl of second and third legs with blunt, rectangular lobe at base of anterior border-----*gibbesii* (p. 136).
 aa. Dactyl of second legs with asymmetrically mucronate spur, and third legs with acute, falciform spur at base of anterior border-----*parctti* (p. 137).

Albunea gibbesii Stimpson

Figure 112

Albunea symnista Gibbes, 1850, p. 187.

Albunea gibbesii Stimpson, 1859, p. 78, pl. 1, fig. 6.—Benedict, 1901, p. 139.—1904, p. 625.—Hay and Shore, 1918, p. 414, pl. 30, fig. 11.—Schmitt, 1935a, p. 208.—Gordon, 1938, fig. 3e, p. 192, fig. 4b, p. 194.

Recognition characters.—Carapace about as broad as long, convex from side to side, nearly straight from front to back; front with a minute rostrum, and at either side a strong spine followed by 7 to 10 slender spines; anterolateral angle with a stout conical spine below *linea anomurica* projecting little if any beyond anterior border; posterior margin deeply and broadly notched; dorsal surface with numerous, irregular, more or less transverse, impressed lines, a short ciliated one near front, and one crossing near middle in shape of spread M being most conspicuous.

Eyestalks narrow, triangular, cornea at tip minute. Antennules about twice as long as carapace; flagella slender and densely ciliated above and below along inner surface, forming respiratory tube when approximated. Basal article of antenna with an acute, small, lateral spine; flagellum about half as long as peduncle. First pair of legs stout, hairy, all but distal articles inflated; hand subchelate; inferior distal angle of propodus produced into a spine; dactyls curved and rather slender. Second, third, and fourth legs stout, hairy, and with falcate dactyls; dactyl of third leg with falciform spur at base of anterior border, and second with similar broader spur. Fifth legs weak, borne above others.

Second, third, and fourth abdominal segments with expanded pleura, fifth and sixth segments small. Female with long uniramous pleopods on second to fifth segments. Uropods consisting of a rather large basal article and two small falcate blades. Telson of male triangular, of female rounded.

Measurements.—Length of carapace: male, 16 mm.; female, 20 mm.

Variations.—There is some individual variation in the pattern of spines on the anterior margin of the carapace. Spines may vary in number, be single, or occasionally be so close together as to appear doubled.

Color.—Light brown to orange tan above, cross striae lighter, with irregularly placed iridescent areas; antennules with alternating light and dark bands; eyestalks with a white ring behind cornea; underparts light (from recently preserved specimens). Light purple with whitish markings, more or less iridescent (various authors).

Habitat.—Sandy bottoms; extreme low-tide mark to 35 fathoms.

Type locality.—St. Augustine, Fla. (Stimpson); Sullivans Island, S.C. (Gibbes).

Known range.—East of Cape Lookout, N.C., to Texas; through West Indies to São Sebastião, São Paulo, Brazil.

Remarks.—*Albunea gibbesii* is occasionally found on sandy shoals, especially at times of extremely low tides when heat from the sun warms the exposed sand and drives the animals to the surface. Occasional specimens are found by digging, and specimens have been taken in both the Carolinas by dredging to depths of 35 fathoms.

Ovigerous females have been taken in North Carolina in June.

Pearse, Humm, and Wharton (1942) showed that *A. gibbesii* burrows backward into the sand as do the similar highly specialized sand dwellers, *Lepidopa websteri* and *Emerita talpoida*. These authors stated that *A. gibbesii* scrapes food from the setose antennules with the mouth parts; however, the chelate first legs and well-developed mandibles suggest feeding habits more like those of *Lepidopa* species. The function of the antennules as a possible feeding device was discussed by Benedict (1904).

***Albunea paretii* Guérin.**

Figures 112–113

Albunea oxyophthalma Leach (MS) in White, 1847b, p. 57 (*nomen nudum*).

Albunea paretii Guérin, 1853, p. 48, pl. 1, figs. 10–10a.

Albunea paretioi: Monod, 1956, p. 37, figs. 2–9 (rev.).

Recognition characters.—Similar to *A. gibbesii*, differing chiefly in characters given in key; dactyl of second legs with asymmetrically mucronate spur, third legs with acute, falciform spur at base of anterior border.

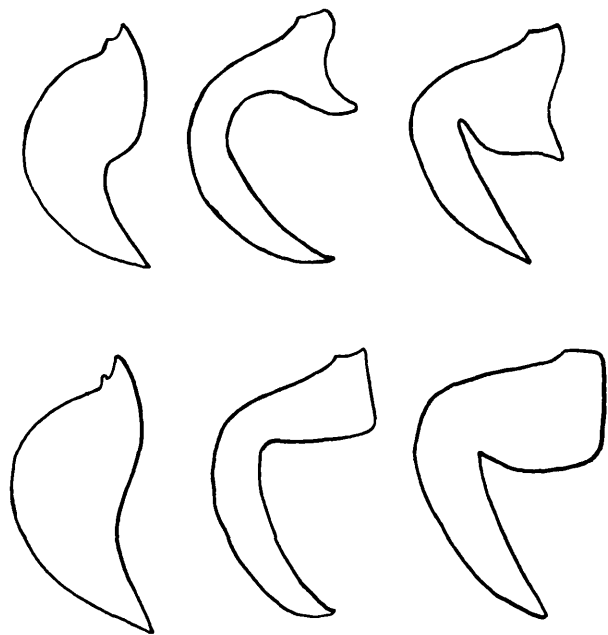


FIGURE 112.—Dactyls of second to fourth legs (from right to left); upper row, *Albunea paretii* Guérin; lower row, *Albunea gibbesii* Stimpson (after Gordon, 1938).

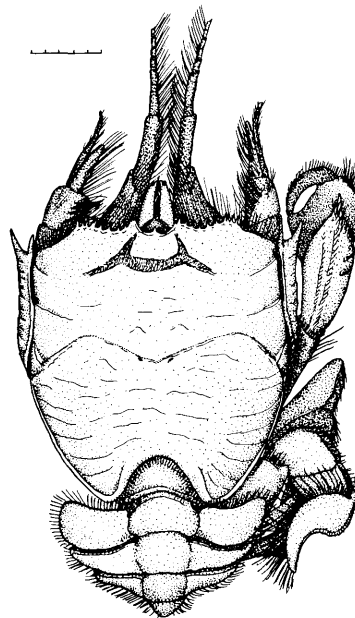


FIGURE 113.—*Albunea paretii* Guérin. Animal in dorsal view, legs of left side not shown, 5 mm. indicated.

Measurements.—Length of carapace: female, 20 mm.

Habitat.—Sandy bottom; low-tide mark to 21 fathoms.

Type locality.—[Uncertain], America.

Known range.—Beaufort Inlet, N.C., to Corpus Christi, Tex.; through West Indies to near mouth of Amazon River, Brazil; Bermuda; Cape Verde Islands and Senegal to Gold Coast, West Africa.

Remarks.—Monod (1956) reviewed the tangled history of the names given this species, but emended the specific name to conform to the name of the donor of the type specimen, Marquis of Pareto. Since Guérin used the spelling *paretii* twice in the original description, this spelling must be regarded not as a printer's error but as intentional (Holthuis, personal communication).

Ovigerous females have been taken in June in North Carolina.

Genus *Lepidopa* Stimpson, 1858

Stimpson, 1858, p. 230.—Holthuis, 1960a, p. 27 (rev.).

Lepidopa websteri Benedict

Figure 114

Lepidopa venusta: Kingsley, 1880, p. 410.

Lepidopa websteri Benedict, 1903, p. 892, fig. 3.—Hay and Shore, 1918, p. 415, pl. 30, fig. 12.

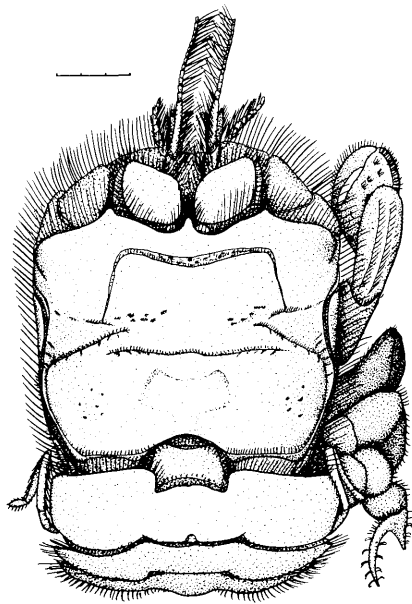


FIGURE 114.—*Lepidopa websteri* Benedict. Animal in dorsal view, first to fourth legs of left side not shown, 5 mm. indicated.

Recognition characters.—Carapace about as broad as long; front fringed with setae, produced into a short, triangular rostrum with acuminate tip, and to either side of it a broadly triangular lateral projection with acuminate tip slightly more advanced; margin between base of rostrum and each lateral projection almost straight; anterolateral angle produced into a flat spine above *linea anomurica*; sides sinuous and slightly convergent posteriorly, folded inward ventrally over bases of legs, more or less membranous posteriorly; dorsal surface crossed near front by an impressed, ciliate band with ends directed posteriorly, a narrower interrupted band ending in obliquely impressed lines crossing at about middle of carapace; posterior margin concave at middle.

Eyestalks irregularly oval, lamellate. Antennules with peduncles exceeding eyestalks; flagella straight, slender, nearly three times as long as carapace, fringed with hairs, and forming a respiratory tube when approximated. Antennae inserted at extreme outer angles of front, basal article stout; antennal scale reduced to a minute point; flagellum stout, curved, composed of seven short joints. First legs with broad, flat articles; dactyl turned back on propodus to form subchela. Second, third, and fourth legs with terminal joint bifurcated. Fifth legs much reduced, slender, and folded.

Abdomen short and partly flexed beneath thorax; second, third, and fourth segments with expanded pleura. Uropods small, with slender basal article, and long, oval blades, their margins and those of abdominal segments fringed with long, silky hairs. Telson cordate.

Measurements.—Length of carapace: 12 mm.

Color.—All parts white, iridescent, with pink being most conspicuous tint on anterior part of carapace, and blue showing along sides, in depressions of carapace, and on extremities of fifth legs; dorsal plates of abdomen faintly pink tinged, bordered by a delicate blue green; on either side of middorsal line, pink shading into red, and blue becoming deeper in shade (from note by A. Shaftsbury, U.S. National Museum records).

Habitat.—Usually found on gradually sloping sand beaches of open ocean at or immediately below low-tide mark (Pearse, Humm, and Wharton, 1942); shallow water, limits unknown.

Type locality.—Beach near Fort Macon, [Carteret County], N.C.

Known range.—Drum Inlet to Beaufort Inlet, N.C.; Ship Island and Petit Bois Island, Miss.

Remarks.—Knowledge of the ecology of this species is confined to the brief account given by Pearse, Humm, and Wharton (1942) which included detailed drawings of the specialized legs, as well as a lateral view of the whole animal. The species is highly adapted for burrowing in sand, and is usually found in small numbers. It burrows backward, and at rest lies at an angle to the surface with the long antennules extended in the water above. If disturbed, the animals may descend several centimeters into the sand. Benedict (1904) commented on the possible feeding function of the antennules in the genus *Lepidopa*. In 1903, he found setae of annelids, skin of a small *Synapta*, and parts of the flagella of some small crustaceans among stomach contents of *Lepidopa scutellata*. Such finding would be in accord with the fact that *Lepidopa*, like *Albunea*, has well-developed mandibles (Snodgrass, 1952).

Ovigerous females have been taken in July, and juveniles taken in plankton tows in July and August in North Carolina.

Family Hippidae

Carapace subcylindrical, and with wings covering legs. First legs simple. Third maxillipeds broad. Telson lengthened, lancet-shaped.

Genus *Emerita* Scopoli, 1777

Heegaard and Holthuis, 1960, p. 181.

KEY TO SPECIES IN THE CAROLINAS

(After Schmitt, 1935a)

- a. Dactyls of first legs subacute or sharply pointed distally; transverse rugosities more or less continuous over dorsum and continued posteriorly to inferior margin of carapace wings.....*benedicti* (p. 139).
- aa. Dactyls of first legs rounded or obtuse distally; lateral expansions or wings of carapace for greater part smooth and punctate.....*talpoida* (p. 140).

Emerita benedicti Schmitt

Figure 115

Emerita benedicti Schmitt, 1935a, p. 215, figs. 71 a, b.—Lunz, 1939, p. 336.

Recognition characters.—Body convex, oval; carapace firm; transverse rugosities more or less continuous, close set, and crossing whole of dor-

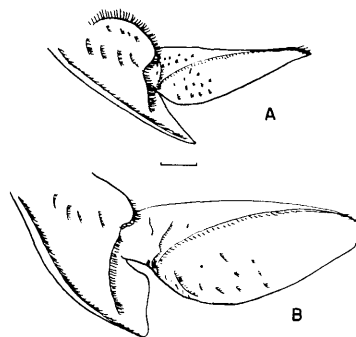


FIGURE 115.—Dactyl and portion of propodus of first leg; A, *Emerita benedicti* Schmitt; B, *Emerita talpoida* (Say); 1 mm. indicated.

sum, those on posterior part continued on wings of carapace to inferior margin. Rostrum equilaterally triangular in shape, separated by a rounded sinus on each side from a prominent and subacute tooth; an impressed, transverse line behind rostrum and a deeper, more strongly curved one farther back. Posterolateral margins extending downward to cover bases of legs; anterolateral margins concave and subserrate.

Eyestalks long, slender; cornea minute. Antennules about three times length of eyestalks; basal article with flagella hairy, forming respiratory tube when approximated. Antennae normally held beneath third maxillipeds, nearly twice as long as carapace when extended; first peduncular article short, second one largest, with outer margin produced into a strong superior, and much longer inferior, spine, both exceeding eyestalks; flagellum densely beset laterally with eight rows of fringed setae, outer rows longest.

First pair of legs directed forward, articles more or less hairy, and with impressed, interrupted, transverse ciliated lines; dactyl subacute distally; fifth article spinose distally. Second, third, and fourth legs less strong, hairy, tips curved and foliaceous. Fifth legs almost filamentous, entirely concealed beneath abdomen.

Abdomen broadest anteriorly, narrow posteriorly, flexed so that telson and sixth segment lie beneath body. Uropods turned forward, resting along sides of proximal segments. Telson elongate, lanceolate, margined with reflected setae above and inflected ones on edge; base with two short, impressed lines.

Measurements.—Length of carapace: ovigerous female, 18 mm.

Habitat.—Shell bottom, and probably other types (Lunz, 1939); to 2 fathoms.

Type locality.—Tampa Bay, Fla.

Known range.—Type locality, and Folly River to Edisto Island, Charleston County, S.C.; Gulf coast of Texas.

Remarks.—Lunz (1939) reported ovigerous females from South Carolina in June, and they are also known from there in July.

Emerita talpoida (Say). Mole crab; sand bug

Figures 115–116

Hippa talpoida Say, 1817, p. 160.

Hippa emerita: Ortmann, 1896 (in part), p. 232.

Emerita talpoida: Hay and Shore, 1918, p. 416, pl. 30, fig. 8.—Schmitt, 1935a, p. 216, figs. 74 a, b.—Snodgrass, 1952.

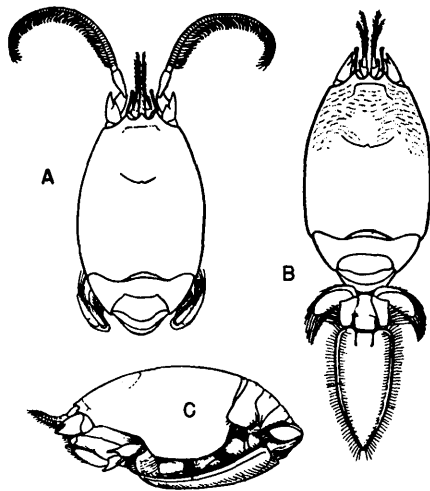


FIGURE 116.—*Emerita talpoida* (Say). A, animal in dorsal view, antennae extended; B, animal in dorsal view, abdomen extended; C, animal in lateral view (after Snodgrass, 1952).

Recognition characters.—Body convex, oval; carapace firm, with overlapping rugosities anteriorly, smoother and polished posteriorly. Anterior margin with a small, blunt rostrum separated by a rounded sinus on each side from a more prominent and acute tooth; an impressed, transverse line behind rostrum, and a deeper, more strongly curved one farther back. Posterolateral margins extending downward to cover bases of legs; anterolateral margins concave and subserrate.

Eyestalks long, slender; cornea minute. Antennules approximately twice length of eyestalks;

basal article with a strong, external spine; flagella hairy, forming respiratory tube when approximated. Antennae, normally held concealed beneath third maxillipeds, nearly twice as long as carapace when extended; first peduncular article short, second one largest with outer margin produced into a strong, anteriorly directed spine widely bifid at tip with a deep fissure below; flagellum densely beset laterally with eight rows of fringed setae, outer rows longest. First pair of legs directed forward, articles more or less hairy, and with impressed, interrupted, transverse ciliated lines; dactyl rounded distally, fifth article spinose distally. Second, third, and fourth legs less strong, hairy, tips curved and foliaceous. Fifth legs almost filamentous, entirely concealed beneath abdomen.

Abdomen broadest anteriorly, narrow posteriorly; flexed so that telson and sixth segment lie beneath body. Uropods turned forward, resting along sides of proximal segments. Telson elongate, lanceolate, margined with reflected setae above and inflected ones on edge; base with two short, impressed lines.

Measurements.—Length of carapace: males, 11 mm.; females, 26 mm.

Color.—Uniform pale yellowish brown (Snodgrass, 1952).

Habitat.—Sandy beaches in and below surfline; to 2 fathoms in winter.

Type locality.—[East] coast of United States.

Known range.—Harwich, [Barnstable County], Mass., to east coast of Florida; west coast of Florida to Grand Isle, La.; Progreso, Yucatan, Mexico (Schmitt, 1935a).

Remarks.—The general ecology of *Emerita talpoida* as a representative of the specialized sandy-beach fauna has been studied by a number of workers, especially Wharton (1942). The eggs are bright orange when first laid and gradually fade to a translucent dirty gray just before hatching. Wharton gave a figure of the mature sperm cell, and Herrick (1892, pl. 25) gave figures of developmental stages in the egg. Wharton found the breeding season in North Carolina to extend from early June through September, and Fish (1925) found larvae at Woods Hole, Mass., from late July to early September. In Florida, ovigerous females have been found in November. The larval stages were most completely described by

Rees (1959) from rearing experiments in the laboratory. Larval development lasts 28 days and normally encompasses at least six zoeal stages. Rees also described the megalops stage which resembles the adult in shape.

Wharton found megalops in large numbers in sand washed by waves. This stage swims with the abdomen extended, whereas young adults swim with the abdomen flexed. Megalops and young adults were found to be distributed evenly in the wave-washed zone rather than in colonies as are adults. Wharton traced development of the pleopods of females from the truly swimming appendages of the megalops to the uniramous non-swimming pleopods of adults. Adult males lack pleopods.

The average carapace length of young adult females increased from 3 mm. in early summer to 8 mm. the following May, and by August had increased to 18 mm. (maximum, 26 mm.). Wharton thought that females have one reproductive period in summer at an age of about 1 year, then live a short time longer and die at an age of about 1 year and 3 months. Williams (1947), studying size-frequency distributions, thought that they live to be 2 years of age, and Edwards and Irving (1943) stated that at Woods Hole females live 27 months, males 25. Since large females (to 21 mm.) can be taken in winter, the latter estimates are more likely correct, and Wharton's 26-mm. female was probably 2 years old.

Small males appear about the same time as females. Sexually mature at very small sizes (carapace length, 3 mm.) they seek out and attach themselves to year-old females. As many as seven small males were found on a single large female, and Wharton judged that they remain attached for long periods:

The attachment of the small males to the large females is achieved by various methods. These semiparasitic mates have been found in the gill chambers, clamped between the coxae of the thoracic appendages, attached to egg masses, clamped by means of their telson to the ovigerous hairs of the pleopods, and some seen to roam about on the ventral surface of the larger females. A few males seemed to be attached by means of the spermatophores which are extruded from the basal segment of the fifth leg; however, these may have been merely depositing the spermatophores.

By winter, the males are free living, and by the following June attain a size of about 7 mm. (max-

imum, 10 mm.). Wharton thought that these die in July after a possible second mating period.

It was estimated that growth of large females from early June to late August may be as much as 0.08 mm. per day. However, both Wharton (1942) and Williams (1947) noticed that there is considerable annual fluctuation in size at the same locality, and Williams further stated that there is considerable variation in size between localities in the same year.

The beautiful adaptations of this species for life in the shifting sand of the surf zone were treated by Wharton, and the anatomical specializations were exhaustively discussed by Snodgrass (1952). Adults can swim by means of the uropods, but they are primarily adapted for burrowing backward into wet sand. This is accomplished by rotating the uropods in unison, throwing sand dorsally, moving the second, third, and fourth legs laterally and posteriorly in unison, and by pushing the first legs alternately laterally and anteriorly. Once the animal is buried, the fringed antennae are allowed to lie on the sand extended anterolaterally to strain the receding water of waves. Stomach contents consist of small particulate matter, but the exact method of transfer of food from the antennae to the mouth is unknown.

Emerita talpoida moves up and down the beach with the tide, following shallow waves toward the water or moving up the beach with deep waves. Jones (1936) compared the habits of *E. emerita* to those of *E. talpoida* and devised a clever method of marking animals with string for the purpose of tracing their movements on the beach.

Edwards and Irving (1943) studied the influence of temperature and season on oxygen consumption in *E. talpoida* at Woods Hole. They found that oxygen consumption of winter animals at 12° C. is about the same as that of the smallest summer animals at 17° C.; consumption of winter animals at 3° C. is about the same as that of summer animals at 13° C. They concluded that *E. talpoida* from the Woods Hole area becomes adjusted to seasonal changes in temperature in such a manner that rate of metabolism in winter is kept at a level comparable to that in summer. This explains why growth is uniform throughout the year, though the animals live in 6 to 12 feet of water in winter rather than in the surf. The method of feeding in winter was not discussed.

Section **Brachyura**

Crabs with abdomen much reduced in size, straight, symmetrical, closely bent under thorax, never used for swimming, and with uropods rarely present, never biramous. Cephalothorax depressed, fused with epistome at sides and nearly always in middle. Antennal scales immovable. Third maxillipeds broad. First pair of legs chelate and nearly always much stronger than other legs.

Subsection **Gymnopleura**

Anterior thoracic sterna broad, posterior thoracic sterna narrow and keellike. Posterior thoracic epimera largely exposed by reduction of branchiostegite. Female openings on coxae. Last pair of legs dorsal in position, normal or reduced in size. Sternal canal present. Thoracic nerve ganglion-chain elongate. Antennary sternum triangular, spout-shaped. Branchiae eight on each side (Bourne, 1922).

Family **Raninidae**

Crabs with carapace remarkably elongate but not covering abdominal terga, first four or five terga lying exposed in dorsal plane of body. Last pair of legs also raised in dorsal plane of body. Antennae and antennules large, not folding into fossettes. Vasa deferentia protruding through bases of fifth pair of legs; oviducts piercing coxa of third pair of legs. Sternum broad anteriorly, narrow or linear posteriorly. A pair of respiratory orifices between tergum of first abdominal segment and coxae of last pair of legs. External maxillipeds completely covering buccal cavity, with palp concealed in repose; exopodite but little longer than ischium. Gills less than nine in number on either side. Hand flat, immovable finger extremely bent allowing movable finger to close against anterior border of hand. (Modified after Alcock, 1896, and Rathbun, 1937.)

Genus **Ranilia** H. Milne Edwards, 1837

Rathbun, 1937, p. 17.

Ranilia muricata H. Milne Edwards

Figure 117

Ranilia muricata H. Milne Edwards, 1837, p. 196.—Hay and Shore, 1918, p. 420, pl. 31, fig. 1.—Rathbun, 1937, p. 18, pl. 3, figs. 3-6; pl. 4, figs. 1-4 (rev.).

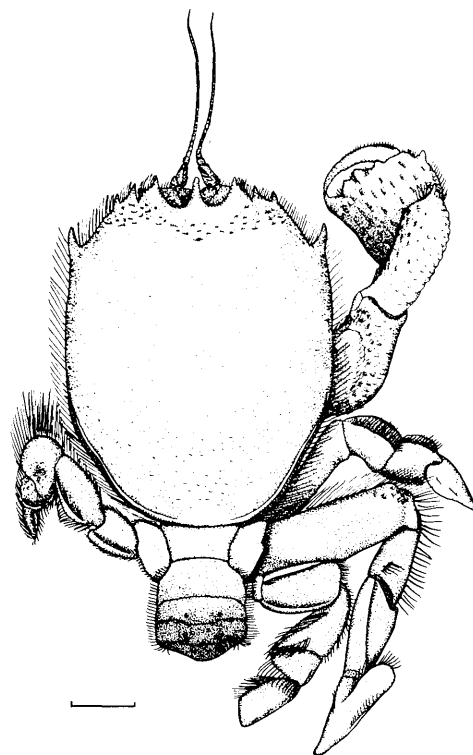


FIGURE 117.—*Ranilia muricata* H. Milne Edwards. Ovigerous female in dorsal view, first to fourth legs of right side shown, only fifth leg of left side shown, 5 mm. indicated.

Recognition characters.—Carapace oval, strongly convex from side to side, slightly so from front to back, smooth posteriorly but with numerous transverse ciliated wrinkles anteriorly. Rostrum slender; anterior border of carapace with four strong spines on each side, innermost overhanging base of orbit, third surmounting external angle of orbit, fourth at external angle of front. Eyestalks strong, about four times as long as rostrum, and capable of being turned back into deep, oblique orbits. Antennules small. Antennae directed forward, slightly longer than eyestalks.

First pair of legs subchelate, stout, flattened distally, squamous-denticulate above, with a strong spine on superodistal margin of merus, carpus, and hand; distal margin of hand perpendicular, toothed; dactyl strong, curved. Second, third, and fourth pairs of legs with flattened, triangular dactyls. Fifth pair of legs elevated, turned forward, fringed with hairs.

Abdomen short and narrow.

Measurements.—Carapace: length, 39 mm.; width, 28 mm.

Color.—Porcelain white with red, vermiculate, transverse lines on cephalothorax, and red dots and blotches on legs. Gibbes, in Rathbun (1937) gave the color of dry specimens as purplish mixed with yellow and orange in places, particularly about the articulations and spines, with the latter having white tips, and the chelipeds, walking legs, and abdominal segments with purplish markings.

Habitat.—This species appears to be confined to sand bottoms well offshore. Specimens have been obtained in dredge hauls, and fragments of others taken from fish stomachs off North Carolina. The species has not been found within Beaufort, N.C., harbor, nor along the beaches; 7 to 56 fathoms.

Type locality.—Unknown.

Known range.—Off Cape Lookout, N.C., to northwest Florida; Bahamas; Swan Island in Caribbean Sea.

Remarks.—Though this modern species has no fossil record in North America, the Family Raninidae in this region has a fossil record dating from the Cretaceous (Rathbun, 1935).

Rathbun (1937) reported ovigerous females in April from Florida, and in September from North Carolina.

Subsection **Dromiacea**

Carapace subglobose or subquadrate, frontal region narrow. Last one or two pairs of legs small, subdorsal in position. Abdomen folded under thorax, penultimate segment usually without appendages; five pairs of appendages in female, first pair rudimentary. Lateral thoracic apodemata united in common center, forming a sternal canal. External maxillipeds with merus and ischium subquadrate (Rathbun, 1937).

Family **Dromiidae**

Carapace subglobular, rarely flattened; no *lineae anomuricae* (a pair of longitudinal suture lines on carapace). Sternum of female traversed at least in part by two obliquely longitudinal grooves. External maxillipeds generally operculiform. Legs of moderate size; fourth and fifth pairs short, subdorsal in position, furnished with small hooklike nail or dactyl. Sixth segment of

abdomen generally with rudimentary uropods (Schmitt, 1921).

The significance of the obliquely longitudinal sternal grooves on the females of this family has recently been treated by Gordon (1950). She found these to be external evidence of a pair of involuted tubes (variously developed in different species) leading from an external opening at the anterior end of the grooves posteriorly to paired spermathecae enclosed in the endophragmal system.

The North American fossil record for this family dates from the lower Cretaceous of Texas (Rathbun, 1935), though no modern species in the Carolinian fauna possesses a known fossil record.

KEY TO GENERA IN THE CAROLINAS

- a. Carapace firm and hard; body covered with short pubescence-----*Dromidia* (p. 143).
- aa. Carapace soft and membranous; body mostly naked
Hypoconcha (p. 144).

Genus *Dromidia* Stimpson, 1858

Rathbun, 1937, p. 32.

Dromidia antillensis Stimpson

Figure 118

Dromidia antillensis Stimpson, 1859, p. 71.—Hay and Shore, 1918, p. 417, pl. 31, fig. 5.—Rathbun, 1937, p. 33, text-fig. 12, pl. 7, figs. 1-3 (rev.).

Recognition characters.—Body and legs covered with thick coat of short pubescence, leaving only parts of fingers exposed. Carapace convex in all directions, longer than broad; frontal region longitudinally grooved along middle; front strongly deflexed, with five small, slender teeth, median three subequal and approximately as long as distance between them at bases, teeth over eyes somewhat shorter but acute. Anterolateral margin of carapace deflected toward corner of buccal area, armed with four or five teeth.

Chelipeds rather thick and heavy; carpus dentate with small teeth at anterior angles; palm shorter than dactyl and armed with three blunt spines on upper margin; fingers curved, with strongly interlocking teeth. Walking legs rather slender; last pair turned forward over back, and much longer than fourth pair; dactyls of fourth and fifth legs hooked, closing against unequal pair of distal spines on propodus.

Measurements.—Carapace of male: length, 32 mm.; width, 31 mm.

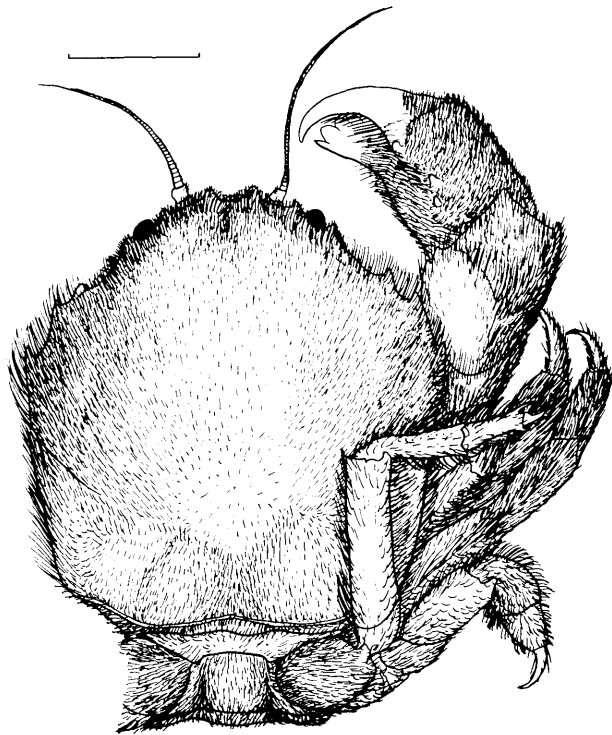


FIGURE 118.—*Dromidia antillensis* Stimpson. Male in dorsal view, legs of left side not shown, 10 mm. indicated.

Color.—Quite variable. General ground color dirty yellowish green, olive buff, white, coral-mud gray, orange buff or various shades of red with lighter pubescence; fingers with bases darker than white tips, shades of orange, pink, or red; cornea of eyes gray, hazel, reddish speckled or brown; some specimens with bluish cast on maxillipeds and antennular peduncles. Rathbun (1937) gave great detail on a number of individuals which appeared to vary from light to dark in a harmonious set of colors.

Habitat.—Shore to 170 fathoms.

Type localities.—St. Thomas, V.I., Key Biscayne and Tortugas, Fla.

Known range.—Off Cape Hatteras, N.C., through Gulf of Mexico and West Indies, to State of Bahia, Brazil; Bermuda.

Remarks.—This species is usually found carrying a covering of compound ascidians, sponge, or zoanthoid polyps. The species is primarily southern in distribution, the North Carolina records representing marginal occurrence in a favorable northern locality. Hildebrand (1955) found it

common on the Campeche Banks shrimping grounds.

Rathbun (1937) reported ovigerous females from Florida and the West Indies in winter, spring, and summer.

Genus *Hypoconcha* Guérin, 1854

Rathbun, 1937, p. 44.

KEY TO SPECIES IN THE CAROLINAS

- a. Anterior margin of carapace without spines *arcuata* (p. 144).
- aa. Anterior margin of carapace with several strong spines.....*sabulosa* (p. 145).

Hypoconcha arcuata Stimpson

Figure 119

Hypoconcha arcuata Stimpson, 1853, p. 226.—Hay and Shore, 1918, p. 418, pl. 31, fig. 2.—Rathbun, 1937, p. 47, pl. 11, figs. 1-4.

Recognition characters.—Body short, broad, flattened, with a thin, parchmentlike covering dorsally, solid and roughly granulate ventrally. Appendages capable of being folded compactly against body. Front margin of carapace nearly semicircular in outline, margin densely ciliated, deeply fissured in middle and with a shallow notch on each side near middle. Ventral surface without ridges, sloping evenly to anterior margin, and with eyes, antennules, antennae, and mouth parts deeply seated in depressions; a narrow fissure in front of eye for lodgment of antennal flagellum; outer posterior margin of orbit fissured. Third maxillipeds completely closing buccal cavity.

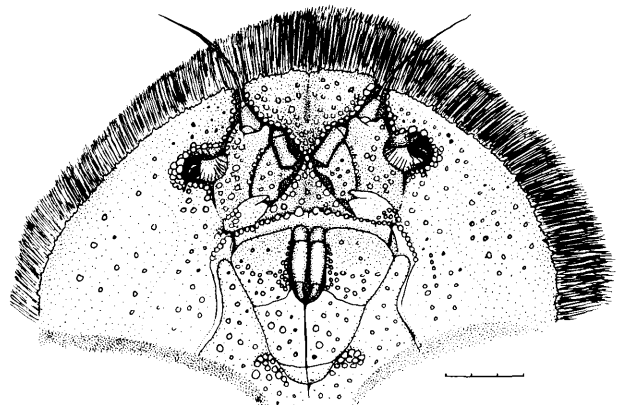


FIGURE 119.—*Hypoconcha arcuata* Stimpson. Anterior portion of animal in ventral view, 3 mm. indicated.

Legs all stout, hairy, and coarsely granulate. First pair chelate; fingers somewhat spatulate and toothed at tip, immovable finger articulated at angle with hand. Second and third legs with sharp, corneous tips; fourth and fifth legs borne on dorsal surface, with penultimate article quite short, and terminal article reduced to a small, curved claw. Abdomen short and flexed so that last two segments lie on thoracic sterna.

Measurements.—Carapace of male: length, 24 mm.; width, 24 mm.

Color.—Gray.

Habitat.—This curious crab has been taken from dredge hauls in Bogue Sound off Morehead City, N.C. It is always found occupying a valve of some lamellibranch shell, preferably a clam-shell, which it carries about upon its back after the manner of a hermit crab. By means of the claws on its fourth and fifth pairs of legs, perhaps aided by pressure of its body against the shell, it clings so tightly that removing it from the shell without crushing it is almost impossible. Shallow water to 22 fathoms.

Type localities.—South Carolina sandy shores, and St. Thomas, [V.I.].

Known range.—Off Cape Lookout, N.C., to west Florida; St. Thomas, V.I.; Surinam to State of Espirito Santo, Brazil.

Hypoconcha sabulosa (Herbst)

Figure 120

Cancer sabulosa Herbst, 1799, p. 57, pl. 48, figs. 2-3.
Hypoconcha sabulosa: Hay and Shore, 1918, p. 418, pl. 31, fig. 3.—Rathbun, 1937, p. 44, pl. 8, figs. 3-4, pl. 9, figs. 1-5 (rev.).

Recognition characters.—Body short, broad, flattened, with front and lateral margin expanded, with thin parchmentlike covering dorsally, solid with surface nodulose, granulate, and marked by several strong ridges ventrally. Carapace in old individuals pubescent above; margin densely hairy, and armed anteriorly with four curved spines with sharp tips pointing obliquely downward followed by a few other smaller spines; front between median pair of spines subtruncate or sloping slightly backward toward short, narrow, median fissure. Antennal fossae limited in front by a pair of strong, oblique ridges arising between two of spines of anterior border, meeting each other in midline in front of epistome; epistome with posterior border raised into a promi-

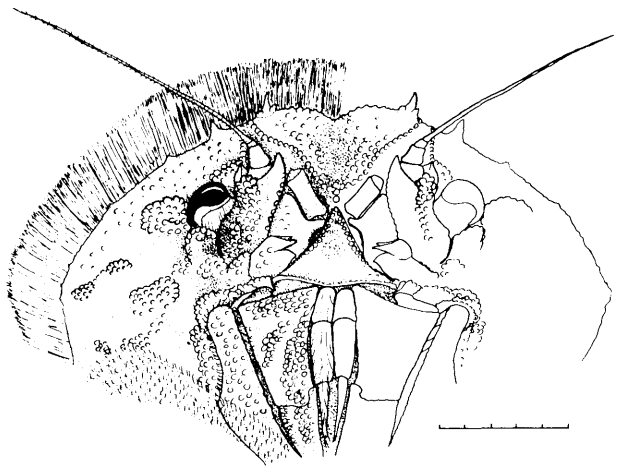


FIGURE 120.—*Hypoconcha sabulosa* (Herbst). Anterior portion of animal in ventral view, detail of right side shown, 5 mm. indicated.

nent ridge continuing on either side across front and some distance along sides of buccal area. Basal articles of antennae tuberculate; proximal article with a strong inwardly directed tooth, distal article with a tooth on each side of base of flagellum. Fissure in outer margin of orbit prominent owing to development of a strong tubercle on either side.

Carpal article of first pair of legs with several dentate tubercles; hand covered with more or less pointed tubercles. Other legs and abdomen much as in *H. arcuata*.

Measurements.—Carapace of female: length, 22 mm.; width, 22 mm.

Color.—Gray; or, as described by Schmitt in Rathbun (1937), coral sand above with whitish-gray hairs, ground color beneath, red; rounded bosses on legs and subfrontal region reddish brown; eyes black or reddish brown; eggs orange.

Habitat.—A few feet to 49 fathoms.

Type locality.—Listed as "Africa" (probably an error).

Known range.—Off Cape Hatteras, N.C., to Sabine, Tex.; Jamaica.

Remarks.—This species has been found in Beaufort, N.C., harbor, and, though it apparently has habits similar to those of *H. arcuata*, it is much the rarer of the two species. Rathbun (1937) listed ovigerous females in June from Florida and in October from North Carolina.

Family Homolidae

Crabs with carapace rectangular, ovoid, or urn-shaped, longer than broad. Eyes incompletely sheltered by orbits when retracted, terminal joint of eyestalk either longer or shorter than slender basal joint. External maxillipeds pediform, subpediform, or suboperculiform. Sternum of female without longitudinal grooves. Gills 8, 10, 13, or 14 on each side (Rathbun, 1937, modified after Gordon, 1950; Hemming, 1958c).

Genus *Homola* Leach, 1815

Rathbun, 1937, p. 62.—Hemming, 1958c.

Homola barbata (Fabricius)

Figure 121

Cancer barbatus Fabricius, 1793, p. 460.
Homola barbata: Hay and Shore, 1918, p. 419, pl. 30, fig. 10.
Thelziope barbata: Rathbun, 1937, p. 63, text-fig. 16, pl. 15, figs. 1-2 (rev.).

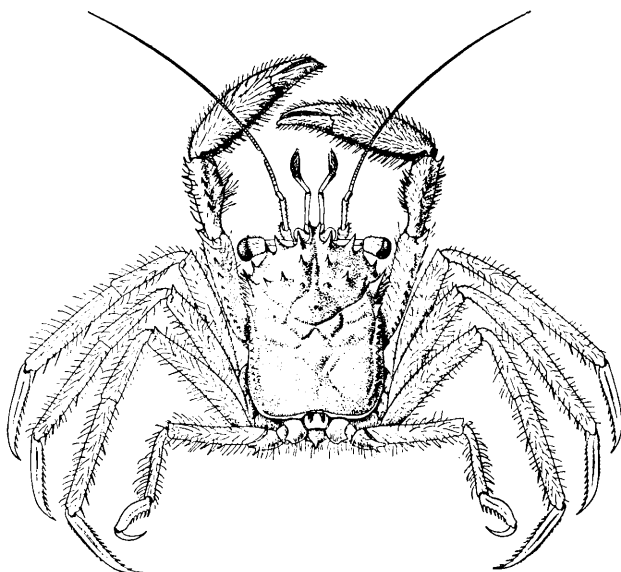


FIGURE 121.—*Homola barbata* (Fabricius). Animal in dorsal view (after Smith, 1887).

Recognition characters.—Carapace about one-fourth longer than wide with surface granulate, spinulose, and sparsely setose; *linea anomurica* distinct and dorsal; sides nearly straight, only slightly convergent posteriorly, and extending almost vertically downward from behind a strong spine situated at extremities of suture separating gastric and hepatic regions. Rostrum small, bifurcate at tip; a spine on each side at base of rostrum, one at

outer orbital angle, a transverse row of two behind rostrum, behind these a transverse row of eight, and farther back a small median spine. Anterolateral parts below and behind orbits with small spines. Eyestalks long, slender at base, and abruptly enlarged below cornea.

Chelipeds of moderate size, surface granulate and hairy; merus and carpus with rows of spines. Walking legs with flattened articles, long, hairy, and spinulose along margins. Second segment of abdomen with a large, median, conical tooth.

Measurements.—Carapace including rostrum: male, length, 30 mm., width at base of lateral spines, 22 mm., posterior width, 16 mm.; female, length, 33 mm., width at spines, 25 mm., posterior width, 20 mm.

Color.—"Body covered with tawny or yellowish-brown or reddish-brown hair; spines red or partly red" (Rathbun, 1937).

Habitat.—Thirty to 373 fathoms.

Type locality.—Bay of Naples.

Known range.—Off southeastern Massachusetts to Caribbean Sea; eastern Atlantic Ocean from Portugal and Azores to Madeira Islands; Mediterranean Sea; South Africa.

Remarks.—This essentially deep-water species has been reported in 63 fathoms off North Carolina. Ovipigerous females have been reported in October off Delaware Bay (Rathbun, 1937), and are known off North Carolina and Florida in June and July.

Gordon (1950) discussed the anatomical structure of the spermathecae of females and copulatory apparatus of males in the genus *Homola*, and remarked upon the evolutionary sequence shown by these structures in the Dromiacea.

Subsection *Oxystomata*

Epistome reduced or absent. Efferent branchial channels terminating at middle of buccal area, buccal cavern produced forward and generally elongate-triangular in shape, efferent channels enclosed by an elongate lamellar process of exopods of first maxillipeds. Afferent branchial openings either in front of bases of chelipeds, or at sides of endostome. Gills six to nine on each side. Antennules folding either longitudinally or obliquely, rarely transversely. Male genital ducts protruding through bases of fifth legs or through

fifth thoracic sternum nearby. (Modified after Alcock, 1896, *in* Rathbun, 1937.)

Family Leucosiidae

Crabs having carapace circular, oval, or polygonal. Eyes and orbits small, front narrow but wider than orbit. Antennules folding more or less obliquely. Antennae small. External maxillipeds completely enclosing buccal cavity, except often a small crevice in front. Afferent branchial channels occupying sides of endostome on either side of deep, median, endostomal groove serving as an efferent branchial channel. Afferent channels covered by exognaths of external (third) maxillipeds, efferent channels by a pair of lamellar processes of first maxillipeds. Chelipeds symmetrical. Abdomen hidden beneath thorax, commonly with third to sixth abdominal terga fused, sixth sometimes free. Vasa deferentia opening on fifth thoracic sternum near bases of last pair of legs. (Modified after Alcock, 1896, *in* Rathbun, 1937.)

KEY TO GENERA AND SOME SPECIES IN THE CAROLINAS

- a. Carapace polygonal, uneven, nodular, or eroded
 - Subfamily Ebaliinae (p. 147).
 - b. Posterior portion of carapace without deep cavities
 - Ebalia cariosa* (p. 147).
 - bb. Posterior portion of carapace with a deep rounded cavity on each side-----*Speloeophorus* (p. 148).
- aa. Carapace ovoid or globular, and smooth or granular
 - Subfamily Philyrinae (p. 150).
 - b. Fingers opening in horizontal plane
 - Persephona punctata aquilonaris* (p. 150).
 - bb. Fingers opening in vertical plane
 - Iliacantha* (p. 150).

Subfamily Ebaliinae

Surface of carapace uneven. Chelipeds of moderate length; fingers not very thin and elongate, dactyl moving in an oblique plane. Anterior margin of buccal cavity arcuate, middle part in front of level of anterior pterygostomian region. Epistome and infraorbital lobe well developed. Pterygostomian margin extending either slightly or distinctly forward, terminating in an indentation. Merus of external maxillipeds half or more than half length of ischium measured along inner border. First abdominal segment in female often under carapace (Rathbun, 1937).

Genus *Ebalia* Leach, [1817]

Rathbun, 1937, p. 123.—Hemming, 1958b, p. 15.

Ebalia cariosa (Stimpson)

Figure 122

Lithadia cariosa Stimpson, 1860a, p. 238.—Hay and Shore, 1918, p. 424, pl. 32, fig. 6.

Ebalia cariosa: Rathbun, 1937, p. 125, pl. 35, figs. 6-7 (rev.).

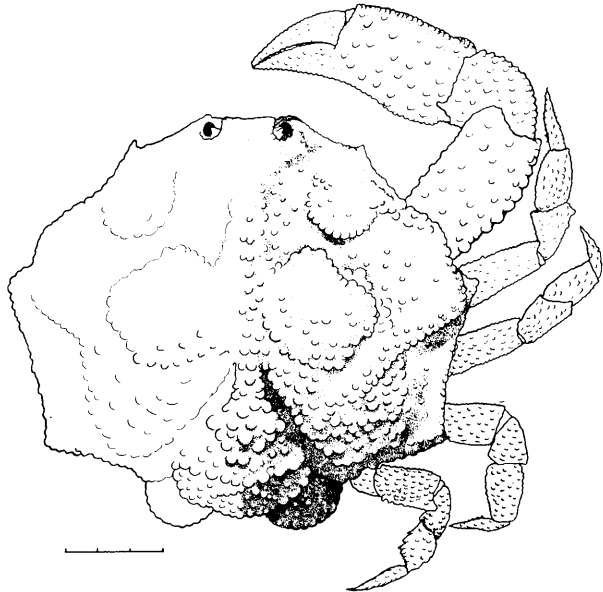


FIGURE 122.—*Ebalia cariosa* (Stimpson). Animal in dorsal view, legs of left side not shown, 3 mm. indicated.

Recognition characters.—Carapace convex, roughly pentagonal; anterior angle truncate, lateral angles obtuse; surface uneven and covered everywhere, including other parts of body and legs, with beadlike granules, larger posteriorly and ventrally. Front narrow, upturned, and broadly notched, connected with middle protuberances by a median ridge traversing gastric region; ridge flanked on each side by a sinuous, deep, broad excavation of darker color than protuberant parts. Anterolateral margin of hepatic region sinuous, hepatic region slightly prominent, delimited posteriorly by an impressed line. Pterygostomian region with a large downward-pointing tooth, hardly visible in dorsal view. Posterolateral margin with a broad tooth, separated from bilobate intestinal region by a deep sinus; cardiac and inner lobules of branchial region strongly protuberant, separated from thick intestinal lobes by a deep narrow sulcus.

Chelipeds stout, a little longer than width of carapace, joints angular; merus as broad as hand, outer margin convex and a little irregular; hands rather small, tapering to rather slender fingers. Walking legs cylindrical. Abdomen of male narrow, triangular, with a backward projecting spine at proximal end of penultimate segment. Abdomen of female with penultimate segment very large, nearly circular.

Measurements.—Carapace: length of male, 12 mm., width, 13 mm.; female, length, 13 mm., width, 15 mm.

Color.—Light gray or buff, female occasionally with two or three small red spots on abdomen; other specimens may be pale red (Rathbun, 1937).

Habitat.—Below low-tide mark to 25 fathoms.

Type locality.—Beaufort, N.C.

Known range.—Bogue Sound near Beaufort, N.C., to west Florida; Jamaica; northeastern South America to Rio de Janeiro, Brazil.

Remarks.—This species is occasionally found in channels in the Beaufort, N.C., harbor. The species feigns death when brought on deck in a dredge haul, and, thus, closely resembles the pebbles and pieces of shell among which it appears to live. Ovipigerous females are found at this locality throughout the summer.

Genus *Speloeophorus* Milne Edwards, 1865

Rathbun, 1937, p. 141.

KEY TO SPECIES IN THE CAROLINAS

- a. Lateral portions of carapace tumid, not expanded into wings; deep cavity of carapace with only two openings, not visible dorsally-----*nodosus* (p. 149).
- aa. Lateral portions of carapace expanded into broad, flattened wings; deep cavity of carapace with four openings, two visible dorsally-----*pontifer* (p. 149).

Speloeophorus nodosus (Bell)

Figures 123-124

Oreophorus nodosus Bell, 1855, p. 307, pl. 33, fig. 8.

Speloeophorus nodosus: Hay and Shore, 1918, p. 425, pl. 32, fig. 5.—Rathbun, 1937, p. 142, pl. 40, figs. 1-5.

Recognition characters.—Carapace convex, roughly pentagonal or hexagonal, broader than long, posterolateral angles rounded; surface nodose, evenly and thickly covered everywhere with crowded, rounded granules. Front thick, bilobed, upturned; a prominent broad ridge extending backward from front to cardiac region. Hepatic region to each side with a low hump, behind this,

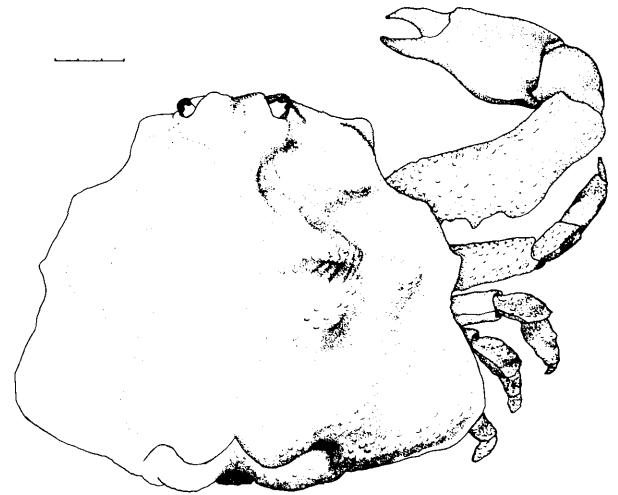


FIGURE 123.—*Speloeophorus nodosus* (Bell). Animal in dorsal view, legs of left side not shown, 3 mm. indicated.

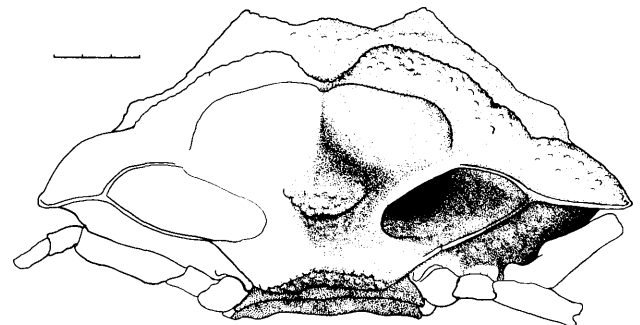


FIGURE 124.—*Speloeophorus nodosus* (Bell). Animal in posterior view, 3 mm. indicated.

at side of gastric region, a much larger hump, and still farther back, near posterior border, another of nearly equal size; posterior humps overhanging and largely containing a deep cavity with two openings invisible in dorsal view. Subhepatic region with a nodose prominence near front, and farther back two others of smaller size.

Chelipeds short, stout, coarsely granulate, crested along outer margin; merus with large distal and small proximal lobe; fingers thin, flat, grooved. Walking legs crested, crests dentate or narrowly lobed.

Measurements.—Carapace: length of male, 12 mm., width, 15 mm.; female, length, 17 mm., width, 21 mm.

Variations.—Carapace of males much more uneven than that of females.

Color.—Pink with a few purplish spots on carapace and rusty-brown marks on legs. Rathbun (1937) described this species as looking like a dead piece of coral overgrown with purplish and greenish algae, with patches of red ones; chelae with natural greenish cast; reticulations around whitish areas of green hue; fingers dull white with articulations pink; legs dirty white with greenish, reddish, and whitish spots; eyes not distinguishable from rest of body; underparts dirty white, abdomen greenish.

Habitat.—One and one-half to 10 fathoms.

Type locality.—Unknown.

Known range.—Off Morehead City, N.C., to southern Florida; West Indies.

Remarks.—This species is rare in the northern part of its range and was most recently reported by Pearse and Williams (1951) from reefs off Beaufort Inlet, N.C. The species readily plays dead when brought on deck.

***Speloeophorus pontifer* (Stimpson)**

Figures 125–126

Lithadia pontifera Stimpson, 1871b, p. 115.

Speloeophorus pontifera: Hay and Shore, 1918, p. 425, pl. 32, fig. 5.

Speloeophorus pontifer: Rathbun, 1937, p. 144, pl. 39, figs. 1–3 (rev.).

Recognition characters.—Carapace angular, roughly trefoil shaped, from one-third to one-sixth wider than long; surface granulate, uneven. Lateral margin of each side extended into a broad wing projecting over bases of legs; anterolateral margins concave, with notch near middle; posterolateral margins broad, with a deep rounded cavity to each side of intestinal region, extending toward and almost to much smaller pit on dorsal surface at side of cardiac region, a narrow suture connecting cavity and pit of each side. Front narrow, produced, upturned, and with a deep median sinus. Orbits small. A middorsal ridge extending from front almost to posterior margin, ridge interrupted in middle of carapace; branchial region on each side with a prominent elevation more or less divided into two parts, one connected by a ridge to anterior angle of lateral wing, other similarly connected to posterior angle. Hepatic region small, slightly elevated; pterygostomian region prominent, with conical downward-pointing eminence visible from above.

Chelipeds of moderate size, somewhat crested; merus with two large triangular teeth on outer

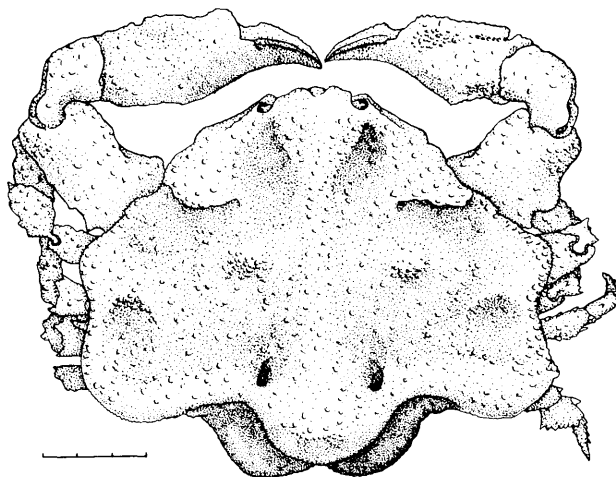


FIGURE 125.—*Speloeophorus pontifer* (Stimpson). Female in dorsal view, 3 mm. indicated.

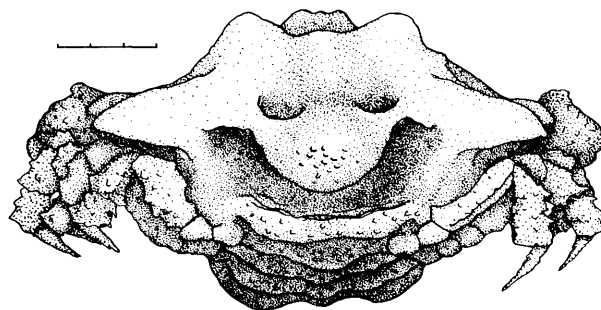


FIGURE 126.—*Speloeophorus pontifer* (Stimpson). Female in posterior view, 3 mm. indicated.

margin; fingers slender and curved. Walking legs granulate and tuberculate.

Abdomen tuberculate; segments three to five only partially fused; sixth segment with a sharp, backward pointing, proximal spine.

Measurements.—Carapace: length of male, 6 mm., width, 8 mm.; female, length, 10 mm., width, 13 mm.

Variations.—This small species apparently attains a width of about 15 mm., and is extremely variable. The ridges and elevations of the dorsal surface may be sharp and conspicuous or low and rounded; the lateral angles of the lateral wings of the carapace may be produced or rounded off. The female is not so wide in proportion to length as the male, and is somewhat tumid on the outer posterior part of the lateral wings.

Color.—Pale red in middle, remainder white (von Martens in Rathbun, 1937.)

Habitat.—Low tide to 125 fathoms.

Type locality.—Barbados.

Known range.—Off Beaufort, N.C., to west Florida; West Indies to Barbados.

Subfamily **Philyrinae**

Carapace almost hemispherical, surface only slightly uneven. So-called frontal teeth often being well-developed inner-orbital angles. A median frontal tooth often present. Infraorbital lobe seldom well developed, roof of efferent branchial channel usually reaching same level. Epistome usually reduced. Margins of mouth and pterygostomian region in same transverse plane. Merus of external maxillipeds half or more than half length of ischium measured along inner border. First abdominal segment in female often under carapace (Rathbun, 1937).

Genus **Persephona** Leach, 1817

Rathbun, 1937, p. 151.—Hemming, 1958b, p. 18.

Persephona punctata aquilonaris Rathbun. Purse crab

Figure 127

Persephona punctata Stimpson, 1859 (in part), p. 70.—Hay and Shore, 1918 (in part), p. 423, pl. 32, fig. 9.

Persephona punctata aquilonaris Rathbun, 1937, p. 154, pl. 42, figs. 6-7 (rev.).

Recognition characters.—Carapace globular, thickly strewn dorsally and laterally with granules of various sizes, and with three sharp, recurved spines, one at each end of posterior margin and one median just above posterior margin. Front narrow, broadly bidentate, produced and elevated, and with dentiform angles of branchial channels projecting slightly beyond it. Anterior and lateral regions bounded externally by a row of beadlike granules broken anteriorly by a single tubercle of larger size, and posteriorly extending to a point nearly opposite termination of posterior margin.

Chelipeds subcylindrical in adult male, approximately 1.5 times as long as carapace; merus with many large tubercles; carpus and chela nearly smooth except on margins; chela somewhat flat and dilated; fingers weak.

Measurements.—Male: length of carapace to tip of posterior spine, 48 mm.; to base of spine, 45 mm.; width, 42 mm.

Color.—Gray to grayish brown, with darker brownish irregular spots or marmorations; granules white or tinged with red.

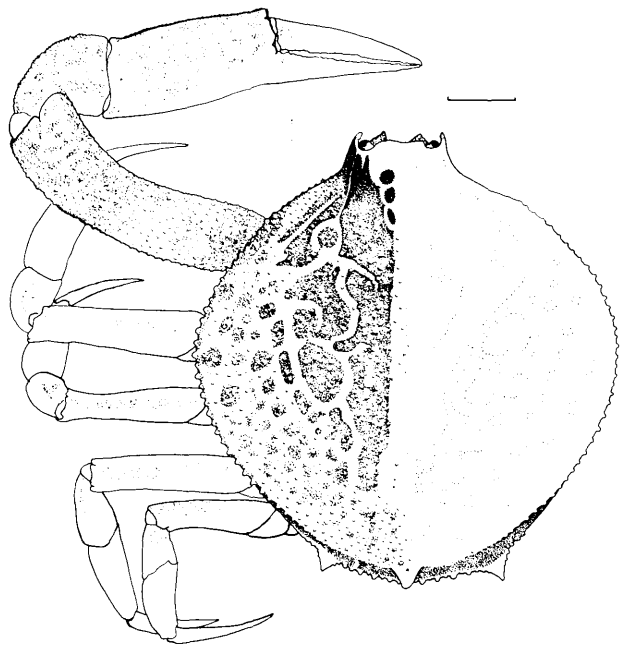


FIGURE 127.—*Persephona punctata aquilonaris* Rathbun. Animal in dorsal view, detail of left side shown, 5 mm. indicated.

Habitat.—This crab is sometimes taken in otter trawls but usually by dredging in shelly mud in relatively shallow water in the ocean; 2 to 30 fathoms.

Type locality.—St. Augustine, Fla.

Known range.—New Jersey to Campeche, Mexico (Hildebrand, 1954, in part).

Remarks.—The species is fairly abundant in colonies. The purselike receptacle formed by the enormously enlarged penultimate segment of the abdomen in the female may be found filled with eggs at almost any time during spring and summer.

Genus **Iliacantha** Stimpson, 1871

Rathbun, 1937, p. 183.

KEY TO SPECIES IN THE CAROLINAS

- a. Fingers longer than palm of hand—*subglobosa* (p. 150).
- aa. Fingers about half as long as palm of hand
intermedia (p. 151).

Iliacantha subglobosa Stimpson

Figure 128

Iliacantha subglobosa Stimpson, 1871a, p. 155.—Hay and Shore, 1918, p. 424, pl. 32, fig. 2.—Rathbun, 1937, p. 185, pl. 53, figs. 1-2 (rev.).

Remarks.—Ovigerous females have been taken in June from the Gulf of Mexico.

Iliacantha intermedia Miers

Figure 129

Iliacantha intermedia Miers, 1886, p. 302, pl. 26, figs. 3, 3a.—Hay and Shore, 1918, p. 424, pl. 32, fig. 3.—Rathbun, 1937, p. 186, pl. 54, figs. 1–2 (rev.).

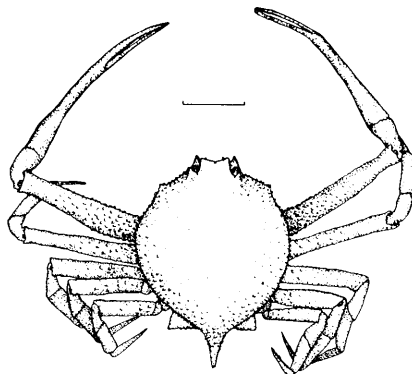


FIGURE 129.—*Iliacantha intermedia* Miers. Male in dorsal view, 5 mm. indicated.

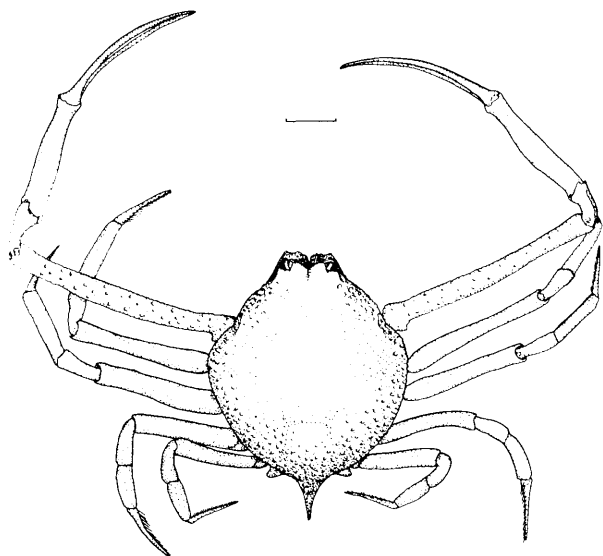


FIGURE 128.—*Iliacantha subglobosa* Stimpson. Female in dorsal view, 5 mm. indicated.

Recognition characters.—Carapace orbicular, smoothly and evenly convex, finely granulate, unarmed except posterior border with three spines; lateral spines subtriangular, blunt; median one higher, longer, conical, and curved upward. Front deeply grooved above, broadly notched anteriorly and with spiniform angles of branchial channels extending beyond it. Margin of carapace distinct, somewhat acute on hepatic region and anterior portion of branchial region, indistinct beyond; hepatic region swollen; intestinal region slightly protuberant above base of median spine.

Chelipeds 2.5 times as long as carapace, excluding spine, finely granulate; merus more sharply granulate than carpus and hand; fingers slender, longer than palm, armed with needlelike teeth. Walking legs slender, smooth; merus as long as three terminal articles; dactyls grooved, and with two fringes of hair on upper and posterior surfaces. Male abdomen gradually tapering from fifth to seventh segment.

Measurements.—Male: carapace length, 21 mm., width, 16 mm.; chela length, 22 mm.; fingers, 13 mm.

Habitat.—Fifteen to 215 fathoms.

Type localities.—Three stations in Florida reefs, 40–80 fathoms.

Known range.—Off Cape Hatteras, N.C., to northwest Florida; through West Indies to Barbados.

Recognition characters.—Similar to *I. subglobosa*, but carapace more coarsely granulate; posterior spines shorter, flattened, triangular, connected by prominent line of granules. Front deeply grooved above, broadly notched anteriorly, and with spiniform angles of branchial channels extending beyond it. Margin of carapace distinctly granulate; intestinal region not protuberant above median spine.

Chelipeds slender, nearly as long as carapace; merus cylindrical and granulate with coarser granulations proximally; hand smooth, somewhat inflated proximally but tapering to slender fingers; fingers about half as long as palm, incurved at tip, and denticulate on opposed margins. Male abdomen widened at convex-sided sixth segment.

Measurements.—Male: carapace length, 16 mm., width, 12 mm.; chela, length, 13 mm.; fingers, 4 mm. Female: carapace length, 27 mm., width, 21 mm.

Color.—Gray without markings of any kind.

Habitat.—Five and one-half to 180 fathoms.

Type locality.—Bahia, Brazil.

Known range.—Off Beaufort, N.C., to northwest Florida; St. Thomas, V.I.; Venezuela; Bahia, Brazil.

Remarks.—The young of this species and *Persephona punctata aquilonaris* have a close resemblance.

Family Calappidae

Oxystomata of normal crablike form with abdomen hidden beneath thorax. Antennae small. Afferent openings of gill chambers in front of chelipeds. Outer maxillipeds not completely closing buccal cavity. Male openings coxal on fifth pair of legs.

Calappid species are known from the Cretaceous to the present in North America (Rathbun, 1935).

KEY TO GENERA AND ONE SPECIES IN THE CAROLINAS

- a. Posterolateral region of carapace expanded and dentate
Calappa (p. 152).
- aa. Posterolateral region of carapace not expanded.
 - b. Merus bispinous on distal outer surface with lower spine strong and greatly extended laterally
Acanthocarpus alexandri (p. 156).
 - bb. Merus not bispinous on distal outer surface.
 - c. Carapace considerably broader than long, regularly convex above.....*Hepatus* (p. 157).
 - cc. Carapace nearly as long as broad, dorsal surface uneven.....*Osachila* (p. 159).

Subfamily Calappinae

Merus of external maxillipeds almost never elongate and acute, never concealing palp in repose. Legs adapted for walking (Alcock in Rathbun, 1937).

Genus *Calappa* Weber, 1795

Rathbun, 1937, p. 197.

KEY TO SPECIES IN THE CAROLINAS

- a. Carapace widest behind middle; proximal tooth on lower edge of hand with margin pointed or angled.
 - b. Carapace smoothly granulate.
 - c. Carapace often with a horizontal tooth or spine at either end of posterior margin; smooth area on lower half of palm on cheliped narrow proximally, widening and continued obliquely upward distally
sulcata (p. 155).
 - cc. Carapace without a horizontal tooth or spine at either end of posterior margin; smooth area on lower half of palm on cheliped concave, not directed obliquely upward distally.
 - d. Male with basal width of fifth abdominal segment twice median length; female with a few granulations near lateral border of fourth abdominal segment.....*flammea* (p. 152).

- dd. Male with basal width of fifth abdominal segment less than twice median length; female with no granulations near lateral border of fourth abdominal segment.....*ocellata* (p. 153).
- bb. Carapace covered with rough protuberances, and granulate.....*angusta* (p. 154).
- aa. Carapace widest in front of middle; proximal tooth on lower edge of hand with margin not pointed or angled.....*angusta* (young) (p. 154).

Calappa flammea (Herbst)

Figures 130-131

Cancer flammeus Herbst, 1794, p. 161, pl. 40, fig. 2.
Calappa flammea: Hay and Shore, 1918, p. 421, pl. 31, fig. 8.—
Holthuis, 1958, p. 148, figs. 28-35 (rev.).

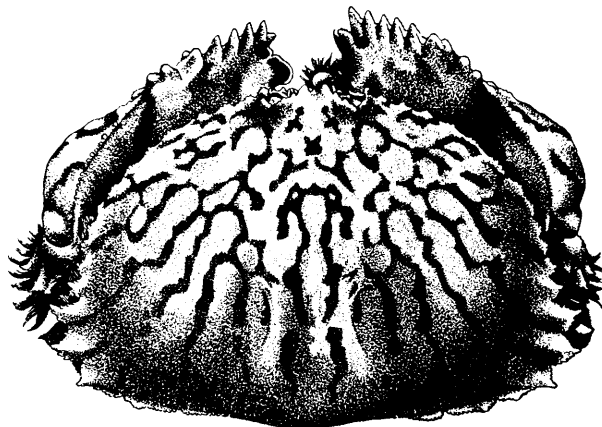


FIGURE 130.—*Calappa flammea* (Herbst). Female from Tortugas, Florida, in dorsal view, approximately $\times 0.66$ (after Holthuis, 1958).

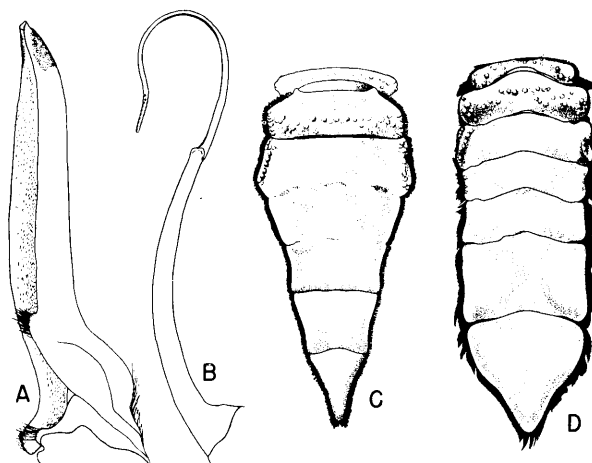


FIGURE 131.—*Calappa flammea* (Herbst). A, male first pleopod in ventral view, $\times 3$; B, male second pleopod in dorsal (anterior) view, $\times 3$; C, abdomen of male, approximately $\times 0.8$; D, abdomen of female, approximately $\times 0.8$; A-C from Tortugas, D from Bahama Islands (after Holthuis, 1958).

Recognition characters.—Carapace 1.14 to 1.42 times broader than long, varying from smaller to larger ratio with increasing size; surface granular, less conspicuously so in posterior half, tuberculate anteriorly, becoming obsolescent in adults; branchiocardiac grooves distinct. Front deeply notched anteriorly, projecting somewhat beyond orbits; anterolateral borders together forming a semicircle in younger specimens, less strongly arched in adults. Posterolateral winglike expansions of carapace distinct, consisting of five broad teeth with beaded edges, second and third with sharp but not pointed apices, fifth tooth with notch on inner basal part.

Chelipeds with outer surface of palm divided into three horizontal zones: a lower one with many large granules; a second zone, slightly sunken, with no large granules but with scattered small ones, more in males than females; a third zone occupying whole upper half of outer surface of palm, separated from second zone by a row of small granules, bearing many small granules, and some large low granular tubercles, more densely granulated than second zone in females, same in both in males. Upper margin of large hand with about seven teeth, six on small hand; proximal teeth broad, low, and bifurcated. Palm with strong tooth on outer lower surface near carpus, apex of tooth approximately rectangular with a sharp tip. Fingers of crushing hand somewhat stouter than on cutting hand, and with prominent projecting lobule near base of each. Merus with strong four-toothed crest parallel with outer distal border.

Male with abdomen narrow; third to fifth segments fused, fifth segment with basal width twice median length, sixth with width greater than length, seventh with length about 1.5 times width. Female with a few granulations near lateral border of fourth segment; length of seventh segment equal to or slightly greater than width.

Measurements.—Carapace: male, length, 99 mm., width, 136 mm.; female, length, 106 mm., width, 135 mm.

Color.—Ground color of carapace gray behind, shading to drab mottled with white over greater portion; reddish blue on outer surface of chelipeds becoming almost white on lower half of palm and on fingers; inner surface of chelipeds, pterygostomial regions, anterior surface of first walk-

ing legs, and a small part of second walking legs reddish hued. Carapace with color pattern variable, purplish brown in interlacing bands on anterior half, obliquely longitudinal stripes on posterior half becoming lighter posteriorly. Merus, carpus, and proximal upper portion of palm striped with purplish brown, two distinct round spots of same color in middle of palm; upper half of palm with spots and patches of sulphur yellow on teeth and tubercles and same color mixed with ground color of merus, carpus, and part of carapace; two or three orange spots on hands near base of dactyls and spots of same near articulation of palm and carpus. Third to fifth legs, and underparts whitish. (Adapted from R. L. Barney in Rathbun, 1937.)

Habitat.—This strikingly colored crab does not often occur within the harbor at Beaufort, N.C., but is often brought up from a few fathoms outside the inlet. Those obtained inside are usually small. Hildebrand (1955) listed the species as common from 6 to 16 fathoms on the Campeche Banks. The species may spend much time buried in sand (Pearse, Humm, and Wharton, 1942).

Habitat.—Surface to 40 fathoms, rarely to 125 fathoms.

Type locality.—America.

Known range.—Cape Hatteras, N.C., to Florida Keys; Gulf coast of United States and Mexico; Bahamas; Bermuda.

Remarks.—This species has a fossil record in North America dating from the Oligocene (Rathbun, 1930b).

The breeding range of the species extends as far northward as Cape Hatteras, but in the larval stages it often drifts as far to the north as southern New England. Some of these larvae are supposed now and then to survive a mild winter and develop by the next summer into the small specimens which have at rare intervals been taken on the coast of Massachusetts and Rhode Island. Some of the larval stages have been figured by Lebour (1944). Smith (1880b) gave a description of the megalops stage of this species.

Calappa ocellata Holthuis

Figures 132-133

Holthuis, 1958, p. 158, figs. 36-40 (rev.).

Recognition characters.—Carapace slightly narrower than in *C. flammea*, having width to

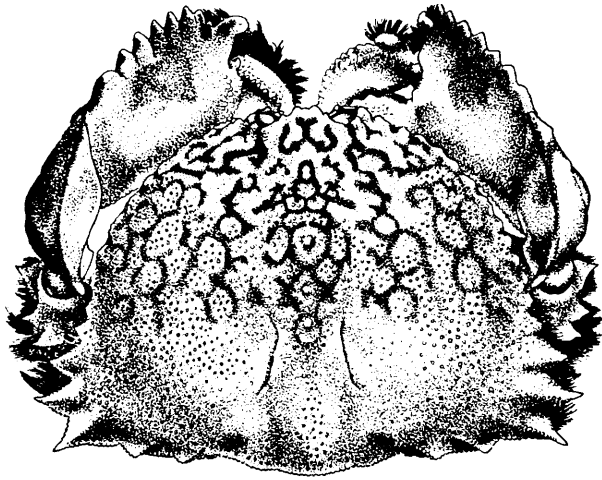


FIGURE 132.—*Calappa ocellata* Holthuis. Male from Curaçao in dorsal view, approximately natural size (after Holthuis, 1958).

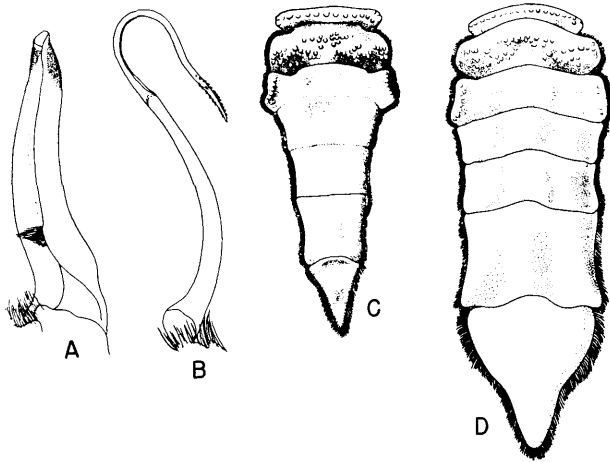


FIGURE 133.—*Calappa ocellata* Holthuis. A, male first pleopod in ventral view, $\times 3$; B, male second pleopod in dorsal (anterior) view, $\times 3$; C, abdomen of male, approximately $\times 0.8$; D, abdomen of female, approximately $\times 0.8$; A-D from Dutch West Indies (after Holthuis, 1958).

length ratio of 1.15 to 1.40, varying from smaller to larger ratio with increasing size; granulations much coarser than in *C. flammea*, granules larger, fewer, and more widely separated. Posterolateral winglike projections distinctly set off from anterolateral margin, teeth with slender pointed tips, more slender than in *C. flammea*, notch in basal part of fifth tooth inconspicuous.

Chelipeds similar to *C. flammea*, though second and third zones of outer palm nearly alike in both

males and females. Upper margin with teeth narrower proximally than in *C. flammea*, and with bifurcation indistinct or absent. Palm with strong tooth on outer lower surface near carpus, apex sharply pointed with an acute tip. Teeth on crest of merus more sharply pointed than in *C. flammea*.

Male with abdomen narrower than in *C. flammea*; third to fifth segments fused, fifth segment with basal width less than twice median length, sixth with width equal to or less than length, seventh more slender than in *C. flammea*. Females with no granules near lateral border of fourth segment; length of seventh segment distinctly greater than width.

Measurements.—Male holotype: length of carapace, 83 mm.; width, 114 mm.

Color.—In preserved specimens, anterior half of carapace red with numerous white, often ocellated, spots and a few white streaks, the whole forming a reticulate pattern of red. Pattern more compact and complete than in *C. flammea*, extending over full width of anterior half of carapace, absent in posterior half showing only a few distinct spots between teeth of posterolateral wings, and two red spots before posterior margin above bases of last legs. Chelipeds with one or two red spots near articulation of dactyls; red between teeth of upper margin; inside of chelipeds reddish (Holthuis, 1958).

Habitat.—Shallow water to 14 fathoms.

Type locality.—Klein Bonaire, Dutch West Indies.

Known range.—Cape Hatteras, N.C., to State of Pernambuco, Brazil; Bermuda.

Remarks.—This species is less common than *C. flammea* from Tortugas northward (Holthuis, 1958).

Calappa angusta Milne Edwards

Figure 134

Calappa angusta Milne Edwards, 1880, p. 18.—Hay and Shore, 1918, p. 421, pl. 31, fig. 7.—Rathbun, 1937, p. 210, pl. 64, figs. 1-6 (rev.).

Recognition characters.—Carapace eight-ninths as long as wide; anterolateral margins finely granulate with larger granules at intervals; surface covered with protuberances, granulate between. Tooth at posterolateral angle of winglike extension of carapace largest, preceded anteriorly by four teeth gradually diminishing in size, and followed posteriorly by one small and one or two

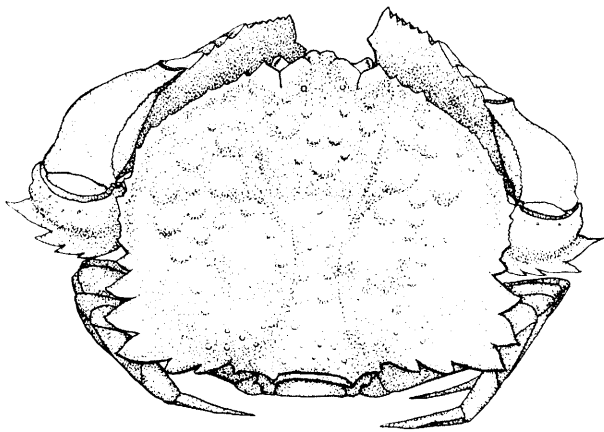


FIGURE 134.—*Calappa angusta* Milne Edwards. Animal from North Carolina in dorsal view, approximately \times 1.8.

extremely small teeth. Orbit completely separated from antennular cavity.

Chelipeds with outer surface of palm divided into three zones as in preceding species; upper margin with six to eight teeth. Abdomen with sixth segment subquadrate; seventh segment subtriangular, slightly longer than wide.

Measurements.—Carapace: male, length, 28 mm., width, 32 mm.; female, length, 23 mm., width, 28 mm.

Variations.—Posterior part narrower than middle of carapace in juveniles, wider than middle in adults.

Color.—Ground color buff to buff yellow; high spots or lumps on carapace and chelipeds red. Marginal spines of carapace, crest of chela and lumps on crest drab. Hairs of carapace, especially those of hind margin, light olive yellow; those of walking legs light citrous yellow. Merus of chelipeds practically colorless. Under parts whitish, pterygostomian region and maxillipeds suffused with pale purple (Schmitt *in* Rathbun, 1937).

Habitat.—More abundant in the Gulf Stream than in adjacent inshore waters; 7.5 to 115 fathoms, rarely deeper.

Type locality.—Barbados.

Known range.—Off Cape Lookout, N.C., through eastern Gulf of Mexico, to Grenada.

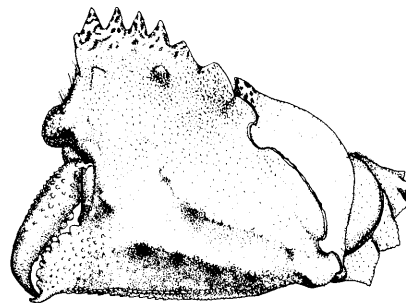
Remarks.—Ovigerous females have been taken from southern Florida in March.

Calappa sulcata Rathbun

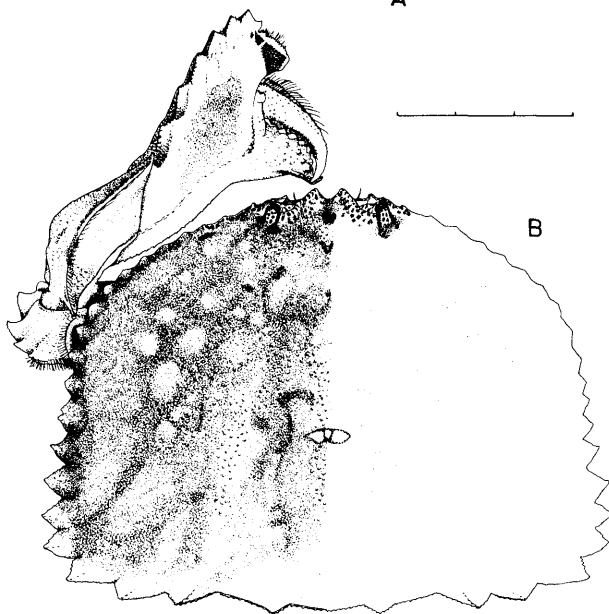
Figures 135–136

Calappa sulcata Rathbun, 1898, p. 289, pl. 9, figs. 3–4.—Hay and Shore, 1918, p. 422, pl. 31, fig. 6.—Holthuis, 1958, p. 179, figs. 51–54 (rev.).

Recognition characters.—Carapace somewhat wider than long, covered with uniform granulations giving appearance of being smooth. Anterolateral margins crenulate and granulate, grading into inconspicuous anterolateral wings; teeth triangular, pointed. Posterior margin with tooth at each end near base of abdomen, sharper in males than in females, very low in adults, most slender and sharp in juveniles; third tooth of posterolateral wings extremely sharp and slender, pointed in juveniles.



A



B

FIGURE 135.—*Calappa sulcata* Rathbun. A, large chela in external view; B, female in dorsal view; 30 mm. indicated.

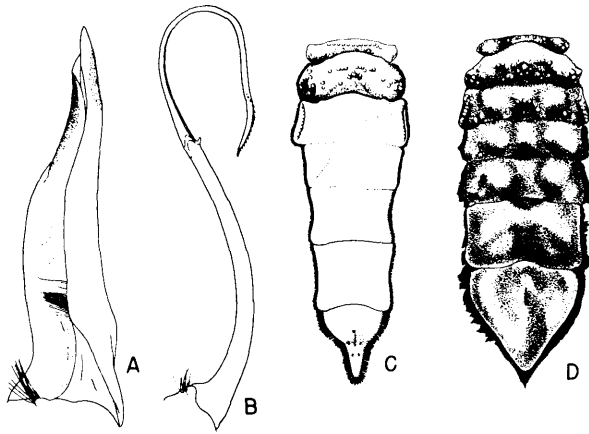


FIGURE 136.—*Calappa sulcata* Rathbun. A, male first pleopod in ventral view, approximately $\times 3$; B, male second pleopod in dorsal (anterior) view, approximately $\times 3$; C, abdomen of male, approximately $\times 0.8$; D, abdomen of female, approximately $\times 0.6$; A-C from near Margarita Island, Venezuela; D from Surinam (after Holthuis, 1958).

Chelipeds with outer surface of palm divided into three zones as in preceding species; large tubercles of lower zone low and inconspicuous; zones one, two, and three each separated by a row of sharply pointed tubercles; middle zone not extending horizontally, but curving dorsally in distal part, smooth, with minute granules; zone three smooth, except for two low, inconspicuous, granular tubercles near upper margin of palm; granulations on palm more distinct in females than in males; tooth on outer, lower, proximal surface of palm nearly rectangular in large individuals, slender and acute in smaller ones. Meral articles of walking legs with granules on lower surface.

Measurements.—Carapace: male, length, 77 mm., width, 98 mm.; female, length, 92 mm., width, 119 mm.

Color.—In alcohol, often light pinkish brown with small, narrow rings of dark red, median ring most conspicuous; each carpus with a ring, and each palm with one near upper margin enclosing tubercle toward proximal end of margin (Rathbun, 1937).

Habitat.—Twelve to 100 fathoms (Cerame-Vivas, personal communication).

Type locality.—Off Louisiana, lat. $29^{\circ}24'30''$ N., long. $88^{\circ}01'$ W., depth, 35 fathoms.

Known range.—Cape Hatteras, N.C., to Gulf of Mexico; through West Indies to French Guiana.

Remarks.—Hildebrand (1954) reported this species (under the name *C. springeri*) as conspicuous but never abundant in the western and northwestern Gulf of Mexico at depths of 12 to 35 fathoms. One ovigerous female was found in May off Padre Island, Tex.

Genus *Acanthocarpus* Stimpson, 1871

Rathbun, 1937, p. 220.

Acanthocarpus alexandri Stimpson

Figure 137

Acanthocarpus alexandri Stimpson, 1871a, p. 153.—Rathbun, 1937, p. 221, pl. 69, figs. 1-2 (rev.).

Recognition characters.—Carapace ovate, regularly convex, widest in anterior half; surface uneven, granulate, and punctate, with protuberances arranged longitudinally in roughly five rows centrally, and two shorter, intercalated rows behind orbits; all rows formed into ridges, those adjacent to midline each terminating in a spine on posterolateral margin. Posterior margin arcuate bearing a low eminence at middle; inferior margin of pterygostomian region with a row of 7 to 11 strong, widely spaced, oblique ridges of varying length. Orbits large, margins ciliated.

Chelipeds strong; merus bispinose on distal outer surface, inferior spine strong and a little longer or shorter than half width of carapace, superior spine one-fourth to one-third length of inferior spine; hand with superior crest of 7 closely placed teeth, and an oblique 6-toothed crest on outer surface extending from base of dactyl to posteroinferior angle, scattered tubercles between crests; inner surface of hand with stridulating ridge composed of about 45 oblique, closely placed striae which can be played against oblique ridges of pterygostomian region. Walking legs smooth. Sternal plastron with a conical tubercle on either side of first article.

Measurements.—Male carapace: length, 13 mm.; width, 32 mm.

Color.—Dorsal surface of carapace and chelipeds pale reddish orange, deepest in hue on elevations of carapace and bases of meral spines of chelipeds; underparts white, slightly tinged with red (Rathbun, 1937).

Habitat.—Thirty-seven to 208 fathoms.

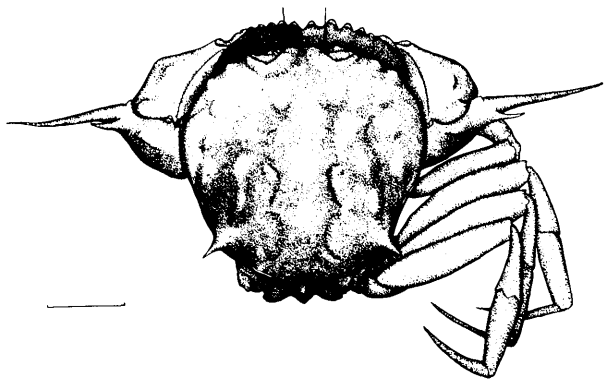


FIGURE 137.—*Acanthocarpus alexandri* Stimpson. Male in dorsal view, walking legs of left side not shown, 10 mm. indicated.

Type locality.—Off the Quicksands, Florida Keys, 74 fathoms.

Known range.—Georges Bank off Massachusetts to west coast of Florida; Puerto Rico to Grenadines; Brazil (Da Costa, 1959).

Remarks.—The species has been recorded off both Carolinas, usually at depths greater than 100 fathoms. One collection was taken off South Carolina in 1950 at 60–65 fathoms along with *Sicyonia* and *Hymenopenaeus* sp.

Rathbun (1937) reported ovigerous females in June and July from Florida.

Subfamily Matutinae

Merus of external maxillipeds elongate and acute, entirely concealing palp in repose (Alcock in Rathbun, 1937).

Genus *Hepatus* Latreille, 1802

Rathbun, 1937, p. 234.—Holthuis, 1959, p. 173.

KEY TO SPECIES IN THE CAROLINAS

- a. Carapace covered with small spots; front bidentate
pubibundus (p. 157).
- aa. Carapace covered with large spots; front truncate
epheliticus (p. 158).

Hepatus pubibundus (Herbst)

Figures 138–139

Cancer pubibundus Herbst, 1785, p. 199.

Hepatus princeps: Rathbun, 1937, p. 235, pl. 70, figs. 1–2 (rev.).

Hepatus pubibundus: Holthuis, 1959, p. 167, figs. 36–38a, b (rev.).

Recognition characters.—Carapace between two-thirds and three-fourths as long as broad, relatively narrower in juveniles than in adults,

covered with transverse lines or small spots, strongly convex. Surface smooth in adults; juveniles with eight distinct rows of tubercles, three in a transverse line in broadest part of carapace, two others in front and three behind. Front thick, obtuse, slightly bidentate. Anterolateral margin divided into 12 or 13 more or less rectangular teeth, denticulate on margins and not projecting; anterior portion of posterolateral margin consisting of 2 rows of tubercles placed side by side with no space between, a small tooth in middle of rows and another in posterior portion of this margin.

Outer face of hands with five rows of tubercles exclusive of marginal ones. Dactyls of walking legs with a coating of short, dense pubescence, except for tip, and a narrow smooth line on each side.

Measurements.—Carapace: males, length, 16–55 mm., width, 21–76 mm.; females, length, 14–46 mm., width, 18–62 mm. (Holthuis, 1959).

Color.—"Pale yellowish brown, with dark-brown transverse lines, or transverse series of spots; legs subochreous [sic], with one or two large purplish blotches in each joint." (Dana in Rathbun, 1937.) Holthuis (1959) gave the color in preserved specimens. Carapace covered with small reddish dots, scattered or sometimes arranged into transverse bands or lines, larger posteriorly than anteriorly; similar dots on carpus and palm; walking legs with two conspicuous broad bands of reddish color on merus, one on carpus and one on propodus, meral bands most distinct on last leg.

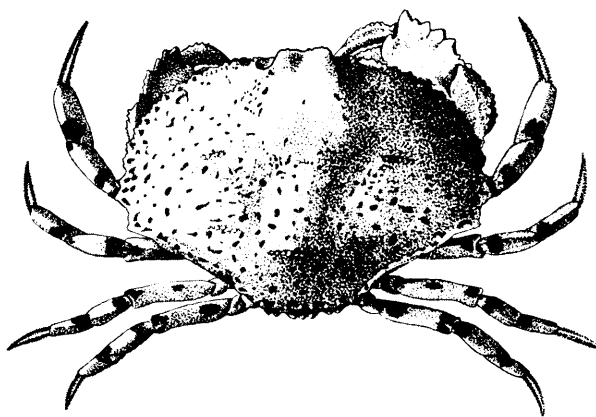


FIGURE 138.—*Hepatus pubibundus* (Herbst). Female in dorsal view, approximately natural size (after Holthuis, 1959).

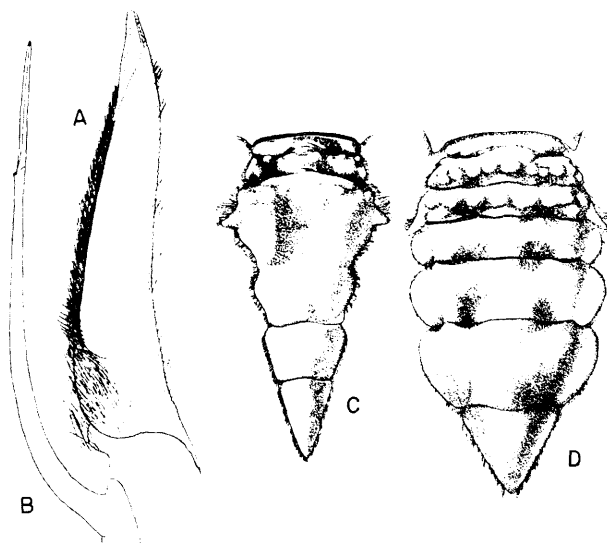


FIGURE 139.—*Hepatus pudibundus* (Herbst). A, male first pleopod; B, male second pleopod; A-B approximately $\times 8$; C, abdomen of male; D, abdomen of female; C-D approximately $\times 2$ (after Holthuis, 1959).

Habitat.—Beach to 6 fathoms.

Type locality.—Martinique.

Known range.—Georgia to State of São Paulo, Brazil.

Remarks.—Holthuis (1959) reported an ovigerous female in April from Surinam. Several of the specimens Holthuis studied carried one or more sea anemones on the carapace and one bore barnacles.

***Hepatus epheliticus* (Linnaeus)** Calico crab, Dolly Varden crab

Figure 140

Cancer epheliticus Linnaeus. 1763, p. 414.

Hepatus epheliticus: Hay and Shore, 1918, p. 422, pl. 37, fig. 1.—Rathbun, 1937, p. 238, pl. 70, figs. 3-4; pl. 71, figs. 1-4 (rev.).

Recognition characters.—Carapace covered with large spots, about two-thirds as long as wide, convex above, regularly arcuate in front, strongly narrowed behind, almost smooth, with indistinct lines of low granules on gastric region and posterior part of branchial region. Front narrow, truncate, tuberculate, not dentate, and placed higher than continuation of anterolateral borders of carapace; anterolateral borders dentate with denticles more prominent than in *H. pudibundus*, middle denticle of each tooth projecting.

Chelipeds moderately strong; carpus and hand with lines of coarse tubercles on outer face and a

three- to four-toothed crest on superior margin of hand. Dactyls of walking legs with a coating of short, dense pubescence except for tip and a narrow smooth line on each side.

Measurements.—Carapace of male: length, 46 mm.; width, 67 mm.

Variations.—In a series representing various ages a great deal of variation is shown, the granulations being relatively much coarser and the spots more numerous and variable in color in juveniles.

Color.—Dark gray or brownish with numerous, rather large, round or irregular spots of light red (muddy lavender to light red in young) with darker borders scattered over carapace.

Habitat.—This species is often found in depths of a few fathoms in channels of Beaufort, N.C., harbor, though such individuals are not so numerous or large as those taken in the ocean outside. Gunter (1950) found the species in water ranging from 28.7 to 35.2‰. Two to 25 fathoms.

Type locality.—Carolina.

Known range.—Chesapeake Bay to Gulf of Campeche, Mexico; Cuba; Jamaica; Dominican Republic.

Remarks.—Though recorded in depths to 25 fathoms, Hildebrand (1954, 1955) found this species most common shoreward of 12 fathoms in

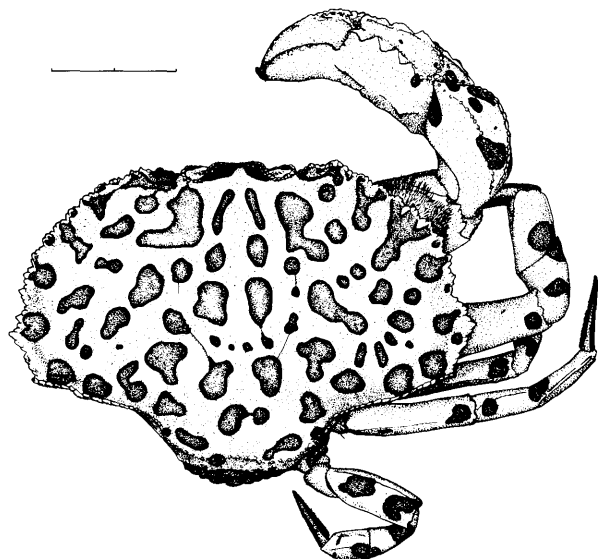


FIGURE 140.—*Hepatus epheliticus* (Linnaeus). Male in dorsal view, legs of left side not shown, 20 mm. indicated.

Texas and Mexico. He found ovigerous females rare, but occurring in July, and noted a common occurrence of the sea anemone, *Calliaectis tricolor*, on the carapace, as found also by Carlgren and Hedgpeth (1952).

Gray (1957) found that *H. epheliticus* has a large gill area in relation to its weight. He related this large respiratory area to its active nature as compared to other strictly aquatic crabs.

Costlow and Bookhout (1962b) described five zoeal and one megalops stage from individuals hatched and reared at 25° C. in an array of salinities ranging from 20 to 40 ‰. Complete development took place only at 30 and 35 ‰ though some growth occurred in the other salinities. The authors pointed out that the adults are usually found in waters with salinity in the 30–35 ‰ range.

Genus *Osachila* Stimpson 1871

Rathbun, 1937, p. 248.—Hemming, 1958b, p. 17.

KEY TO SPECIES IN THE CAROLINAS

- a. Posterolateral margin of carapace thin edged, almost sharp-----*tuberosa* (p. 159).
- aa. Posterolateral margin of carapace thick, blunt
semilevis (p. 159).

Osachila tuberosa Stimpson

Figure 141

Osachila tuberosa Stimpson, 1871a, p. 154.—Hay and Shore, 1918, p. 423, pl. 31, fig. 10.—Rathbun, 1937, p. 250, pl. 77, fig. 3 (rev.).

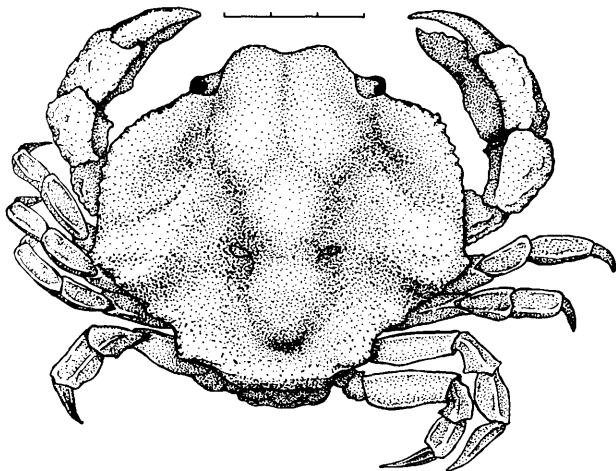


FIGURE 141.—*Osachila tuberosa* Stimpson. Male in dorsal view, 3 mm. indicated.

Recognition characters.—Carapace octagonal, with six large protuberances, one mesogastric, paired metagastric, one cardiac, paired mesobranchial; protuberances and lateral margins finely eroded. Anterolateral margins finely dentate, continued toward buccal cavity; posterolateral margins thin edged, with four lobes, first lobe projecting sideways slightly beyond adjacent anterolateral tooth. Front usually with a narrow sinus. Maxillipeds, sternum, abdomen, and bases of legs eroded.

Chelipeds short, thick, tuberculate on outer face, and with rough margins; hand stout, upper margin with three teeth, proximal one bifid; immovable finger thick. Walking legs more or less prismatic with sharp margins and light longitudinal grooves.

Measurements.—Carapace of female: length, 18 mm.; width, 20 mm.

Color.—“Sand color with reddish cast, white below, claws and legs white.” (Henderson in Rathbun, 1937.)

Habitat.—Forty to 65 fathoms.

Type locality.—Five stations among the Florida reefs, 36–68 fathoms.

Known range.—Off Cape Hatteras, N.C., to west Florida.

Remarks.—This southern species has been recorded only once from North Carolina.

Osachila semilevis Rathbun

Figure 142

Osachila semilevis Rathbun, 1916, p. 652, pl. 36, fig. 1.—Hay and Shore, 1918, p. 422, pl. 31, fig. 9.—Rathbun, 1937, p. 251, pl. 77, fig. 1 (rev.).

Recognition characters.—Much like *O. tuberosa*. Carapace octagonal, with six large protuberances, one mesogastric, paired metagastric, one cardiac, paired mesobranchial; protuberances eroded, depressions nearly smooth. Anterolateral margins finely dentate, continued toward buccal cavity; posterolateral margins thick, with four lobes; first lobe not projecting laterally so far as adjacent anterolateral lobe; last lobe quite prominent. Front usually with a narrow buttonholelike sinus.

Chelipeds short, thick, tuberculate on outer face and with rough margins; hand stout, upper margin with three simple teeth; immovable finger thick, dactyl comparatively slender and straight. Walking legs of moderate size, more or less

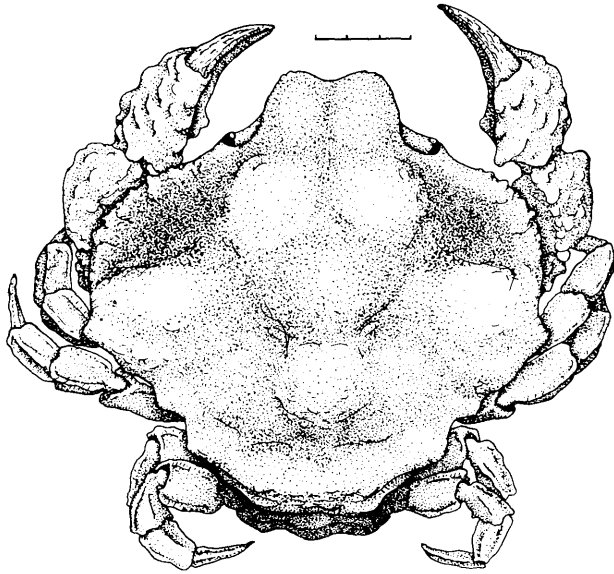


FIGURE 142.—*Osachila semilevis* Rathbun. Animal in dorsal view, 3 mm. indicated.

prismatic and lightly grooved. Abdomen narrow, eroded along margins and on last two segments.

Measurements.—Carapace of ovigerous female: length, 13 mm.; width, 15 mm.

Habitat.—Thirteen to 50 fathoms.

Type locality.—Gulf of Mexico, 25 fathoms.

Known range.—Off Beaufort, N.C., to north-west Florida.

Remarks.—This southern species has been recorded north of Florida only twice, both times from the Beaufort, N.C., area. Ovigerous females have been taken from Florida in July.

Subsection **Brachygnatha**

Brachyura having buccal frame roughly quadrate. Last pair of legs normal in form, rarely reduced in size, and almost never dorsal. Gills few. First abdominal appendages of female absent, female openings sternal.

Superfamily **Brachyrhyncha**

Fore part of body broad, rostrum reduced or absent; body oval, round, or square, usually broader than long. Orbits nearly always well enclosed.

Family **Portunidae**. The swimming crabs

Crabs with body transversely oval, usually five to nine lateral teeth. Last pair of legs usually dis-

tinctly adapted for swimming, with terminal article ovate, flattened.

The family has a fossil record in America dating from the Cretaceous (Rathbun, 1935).

Stephenson and Campbell (1960) discussed the status of portunid subfamily names in the light of recent action by the International Commission on Zoological Nomenclature. This decision altered the usage of Rathbun (1930a) in that the subfamilies Liocarcininae and Thalamitinae become respectively Macropipinae and Portuninae.

KEY TO GENERA AND SOME SPECIES IN THE CAROLINAS

- a. Carapace with five teeth of about equal size on anterolateral margin; interocular teeth three (Subfamily Macropipinae).....*Ovalipes* (p. 160).
- aa. Carapace with nine anterolateral teeth, lateral tooth usually much larger than others; interocular teeth four, six, or eight (Subfamily Portuninae).
- b. Movable portion of antenna not excluded from orbit.
 - c. Palate with longitudinal ridge.
 - d. Abdomen of male more or less triangular.....*Portunus* (p. 162).
 - dd. Abdomen of male with last two segments much narrower than basal segments.....*Callinectes* (p. 168).
 - cc. Palate without longitudinal ridge.....*Arenaeus cribrarius* (p. 173).
- bb. Movable portion of antenna excluded from orbit by prolongation of basal article; anterolateral teeth alternately large and small...*Cronius ruber* (p. 174).

Subfamily **Macropipinae**

Genus **Ovalipes** Rathbun, 1898

Rathbun, 1930a, p. 18.

KEY TO SPECIES IN THE CAROLINAS

- a. Carapace yellowish gray, closely set with small annular spots of reddish purple; iridescent spots between each pair of anterolateral spines approximately alike in size and shape.....*ocellatus* (p. 160.)
- aa. Carapace yellowish gray, without ocellated spots; iridescent spot between fourth and fifth anterolateral spines large and nearly semicircular in shape.....*quadripensis* (p. 161).

Ovalipes ocellatus (Herbst)

Figure 143

- Cancer ocellatus* Herbst, 1799, p. 61, pl. 49, fig. 1.
- Ovalipes ocellatus ocellatus*: Hay and Shore, 1918, p. 426, pl. 32, fig. 7.—Rathbun, 1930a, p. 19, pls. 2-3 (rev.).
- Ovalipes ocellatus*: Williams, 1962, pp. 39-41.

Recognition characters.—Carapace about one-fourth wider than long, convex, finely granulate

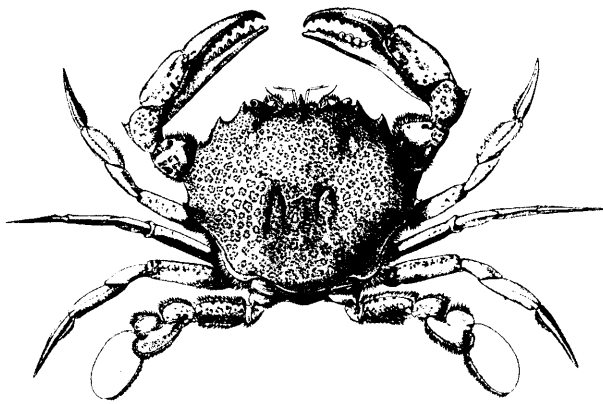


FIGURE 143.—*Ovalipes ocellatus* (Herbst). Male in dorsal view, approximately $\times 0.80$ (after Rathbun, 1884).

overall except for longitudinal band of slightly enlarged granules in median line and smooth area on posterior central portion of adults. Front with three acute teeth, median one about twice as long as lateral ones. Orbit with a shallow fissure above, often nearly closed in adults, open in young. Five anterolateral teeth strong, acute, directed forward; inner suborbital angle projecting at least as far as median frontal tooth. Pterygostomian region with a long, curved, stridulating ridge made up of approximately 50 close-set striae narrowing into tubercles at inner end of ridge, a short complementary ridge on proximal end of inner margin of merus; lobe at distal inner angle of merus of outer maxilliped longer than broad.

Chelipeds rather large; distal three-fifths of anterior margin of merus with several small spines and a dense fringe of hair; carpus with two spines, inner one very long; hand triangular in section, external border costate, covered with uniform small tubercles, internal border with an overhanging densely hairy ridge ending distally in a sharp spine, ridges and internal line of hairs continued on dactyl; fingers about as long as palm, tapering gradually, tips turned abruptly toward each other.

Abdomen of male narrow, sides nearly parallel; sixth segment nearly twice as long as seventh in midline, seventh segment subcircular; first pleopods of male broad and stout in proximal two-thirds, narrowing abruptly distally and with terminal portion bent ventrolaterally in a sinuous curve. Abdomen of adult female suboval and small compared to sternum.

Measurements.—Carapace: males, length, 64 mm., width, 77 mm.; female, length, 39 mm., width, 48 mm.

Variations.—Spines are more acute on young than on old individuals, and on some old adults the anterolateral spines are worn away leaving only rounded humps. The orbital fissure is nearly closed in adults but often open in young individuals. The width between the suborbital angles tends to increase relatively with age.

Color.—"Yellowish gray, closely set with small annular spots of reddish purple; carapace and chelipeds with a silvery or brassy iridescence; ground color of chelipeds and legs light brownish tending to orange and bluish; large irregular bluish purple spots on upper surface of chelipeds; large part of carpus including spine bluish; similar but lighter spots on proximal half of other legs; paddles greenish yellow, with deep yellow rim" (Rathbun, 1930a, and other authors). An iridescent spot between each pair of anterolateral spines.

Habitat.—Common on a variety of bottoms, especially sand; surface to 18 fathoms.

Type locality.—Long Island near New York.

Known range.—Prince Edward Island, Canada (E. L. Bousfield, personal communication), to Charleston, S.C., and on Texas coast jetties (Whitten, Rosene, and Hedgpeth, 1950).

Remarks.—The distinctions between this species and *O. gadulpensis* were discussed by Williams (1962). There is a distinct color difference, pointed out in the color descriptions, and an apparent difference in habitat among the adults. Adults of *O. ocellatus* are found near shore in the Carolinas where the young of both species are also found, as pointed out by a number of authors.

Pearse, Humm, and Wharton (1942) pointed out that *O. ocellatus* can bury itself completely in sand and respire by passing water into the gill cavity from anterior lateral openings, then out through two posterior openings. Gray (1957) correlated great activity of the species with large gill area and compared this with gill areas of other strictly aquatic crabs.

Ovalipes gadulpensis (Saussure)

Portunus gadulpensis Saussure, 1858, p. 433, pl. 2, fig. 10.

Ovalipes ocellatus floridanus Hay and Shore, 1918, p. 427, pl. 32, fig. 8.

Ovalipes ocellatus gadulpensis: Rathbun, 1930a, p. 23, pl. 4 (rev.).

Ovalipes gadulpensis: Williams, 1962, pp. 39–41.

Recognition characters.—Closely resembling *O. ocellatus*, but differing in the following characters: dorsal aspect of carapace not covered with ocellated spots; body flatter than *O. ocellatus*, and carapace evenly granulate overall except for smooth area on rear central portion; outer orbital and frontal teeth more acute than in *O. ocellatus*, median frontal tooth acuminate; iridescent spot between fourth and fifth anterolateral spines larger than spots between first to fourth teeth and nearly semicircular in shape; external ridge on palm of chelipeds with tubercles not uniform in size giving a roughened appearance in individuals larger than 30 mm. in width.

Measurements.—Carapace: male, length, 67 mm., width, 82 mm.; female, length, 56 mm., width, 67 mm.

Variations.—The distance between the sub-orbital angles tends to increase relatively with age.

Color.—“General color of carapace light lavender gray underlaid with dull yellow, some specimens darker or lighter, with a regular pattern of lighter spots dull yellow, off white, or bluish yellow to lavender yellow, rear border of carapace light blue; spines of carapace purplish red at base to red or purple subdistally, white at tips; carpus and merus of chelipeds somewhat same color as carapace except pink flesh colored at carpo-meral joint and on hand; fingers white on inner surface, and with white teeth; large spine at internal angle of carpus and a few small but distinct spots on superoexternal surface of hand purple, large spine grading to lighter purple on body of carpus; anterior border of chela and first three pairs of walking legs with a longitudinal band of brownish purple, band extending to lower border of dactyl on chela; dactyls of first three walking legs and outer border of hand immediately below external ridge, same color, sometimes darker on dactyl with teeth same color, distal tip of immovable finger similarly colored; blade of swimming leg yellowish; underparts light.

“Iridescent spots between anterolateral teeth, on distal or dorsal surface of external carpal spine and along upper edge of hand, at superodistal corner of merus on first three walking legs and along dorsal edge of first three pairs of walking legs distally, or dorsal surface of second abdom-

inal segment; spot between fourth and fifth anterolateral spines nearly semicircular” (Williams, 1962).

Habitat.—Taken on sandy bottom in the Carolinas and from similar bottoms elsewhere, according to literature records; surface to 49 fathoms (rarely to 925 fathoms?).

Type locality.—Guadeloupe.

Known range.—Cape Hatteras, N.C., to Port Aransas, Tex.; Guadeloupe; Brazil.

Remarks.—The distinctions between this species and *O. ocellatus* were discussed by Williams (1962). There is a distinct color difference, pointed out in the color descriptions, and an apparent difference in habitat among the adults. Adults of *O. gadulpensis* are found farther from shore than adults of *O. ocellatus* in the Carolinas, but the young of both species are found near shore, as pointed out by a number of authors.

Ovigerous females are known from North Carolina in January.

Subfamily Portuninae

Genus *Portunus* Weber, 1795

Rathbun, 1930a, p. 33.—Hemming, 1958b, p. 133.—Stephenson and Campbell, 1959, p. 85.

Stephenson and Campbell (1959) gave a number of arguments for and against the utility of subgeneric limitations within this genus as now understood. Though subgeneric subdivisions may be useful in the limited Carolinian fauna, they are being deleted here.

KEY TO SPECIES IN THE CAROLINAS

- a. Carapace wide; anterolateral margins forming arc of a circle with center near posterior margin of carapace.
 - b. Interocular teeth six, inner orbital tooth being entire.
 - c. Carapace convex, mostly smooth and glossy; palms swollen, only one spine on upper margin in addition to spine at base of dactyl.....*sayi* (p. 163).
 - cc. Carapace uneven, not smooth and glossy; two spines on upper margin of palm in addition to spine at base of dactyl.....*anceps* (p. 163).
 - bb. Interocular teeth eight, inner orbital tooth being bilobed.....*gibbesii* (p. 164).
- aa. Carapace narrow; anterolateral margins forming arc of a circle with center near middle of cardiac region.
 - b. Interocular teeth eight, inner orbital tooth being bilobed.....*spinimanus* (p. 165).
 - bb. Interocular teeth six, inner orbital tooth being entire or notched laterally.
 - c. Superoexternal surface of chela with a conspicuous, smooth, silvery, or iridescent area
ordwayi (p. 166).

cc. Superoexternal surface of chela ridged and not iridescent.

d. Last pair of legs with posterodistal margin of merus unarmed; upper margin of dactyl conspicuously fringed with long hairs

depressifrons (p. 163).

dd. Last pair of legs with posterodistal margin of merus armed with spinulose lobe; carpus of cheliped with inner spine greatly elongated

spinicarpus (p. 167).

Portunus sayi (Gibbes)

Figure 144

Lupa sayi Gibbes, 1850, p. 178.

Portunus sayi: Hay and Shore, 1918, p. 428, pl. 33, fig. 2.—Rathbun, 1930a, p. 37, text-figs. 6-7; pl. 14 (rev.).

Recognition characters.—Carapace nearly twice as wide as long, somewhat tumid, smooth and polished to naked eye, finely granulate under magnification. Six frontal teeth including inner orbitals, two submedian teeth smaller but on a line with next pair. External orbital tooth larger than those of anterolateral border except stout, acute ninth; remaining anterolateral teeth blunt and increasing slightly in size posteriorly.

Chelipeds of moderate length, somewhat larger in males than in females; merus with four, rarely three, stout, curved spines in front, none behind; carpus with two spines; hand with an acute spine at articulation and a smaller one near base of movable finger; external surface with two longitudinal ribs with lowermost extending on finger; superior surface with three ribs continuing on finger, innermost one with fringe of hair beneath.

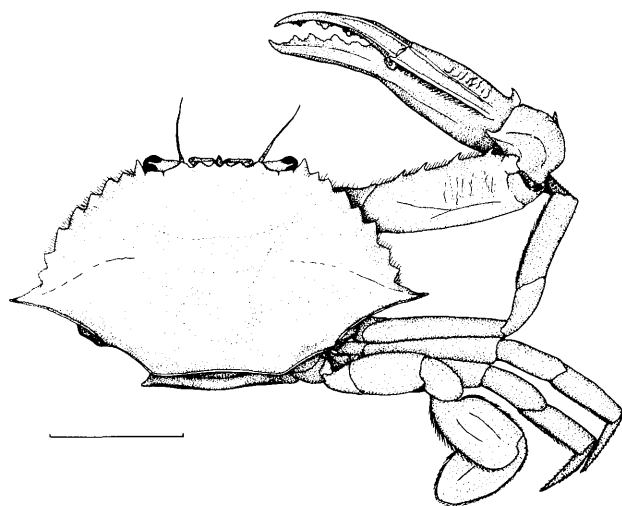


FIGURE 144.—*Portunus sayi* (Gibbes). Animal in dorsal view, legs of left side not shown, 20 mm. indicated.

Measurements.—Carapace: male, length, 27 mm.; width, 53 mm.

Color.—Chocolate brown or purplish with cloudings of olive green or light brown and irregular white or flesh-colored spots; orange margins on spines of chelipeds.

Habitat.—Normally this is a pelagic form living among floating *Sargassum*, but it is often carried into Beaufort Inlet, N.C., by currents.

Known range.—North Atlantic Ocean from Nova Scotia south through Gulf of Mexico to Brazil; mid-Atlantic Ocean; Bermuda; Kerguelen Island, south Indian Ocean.

Remarks.—The species has a fossil record dating from the lower Miocene of North America (Rathbun, 1935).

Ovigerous females are known from April to August in the southeastern United States and in parts of the West Indies. They are also known from Culebra in February and near Nantucket in September (Rathbun, 1930a, in part). Some of the larval stages were described by Lebour (1944) at Bermuda. Coventry (1944) gave new records for the Bahamas in addition to those listed by Rathbun (1930a).

Portunus anceps (Saussure)

Figure 145

Lupea anceps Saussure, 1858, p. 434, pl. 2, figs. 11-11b.

Portunus anceps: Hay and Shore, 1918, p. 431, pl. 33, fig. 8.—Rathbun, 1930a, p. 42, pl. 15 (rev.).

Recognition characters.—Carapace twice as wide as long, pubescent, and with several indistinct, arching, granulate, transverse ridges. Six frontal teeth including inner orbitals, inner orbitals blunt and considerably shorter than outer pair of true frontal teeth, submedian teeth short, smaller than inner orbitals. Anterolateral teeth small, acute, curved forward, last one sharp, slender, and about as long as space occupied by four preceding teeth.

Chelipeds long; merus with four spines in front, a distal one behind; carpus ridged, with a strong internal and a smaller external spine; hand with ridges on outer and superior surfaces, most of ridges continuing on fingers, superointernal ridge more elevated than others, ending distally in two spines, one behind other.

Measurements.—Carapace: male, length, 13 mm., width, 26 mm.; ovigerous female, length, 15 mm., width, 29 mm.