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THE GENUS *CALLIANASSA* (CRUSTACEA, DECAPODA,
THALASSINIDEA) IN SOUTH FLORIDA, WITH KEYS TO
THE WESTERN ATLANTIC SPECIES¹

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ABSTRACT

Ten species of the decapod crustacean genus *Callianassa* have been collected in south Florida. Of that number, *Callianassa branneri* (Rathbun) and *C. acanthochirus* (Stimpson) had been reported previously from the area, but *C. marginata* Rathbun, *C. latispina* Dawson, *C. longiventris* A. Milne-Edwards, *C. rathbunae* Schmitt, and *C. guassutinga* Rodrigues had not. In addition, three new species, *C. trilobata*, *C. fragilis*, and *C. quadracuta*, were discovered and reported earlier (Biffar, 1970). All species are described and illustrated. The accounts include complete synonymies, numerous new records for both south Florida and other areas of the western Atlantic, color notes, remarks on the ecology of the species, and a discussion of the intraspecific variation and interspecific affinities.

The literature dealing with all western Atlantic species has been reviewed, and measurements and terminology used in the descriptions have been defined. Two keys have been provided to make possible identification of most western Atlantic species of *Callianassa*. The first key is based solely on large chelipeds, and the second utilizes characteristics from the remainder of the animal. These keys include 19 species. Insufficient information exists to permit inclusion of *C. occidentalis* Bate and *C. grandimana* Gibbes in either key, but the latter species is discussed in detail. *Callianassa siguanensis* (Boone) is synonymized with *C. branneri*.

INTRODUCTION

Burrowing shrimp of the genus *Callianassa* have received limited attention in the past, probably as a result of their cryptic habits. Concentrated collecting has been done in very few areas and specimens are rare in most collections. The present study began as an attempt to define the poorly known, local callianassid fauna, but it soon became apparent that the scope of the study was insufficient. South Florida is not faunally isolated; the

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same species of *Callianassa* collected here have been reported from other areas of the western Atlantic, and present research uncovered numerous new records beyond south Florida. In addition, the scattered literature dealing with the local species included references to almost all western Atlantic species. It became necessary to review the knowledge of all western Atlantic species of *Callianassa* before the local fauna could be adequately defined. As a result, each species is dealt with as it occurs in the western Atlantic. Unfortunately, it is not yet possible to deal with all western Atlantic species since such a comprehensive study is beyond the scope of present data and would require numerous additional collections in the Caribbean and along the coast of South America.

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HISTORICAL RÉSUMÉ

The first western Atlantic species of *Callianassa* to be described was *C. major* Say (1818) from a tidal bay of the St. John's River, Florida. Say also remarked on recent and fossil burrows of the species. In 1837, H. Milne Edwards included *C. major* in his work and contrasted it with other known species. Costa (1844) suggested that *C. major* might be synonymous with *C. subterranea* (Montagu), but he synonymized all other known species of *Callianassa* as well.

Gibbes (1850) described a second western Atlantic species, *Callianassa grandimana*, from Key West, Florida, but the short description and lack of illustration have made any subsequent identification very difficult. He also mentioned *C. major* and extended its range to include the coast of South Carolina. The range was further extended by Stimpson (1866, 1871) to include North Carolina and Georgia. In addition, the species was reassigned to the new genus *Callichirus*, a taxon now considered to be subgeneric at best. Stimpson also described the genus *Glypturus* (now synonymous with *Callianassa*) for *G. acanthochirus* from the Florida Keys and Dry Tortugas, and he noted possible difficulty in separating this species from *C. grandimana*.

The revision of the genus *Callianassa* undertaken by A. Milne-Edwards (1870) included *C. major* and a new species from Martinique, *C. longiventris*. No mention was made of *C. acanthochirus* or *C. grandimana*. In 1873, Smith described a new species, *C. stimpsoni*, from the east coast of the United States ("Southern States north to Long Island Sound"). However, as Rathbun (1926) pointed out, that name had been used previously by Gabb (1864) for a fossil species, and the junior synonym was renamed *C. atlantica* Rathbun. Fossil representatives of the latter species are known (Rathbun, 1935).

Kingsley (1879) recorded *C. atlantica* (as *C. stimpsoni* Smith) from Beaufort, North Carolina, and Northampton County, Virginia. In 1893, Stebbing also noted the presence of *C. atlantica*, but provided no new records. In the interim, Bate (1888) reported on the callianassids of the CHALLENGER. A new species, *Callianassa occidentalis*, was described from the waters off Sombrero Island, a small island at the northern tip of the Lesser Antilles chain, at a depth of 450 fathoms. Only the large cheliped was taken, and this was contrasted with that of *C. major*. The illustration showed the form of the cheliped to be unusual for *Callianassa*, but the description was too incomplete to clarify this point. Bate himself questioned whether the cheliped might not belong to *Cheramus occidentalis*, another new species taken at the same station and lacking the chelipeds. Neither species has been taken again, and the validity of at least *Callianassa occidentalis* has been questioned (De Man, 1928b; Schmitt, 1935b).

Kingsley (1899) published a key to United States thalassinideans, which included *C. grandimana*, *C. atlantica* (as *C. stimpsoni*) and *Callichirus*

major (Say). *Glypturus acanthochirus* was mentioned in a footnote, but it was not included elsewhere. Kingsley had not seen specimens of the latter species and believed the genus might belong to the Gebidae (= Upogebiidae). In the same year, the Branner-Agassiz Expedition to Brazil took a new species of *Callianassa* from Mamanguape stone reef. This was described as *Glypturus branneri* by Rathbun (1900). The species was contrasted with *C. acanthochirus* and *C. grandimana*. Rathbun chose to include the latter species in the genus *Glypturus*.

Borradaile (1902) identified a specimen from Gorfurfehendu Atoll in the Indian Ocean as *C. longiventris*. The identification was made by comparing the specimen with the original description of the western Atlantic species. The form from the Indian Ocean was subsequently elevated to the rank of a variety and the differentiating characters were noted by De Man (1928a). Rathbun (1901) described two new species, *C. marginata* and *C. minima*, based on FISH HAWK material from Puerto Rico. In the same paper, *G. branneri* was again described, almost as it had been earlier (Rathbun, 1900).

In 1903, Borradaile published his classification of the Thalassinidea. This was fairly complete and included most of the species known at that time. Of the 50 species of *Callianassa* listed, seven were from the western Atlantic. Under the subgenus *Cheramus*, Borradaile listed *Callianassa minima* and *C. batei* (new name for *Cheramus occidentalis*). He placed *Callianassa major*, *C. longiventris*, and *C. marginata* under *Callichirus*, and was unable to place *Callianassa atlantica* or *C. occidentalis*. *Glypturus acanthochirus*, *G. grandimana*, and *G. branneri* were listed separately. This paper is most useful as a guide to earlier descriptive literature, but its systematic value is reduced by the establishment of arbitrarily defined subgenera, a move which apparently was stimulated by the large number of species in the genus.

Rathbun (1905) extended the range of *C. atlantica* north to Vineyard Sound when she reported on the fauna of New England. Fowler (1912) noted the presence of the same species in New Jersey and included a listing of *Callichirus major*. The presence of *C. atlantica* was further confirmed by the dredging survey of Woods Hole and vicinity conducted by Sumner *et al.* (1913) and by the report on the fauna of Beaufort, North Carolina, published by Hay & Shore (1918). The latter work also gave a comprehensive description and discussion of *Callianassa major*.

Glypturus branneri was reported from Curaçao (Rathbun, 1920) and from Bermuda (Verrill, 1922). Another species of *Glypturus*, *G. grandimanus* (Gibbes), was described by Balss (1924) based on a specimen from Kingston, but this identification appears to be in error. The incompatibility of Balss's description and the original was noted by Schmitt (1935b), who redesignated Balss's species as *Callianassa hartmeyeri*. Hult

(1938) discussed a second specimen from Indefatigable Island in the Galapagos. Based on a comparison of his specimen with that of Balss, he called it *C. hartmeyeri*, recognizing that Schmitt had been correct in changing the name. This species has not been taken again in the Atlantic, and its status there remains questionable. Chace (1962) synonymized *C. hartmeyeri* with *C. placida* De Man, a Pacific species.

Schmitt (1924) published the findings of the Barbados-Antigua Expedition, which included a record of *G. branneri* and of a juvenile tentatively identified as *G. acanthochirus*. The small specimen was taken from a coral head, a habitat not previously reported. A specimen of *C. marginata* was also found at Barbados by the BLAKE (Bouvier, 1925). Larval specimens of *C. atlantica* were noted in the plankton of the Woods Hole region by Fish (1926), but no attempt was made to describe the zoeal stages.

Glypturus siguanensis, a species of questionable validity, was described from the Isle of Pines by Boone in 1927. It apparently is very closely related to, if not identical with, *C. branneri*. Unfortunately, the type has been lost or misplaced (Hartmann, personal communication).

In 1928, De Man published two comprehensive and very valuable works on the genus *Callianassa*. The first (De Man, 1928a) dealt with 22 species and three varieties. Of this number, four species were western Atlantic (*C. batei*, *C. longiventris*, *C. major*, *C. atlantica*). Each species was described, at least to some extent, and illustrated. It was De Man's intent to clear up taxonomic deficiencies by redescribing several species before attempting a key to the species of *Callianassa*. He attempted such a key in his second work (1928b), which reported the Thalassinidae and Callianassidae of the Siboga Expedition. This remains the most useful work on the group, and a more comprehensive volume has yet to be published. The following western Atlantic species were included in the key: *C. batei*, *C. minima*, *C. atlantica*, *C. longiventris*, *C. major*, and *C. marginata*. *Callianassa acanthochirus*, *C. branneri* and *C. grandimana* were mentioned as species belonging to the genus *Glypturus*, and *C. occidentalis* was omitted for lack of information.

No other major publications appeared until Schmitt published two works in 1935. The first (Schmitt, 1935a) dealt with the fauna of Puerto Rico and included records, descriptions, and illustrations of *Glypturus branneri*, *Callianassa marginata*, and *C. minima*. The second work (1935b) was a comprehensive study of 15 western Atlantic species. Three new species, *C. islagrande*, *C. jamaicense*, and *C. rathbunae*, and a variety of *C. jamaicense* (var. *louisianensis*) were described. In addition, three questionable species (*C. grandimana*, *C. siguanensis*, and *C. occidentalis*) were discussed, and a key to the western Atlantic species was included.

Callianassa major has been the subject of a number of ecological studies. Lunz (1937) described the animal, its burrow, and its habits. Pearse *et al.*

(1942) and Pohl (1946) expanded the ecological data dealing with the animal's burrows and burrowing technique. Weimer & Hoyt (1964) dealt with the recent and fossil burrows of the species, and Frankenberg *et al.* (1967) attempted to determine the trophic significance of a population.

A number of scattered works, which included references to various species, were published. Lebour (1941) tentatively identified a zoea from the plankton off Bermuda as *C. branneri*. Willis (1942) mentioned *C. major*, *C. islagrande*, and *C. jamaicense louisianensis* in his faunal study of the Louisiana coast. Hedgpeth (1950) found *C. jamaicense louisianensis* along the coast of Texas, and the same species plus *C. islagrande* was reported by Wass (1955) from northwestern Florida. Williams's (1965) comprehensive work on the decapods of the Carolinas contained descriptions and illustrations of *C. atlantica* and *C. major*.

A short but informative paper of systematic interest was published earlier by Gurney (1944). His comments on the validity of generic and subgeneric taxa and on the value of certain systematic characters are most valuable. A number of western Atlantic species were mentioned in the course of his general comments.

Recent publications have contained descriptions of seven new species. Dawson (1967) described *C. latispina* from the northern Gulf of Mexico, and Rodrigues (1966) described *C. guassutinga*, *C. mirim*, and *C. guara* from the relatively unexplored coastal areas of Brazil. In addition, Rodrigues suggested synonymizing *C. jamaicense* var. *louisianensis* with *C. jamaicense*. He also reported findings dealing with the rearing of larvae of *C. major* and the general biology, ecology, behavior, and internal anatomy of the five species considered. Biffar (1970) described *C. trilobata*, *C. fragilis*, and *C. quadracuta* from south Florida and Venezuela.

METHODS

Identification.—Identification of species is based primarily on readily observable, qualitative characters, such as the form of the large cheliped. Unfortunately, this can lead to confusion, e.g., Borradaile's use of the form of the external maxillipeds as a basis for establishing subgenera (Borradaile, 1903). Characters which have proven useful in identification include the presence of sutures on the carapace, form of the front, shape of the eyestalks, placement of the cornea, setation of the antennules, form of the mouthparts, form of the pereopods and pleopods, shape of the abdominal somites, form of the telson and uropods, and dentition and spination of the large and small chelipeds. Color may also be an aid to identification, as evidenced by such species as *C. acanthochirus* and *C. longiventris*, which have very distinctive coloration. However, many species have little or no color other than white. Intraspecific color variation as seen in *C. guassutinga* further limits the usefulness of this characteristic.

Measurable characters are being used increasingly in descriptions because they make possible more objective comparisons. The following callianassid characters are utilized in the present study: dimensions of the antennal and antennular peduncles, relative sizes of the segments of the third maxilliped and large cheliped, branchial formulae, and dimensions of the uropods and telson. The total length of an adult animal can be important in separating certain species, e.g., *C. marginata* and *C. branneri*.

Although the study of intraspecific variation in *Callianassa* is still in a preliminary stage, the following remarks may be useful. Sexual dimorphism is exhibited in *Callianassa* in the form of the chelipeds and of the first two pairs of pleopods. Not all species show sexually dimorphic chelipeds, but in species such as *C. islagrande*, *C. major*, and *C. trilobata*, this phenomenon is evident. The cheliped of the male is more elongate and stronger. The length of the carpus is much greater relative to its width than in the female, and the dentition is usually stronger in the male. The female's first pleopod is uniramous and two-segmented, as in most males, but the distal segment is bladelike rather than hooked or lobed. Some species may have reduced pleopods or, as is sometimes the case with males, lack them entirely (see Gurney, 1944). Second pleopods, when present, are biramous with a varying number of segments and varying shapes. In many cases, the shape of this appendage can be an aid in specific identification.

Immature specimens of *Callianassa* are seldom found in collections, and, because of the lack of information concerning juvenile morphology, differences between juvenile and adult morphology can make accurate identification of juveniles difficult. The size-range of animals from the field and observations on specimens which have molted in the laboratory suggest that the maturing process is relatively lengthy, with only gradual changes taking place in the animals' morphology. The eyestalks of the younger specimens are cylindrical with terminal, bulbous corneas. With increasing age, the stalks flatten and the size and position of the cornea are altered. The relative lengths of the antennae and antennules vary considerably between juvenile and mature animals. This is most evident in species where the antennular peduncle extends beyond the antennal peduncle in the adult, whereas in small specimens the antennal peduncle is usually longer. The rostrum is longer and more acute in juveniles, and the form of the uropods and telson varies. The chelipeds are generally weaker, particularly their spination and serration, and the proportions of their segments differ from those of the adults. Dentition of the dactylus and propodus is more clearly defined in juveniles of the species. Finally, the pleopods of the first and second abdominal somites are weaker and lack the characteristic shape of the adult appendages.

Few malformations have been found, but those most evident are in the

form of the large cheliped. Specimens of *C. branneri* and *C. jamaicense louisianensis* with partially regenerated chelipeds have been examined. The morphology differed considerably from the norm. In one case, the entire new appendage was only about 0.25 times the length of the small cheliped and the shape did not approximate that of the characteristic large cheliped. A specimen of *C. branneri* with two full-sized small chelipeds was found, and another specimen of the same species had a misshapen dactylus on the large cheliped. All these variations appear to be a result of regeneration of lost limbs or segments.

Terminology.—The general morphology of a callianassid is illustrated in Figure 1. Some of the characters employed in the descriptive accounts are shown. Those characters which are not commonly used by previous authors are defined as follows:

1. Dorsal carapace. Dorsal external covering of cephalothorax including entire surface between *lineae thalassinicae*.
2. Dorsal oval. Area of dorsal carapace bounded posteriorly by cervical groove, laterally by *lineae thalassinicae*, and anteriorly by front or weak transverse groove, more or less analogous to gastric region of other decapods.
3. Hook. Broad curved process situated proximoventrally on merus of large cheliped, directed distally.
4. Lower exopodal plate. Mesial portion of exopod of uropod, bounded by median suture, distal margin of exopod, and mesial margin of exopod.
5. Propodal notch. Concave area formed at base of propodal finger by upward curvature of its cutting edge and proximal portion of cutting edge of dactylus. Notch may extend proximally into palm.
6. Upper exopodal plate. Lateral portion of exopod of uropod, bounded by median suture, inner distal fringe, and lateral margin of exopod.

For convenience, the designation of a pereopod is P, followed by a number indicating its position, e.g., P5 = fifth pereopod. Abdominal somites are indicated similarly, e.g., A2 = second abdominal somite.

The standards used to obtain various measurements are defined as follows:

1. Total length. From tip of rostrum to distal margin of telson along midline of dorsum; abdomen straightened and connecting membranes extended.
2. Rostral length. From tip of rostral projection, along midline, to point on projected curve of carapacial margin (Fig. 2, a).
3. Lateral spine length. From tip of projection to midpoint on projected curve of carapacial margin (Fig. 2, b-b₁).
4. Eyestalk width. From mesial margin of eyestalk to greatest width, measured perpendicular to mesial margin (Fig. 2, c).

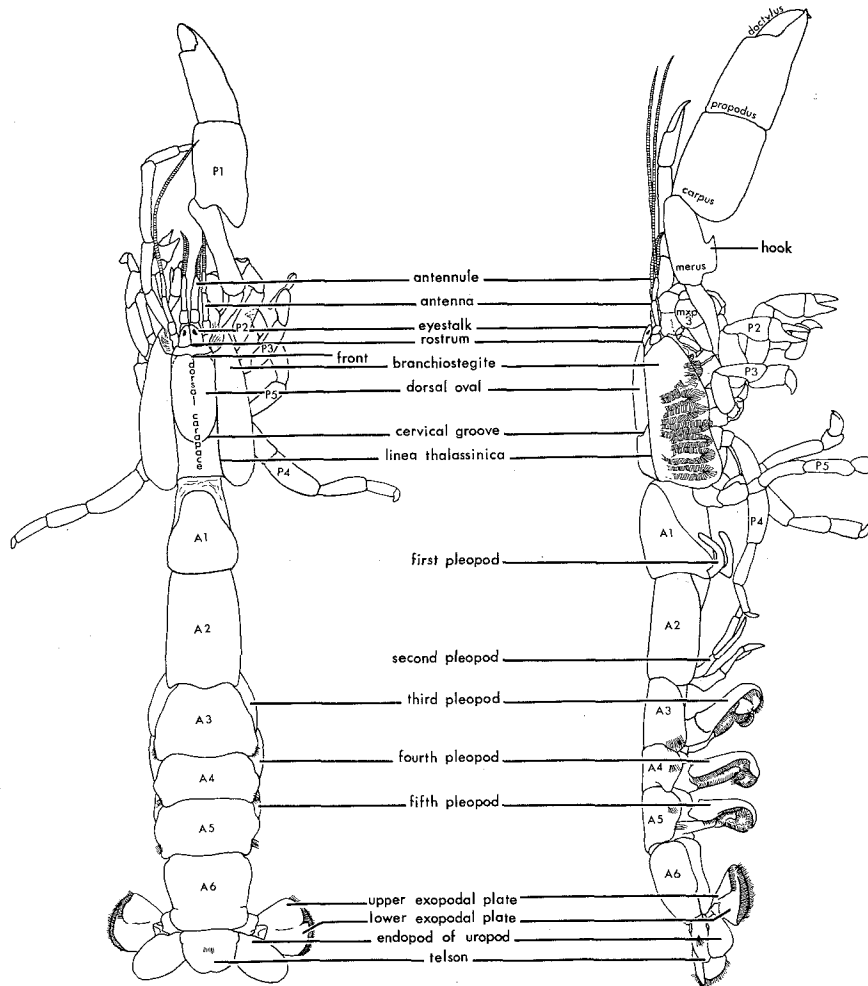


FIGURE 1. General morphology of *Callianassa*, dorsal and lateral views. Abdominal somites designated A1, A2, etc.; walking legs designated P1, P2, etc.

5. Eyestalk length. From projected level of intersection of lateral margin of eyestalk and front to anterior tip, measured parallel to midline of body (Fig. 2, c).

6. Length of antennal or antennular segment. From articulation to articulation along dorsal midline.

7. Third maxilliped:

- a. Length of merus and ischium. From point at center of merus's distal articulation to farthest point on proximal margin of ischium, measured on mesial surface (Fig. 2, d).
 - b. Width of merus or ischium. Greatest width of either segment, measured perpendicular to axis of appendage (Fig. 2, d).
 - c. Width of propodus or dactylus. Greatest width, measured perpendicular to axis of appendage (Fig. 2, d).
8. Length of abdominal somites. From posterior margin to anterior margin, or projection of margin if median concavity present, measured along dorsal midline (Fig. 2, e).
9. Telson length. From proximal articulation to distalmost point, measured parallel to body axis (Fig. 2, f).
10. Telson width. Greatest distance across telson, measured perpendicular to body axis (Fig. 2, f).
11. Uropod:
- a. Length of endopod. Varies with shape of endopod.
 - a'. round, oval, or triangular—from center of proximal articulation to distalmost point (Fig. 2, g).
 - b'. rectangular or square—from center of proximal articulation, along median ridge, to distal margin (Fig. 2, h).
 - b. Width of endopod. Greatest width perpendicular to previous measurement (Fig. 2, g-h).
 - c. Upper exopodal plate. From center of proximal articulation of exopod to midpoint of distal margin (Fig. 2, i).
 - d. Lower exopodal plate. From center of proximal articulation of exopod to midpoint of distal margin (Fig. 2, i).
12. Chelipeds:
- a. Length of merus, carpus, or palm. From vertical projection of proximal articulation to vertical projection of distal articulation, at dorsal margin (Fig. 2, j).
 - b. Length of dactylus. From vertical projection of proximal articulation to vertical projection of distalmost point of dactylus, measured when dactylus horizontal (Fig. 2, j).
 - c. Width of carpus or palm. Greatest width perpendicular to dorsal margin (Fig. 2, j).
 - d. Width of merus. Greatest width perpendicular to dorsal margin, excluding dorsal spines and ventral hooks, spines, and serrations (Fig. 2, j).

Since most measurements were obtained without the necessity of dissections, it was possible to measure all available specimens to determine the variability of most parameters. It was necessary to dissect the mouthparts to determine their morphology and to measure the size of the third

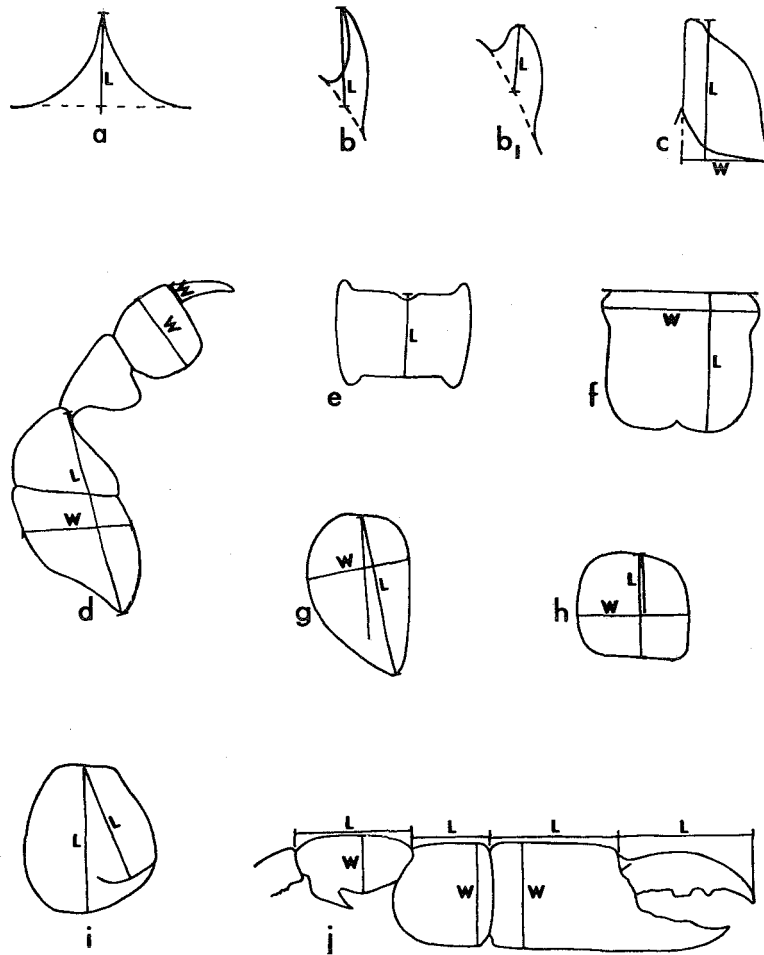


FIGURE 2. Measurements used in callianassid taxonomy: a, rostrum; b-b₁, lateral projections; c, eyestalk; d, third maxilliped; e, abdominal somite; f, telson; g-h, endopods of uropod; i, exopod of uropod; j, large cheliped. Lines indicate length (L) and width (W).

maxillipedal segments and the relative length of the exopod of the second maxilliped. For the latter parameters, samples from five or more specimens were measured. Measurements were made either with a ruler marked in millimeters or with an ocular micrometer, depending on the size of the object to be measured.

Descriptive Accounts.—The measurements given in the Material Examined section refer to total body length of the animals. Those specimens for which measurements are lacking but which have the designation “damaged” are partial or are damaged in such a way as to preclude measurement. Specimens recorded as “destroyed” were lost in a laboratory fire.

The Diagnosis is an attempt to summarize the primary characteristics of a species. It is possible, using only these characteristics, to differentiate any diagnosed species from any other species currently known from the western Atlantic fauna. This section is not intended to allow the species to be distinguished from all known species of *Callianassa*.

TAXONOMY

The genus *Callianassa* was erected by Leach in 1814. It is now placed in the Family Callianassidae of the Section Thalassinidea. The only other genus in the family is *Ctenocheles* Kishinouye, which is characterized by the elongate form of the claw (see Holthuis, 1967) and the presence of four pairs of like pleopods. The following definition of *Callianassa* is based primarily on that of Makarov (1938).

Genus *Callianassa* Leach

Body more or less cylindrical, lobsterlike. Carapace short compared to total body length. Integument more or less soft, except for that of first pereopods. Well-developed *linea thalassinica* and cervical groove present. Rostrum flattened, triangular and short, or spinous and of varying lengths, or lacking. Eyestalks flat, triangular; cornea on dorsal surface. Antennular peduncle three-segmented. Antennal peduncle five-segmented; scale a spinous vestige or lacking. Third maxillipeds broad and squamiform or narrow and pediform; usually without exopod. First pereopods chelate, unequal, rarely subequal; large cheliped right or left, noticeably stronger. Carpus and propodus broad compared to other segments; carpus articulating with merus by means of narrow suture. Palm rectangular or quadrate, compressed; dentition of propodal finger and dactylus rarely spinous; length of finger less than 1.5 times length of palm. Second pereopods chelate; chela flat, triangular or heart-shaped. Third pereopods simple; propodus often broad, transversely oval. Fourth pereopods weakly subchelate or simple. Fifth pereopods subchelate or dactylus forming chela with distal margin of propodus. Fifth thoracic segment free. Gills arthrobranchiae only, intermediate between phyllobranchiate and trichobranchiate. Two gills on each third maxilliped and first four pereopods; rudimentary or small lamellate gill on second maxilliped. No pereopodal epipods. Abdomen elongate, first two pairs of pleopods unlike subsequent three pairs. First two pairs often sexually dimorphic, posterior pairs alike in male and female, branches foliaceous, lacking branchial filaments, endo-

pod bearing an *appendix interna*. Tail fan well formed, uropods at least as long as telson, lacking transverse sutures.

KEYS TO WESTERN ATLANTIC SPECIES OF *Callianassa*

The availability of complete undamaged specimens has been assumed in the formulation of most keys to the species of *Callianassa*. Unfortunately, there is a remarkably high incidence of dismembered specimens in collections, and it is not uncommon to obtain a body without chelipeds, or vice versa, while doing field work. In an effort to overcome the resultant difficulty, two keys have been prepared: one to the body characters alone, and one to the large chelipeds. Page references have been given for those species described in the present publication.

Several western Atlantic species, because of inadequate descriptions or otherwise insufficient information, must be considered of questionable validity, and several are not included in the keys. The species are:

1. *C. grandimana* Gibbes. This species is known only from the original specimen, which has subsequently been lost, and from a short description of the large cheliped. The uncertain status of the species is discussed elsewhere in this paper, and its similarity to *C. branneri* is noted.

2. *C. siguanensis* (Boone). This species is considered synonymous with *C. branneri*, for reasons noted under the discussion of the latter species.

3. *C. hartmeyeri* Schmitt. This species is known from a single western Atlantic specimen, and works of Hult (1938) and Chace (1962), although constituting pertinent evidence, have not firmly established the validity of the species, or its occurrence, in the western Atlantic. The species is included in the present keys (as *C. hartmeyeri*), but only the works of Hult and Balss are used to provide characters.

Callianassa hartmeyeri was included in Schmitt's (1935b) key, but the couplet under I, B, 2, b, was reversed. The characters under (i) are those of *C. hartmeyeri* and those under (ii) are those of *C. longiventris*. The locational data and the author citations are placed correctly with the species to which they refer.

4. *C. occidentalis* Bate. This species is based on a single cheliped. The cheliped alone is not sufficient to define the species, particularly when Bate's own illustration showed the shapes of the merus and carpus to be unusual, compared with those of other species of the genus.

5. *C. batei* Borradaile (= *Cheramus occidentalis* Bate). As Schmitt noted (1935b), this species is based on a single mutilated specimen taken at the same station as *Callianassa occidentalis*. The specimen lacked numerous appendages and had only one arthrobranch on the fourth pereopod. No other species of *Callianassa* is known to have this gill pattern, but the significance of the missing arthrobranch is questionable because of the condition of the specimen. Other questionable characteristics include the

form of the eyestalks and of the gill lamellae and the lack of a *linea thalassinica* (Bate's illustration showed no *linea*, and he remarked only that the branchial and gastric regions were defined). No further evidence supporting the original description has been contributed by more recent authors (De Man, 1928a, 1928b; Schmitt, 1935b), and De Man (1928a) cast doubt on at least the illustrations when he pointed out an error in the form of the uropods. Additional specimens would be most helpful in dealing with the species, but for the present, sufficient characters are available so that *C. batei* can be included in the second key.

6. *C. jamaicense* var. *louisianensis* Schmitt. Rodrigues recently obtained specimens which appeared to be intermediate between the species and its variety. He concluded, after comparing a series of characters, that the variety should not be retained as a subspecies. Although the previously known specimens were easily separable, his conclusion seems well founded. Additional supporting evidence comes from examination of the type-specimens of the species. These are the only specimens of *C. jamaicense*, and both come from Montego Bay, Jamaica. They show several characters which suggest that they may be abnormal, possibly affected by a parasite. For example, the sterna of the anterior abdominal somites has been broken down into numerous, individual, calcified plates, each with a central seta. Variation in the form of the chelipeds and pleopods would not be unexpected in parasitized material.

KEY TO LARGE CHELIPEDS OF WESTERN ATLANTIC SPECIES OF *Callianassa*

1. Dorsal and ventral margins of carpus ending distally in two acute prominences; upper margin of palm ending in acute prominence distally *quadracuta* Biffar (p. 694)
Carpus otherwise, no second prominence dorsally or ventrally, distal margins usually rounded; margin of palm rounded distally 2
2. Ischium with midventral projection, remainder of margin denticulate 3
Ischium lacking midventral projection, ventral margin serrate, denticulate, spinous, or entire 4
3. Projection on ischium denticulate, approximately as long as remainder of segment's width; ventral margin of merus inconspicuously serrate, without elongate projection *islagrande* Schmitt ♂
Projection not denticulate, length approximately 0.2 times remainder of segment's width; merus with proximoventral bifurcate projection, remainder of margin with several strong denticles
..... *jamaicense* Schmitt
4. Ischium with distinct ventral spines 5
Ischium lacking distinct ventral spines 9
5. Merus and palm with two or three spines along dorsal margin

 <i>acanthochirus</i> (Stimpson) (p. 655)	
	Merus and palm lacking dorsal spines	6
6.	Ventral margin of merus entire <i>marginata</i> Rathbun (p. 689)	
	Ventral margin of merus spinous or serrate	7
7.	Ventral margin of merus serrate (cutting edge of dactylus with two rounded teeth proximally, remainder of margin entire)	
 <i>hartmeyeri</i> Schmitt	
	Ventral margin of merus spinous	8
8.	Merus with 3-5 spines on proximal half of ventral margin, remainder of margin denticulate; ischium with numerous (7-9) spines on ventral margin; cutting edge of dactylus entire	
 <i>longiventris</i> A. Milne-Edwards (p. 685)	
	Merus with 7-12 spines plus acute serrations; ischium with 3-4 spines distally, acute serrations proximally; cutting edge of dactylus with median quadrate notch (♂) or entire (♀)	
 <i>rathbunae</i> Schmitt (p. 699)	
9.	Ventral margin of merus entire	10
	Ventral margin of merus serrate, spinous or with some sort of proximoventral projection	12
10.	Carpus shorter than palm (ischium with 2-3 inconspicuous serrations or entire; merus ovoid, length less than 1.5 times width; ridge running along propodal finger and palm on lateral surface) ..	
 <i>minima</i> Rathbun	
	Carpus longer than palm	11
11.	Propodal finger with acute triangular tooth proximally; carpus less than 1.7 times length of palm	<i>major</i> Say ♀
	Propodal finger serrate but lacking well-developed tooth; carpus more than 1.7 times length of palm	<i>islagrande</i> Schmitt ♀
12.	Proximoventral corner of merus with spinous or robust spinelike projection (see Figs. 9 and 12)	13
	Proximoventral projection, if present, quadrate or forming hook, not spinelike	14
13.	Lateral surface of palm with 2-3 spines just proximal to base of propodal finger; projection on merus strong, bifurcate	
 <i>guassutunga</i> Rodrigues (p. 674)	
	Surface of palm lacking spines; distally curving spinous projection on merus, remainder of margin weakly serrate	
 <i>latispina</i> Dawson (p. 679)	
14.	Merus with broad, well-developed, proximoventral hook, distal margin of hook concave, tip acute or subacute (see Figs. 1 and 8), remainder of margin weakly serrate	15
	Merus lacking hook, ventral margin serrate, spinous, or with quadrate proximoventral projection	17

15. Propodal notch extending proximally into palm; cutting edge of dactylus with three strong teeth; length of carpus less than 0.75 times length of palm *fragilis* Biffar ♂ (p. 667)
 Propodal notch extending little or not at all into palm; dactylus lacking strong dentition; length of carpus greater than 0.75 times length of palm 16
16. Proximoventral margin of carpus broadly rounded, extending proximally beyond level of dorsal articulation with merus; cutting edge of propodal finger serrate; proximodorsal margin of merus elevated, denticulate, margin more or less straight; total length of carpus, palm, and dactylus in adults less than 15 mm
 *fragilis* Biffar ♀ (p. 667)
 Proximoventral margin of carpus rounded, not extending proximally beyond level of articulation; propodal finger serrate in proximal third only; dorsal margin of merus rounded, highest centrally; total length of carpus, palm, and dactylus in adults more than 20 mm *atlantica* Rathbun
17. Merus with proximoventral quadrate (may appear triangular in *C. major*) projection, ventral margin including projection serrate .. 18
 Merus without distinct projection, ventral margin either convex and serrate or forming serrate keel 20
18. Carpus distinctly shorter (0.6-0.9) than palm (propodal notch extending proximally into palm; dactylus strong, not hooked, lacking strong dentition; propodal finger with acute triangular tooth medially) *mirim* Rodrigues ♂
 Carpus as long as, or longer than, palm 19
19. Carpus slightly longer (1-1.2) than palm; propodal notch not extending proximally into palm; dactylus not hooked, 3-4 strong teeth on cutting edge; propodal finger narrowing distally, subacute at tip *guara* Rodrigues (only ♂ known)
 Carpus much longer (greater than 1.25) than palm; propodal notch extending proximally into palm; dactylus hooked, with single rounded bifid tooth; propodal finger heavy, short, blunt at tip
 *major* Say ♂
20. Ventral margin of merus convex, serrate, not forming a keel
 *mirim* Rodrigues ♀
 Ventral margin of merus forming serrate keel with proximal concave area lacking serrations 21
21. Carpus 0.33-0.67 times length of palm; palm subquadrate; dactylus heavy, with 2-3 strong teeth on cutting edge, acute at tip
 *branneri* (Rathbun) (p. 661)
 Carpus 0.65-0.95 times length of palm; palm distinctly longer than

wide; dactylus with two truncate teeth medially (♂) or lacking strong dentition (♀) *trilobata* Biffar (p. 704)

KEY TO WESTERN ATLANTIC SPECIES OF *Callianassa*

1. Front with lateral spinous projections 2
 Front lacking lateral spinous projections 6
2. Third maxilliped lacking strong spinous crest on mesial surface of ischium, series of small separate denticles; rostrum short, 0.25-0.33 times length of eyestalks (posterior margin of telson concave) ---
 *guassutinga* Rodrigues (p. 674)
 Strong spinous crest present on third maxilliped; rostrum usually more than 0.33 times length of eyestalks (occasionally shorter in *C. rathbunae*) 3
3. Endopod of uropod elongate oval, twice as long as wide; telson widest midlaterally, generally rounded in outline, posterior margin convex or straight (length of eyestalks only 1.2-1.7 times width) --
 *acanthochirus* (Stimpson) (p. 655)
 Endopod of uropod rhomboid or subtriangular; telson widest in anterior third, trapezoidal 4
4. Posterior margin of telson with triangular median projection (rostrum almost as long as eyestalks; endopod of uropod subtriangular) *longiventris* A. Milne-Edwards (p. 685)
 Posterior margin of telson lacking median projection 5
5. Pigmented area of eyestalk lateral, small, covering about 0.1 of exposed dorsal surface of eyestalk, mediobasal projection acute or rounded, curving laterally; upper exopodal plate almost as long as lower *rathbunae* Schmitt (p. 699)
 Pigmented area of eyestalk terminal, large, bulbous, covering about 0.33 of exposed surface; upper exopodal plate 0.5 times length of lower *hartmeyeri* Schmitt
6. Rostrum triangular, rounded or acute, extending less than 0.25 length of eyestalks 7
 Rostrum spinous or flattened dorsoventrally, acute, extending more than 0.25 length of eyestalks 14
7. Antennular peduncle extending beyond tip of antennal peduncle .. 8
 Antennular peduncle not extending beyond tip of antennal peduncle 11
8. Endopod of uropods narrow, styliform, about four times longer than wide 9
 Endopods oval, not styliform, length less than two times width 10
9. Eyestalks shorter than first segment of antennular peduncle, terminating in short, subtriangular distal projections; telson widest midlaterally *major* Say

- Eyestalks extending beyond first antennular segment, distomedial projection of eyestalks elongate, curving laterally; telson widest in posterior third *islagrande* Schmitt
10. Posterior border of telson straight, with acute median projection; distomedial projection of eyestalks elongate, slender, curving laterally; length of third antennular segment five times length of second segment *atlantica* Rathbun
- Posterior border of telson concave; tip of eyestalks with short rounded projection; length of third antennular segment three times length of second segment *fragilis* Biffar (p. 667)
11. Propodus of third maxilliped less than two times width of dactylus *quadracuta* Biffar (p. 694)
- Propodus of third maxilliped about four times width of dactylus 12
12. Lateral margin of telson trilobed *trilobata* Biffar (p. 704)
- Lateral margin of telson more or less smoothly rounded 13
13. Posterior margin of telson obviously concave centrally; distal margin of endopod of uropod rounded; propodus of P3 extending posteriorly beyond margin of carpus, length two times width *guara* Rodrigues
- Posterior margin of telson inconspicuously convex or concave; distal margin of endopod of uropod quadrate; propodus of P3 short, extending posteriorly only as far as margin of carpus, length 1.5 times width *branneri* (Rathbun) (p. 661)
14. Telson approximately as long as uropods; merus of third maxilliped with acute distoventral projection* 15
- Telson distinctly shorter than uropods; merus of third maxilliped lacking projection 17
15. Sixth abdominal somite with lateral keel; rostrum extending at most 0.7 length of eyestalks *latispina* Dawson (p. 679)
- Sixth abdominal somite lacking keel; rostrum extending at least 0.9 length of eyestalks 16
16. Telson with two spines on posterior half of lateral margin, median spine on posterior margin *batei* Borradaile
- Telson with two midlateral spinules on each side, posterior margin unarmed *minima* Rathbun
17. Posterior border of telson convex medially *jamaicense* Schmitt
- Posterior border of telson with acute projection medially 18
18. Propodus of third maxilliped narrow, about twice width of dactylus; rostrum greater than 0.5 times length of eyestalks; exopod of uropod elongate, rectangular *marginata* Rathbun (p. 689)
- Propodus four times width of dactylus; rostrum less than 0.33 times length of eyestalks; exopod of uropod oval *mirim* Rodrigues

* Third maxilliped of *C. batei* unknown.

Callianassa acanthochirus (Stimpson, 1866)

Figs. 3, 4

Glypturus acanthochirus Stimpson, 1866: 46; 1871: 121.—Kingsley, 1899: 821 (footnote).—Rathbun, 1900: 150; 1901: 93.—Borradaile, 1903: 548.—De Man, 1928b: 19.

Callianassa acanthochirus, Schmitt, 1935b: 20, pls. 1-4.—Gurney, 1944: 84.
? *Glypturus acanthochirus*, Schmitt, 1924: 93.

Material Examined.—FLORIDA: Miami, Virginia Key, west side, mud flat, T. Biffar, 13 April 1967; 1 ♂, 65 mm, destroyed.—Miami, Virginia Key, west side, mud flat, T. Biffar, 26 April 1967; 1 ♂, 85 mm, destroyed.—Miami, Biscayne Bay, November 1967; 1 ♂, damaged, UMML 32.1695, destroyed.—Biscayne Bay, ¼ mi west of Pelikan Shoal, 2 m, G. Shinn and T. Reed, 16 August 1968; 1 ♂, 71 mm, UMML 32.4191.—Miami; 1 ♀, 46 mm, USNM 46418.—Miami; 1 ♀, 43 mm, USNM 46310.—Dry Tortugas, W. L. Schmitt, Sta. 43-30, 5 August 1930; 1 ♂, 60 mm, 1 ♀, 111 mm, USNM 122438.—Packard (coll.); 1 ♀, 106 mm, MCZ 12856.—Capt. Wurdemann, July 1859; 1 ♀, damaged, MCZ 12882.

PUERTO RICO: Punta Arenas, W. G. Hewatt, 8 July 1946; 1 ♀ (ovig.), 90 mm, USNM 82369.—Mayagüez, V. Biaggi, Jr., 1934; 1 ♂, 63 mm, USNM 122436.

JAMAICA: Coral Key, 8 mi east Montego Bay, C. B. Wilson, 20 July 1910; 1 ♂, 66 mm, USNM 70798.—Bluefields, washed up after storm; 2 ♀♀, 62 and 63 mm, 2 ♂♂, 58 and 76 mm, USNM 23009.

BARBADOS: Bayview, Bath Reef, Humes and Gooding, 22 July 1959; 1 ♀, 105 mm, USNM 104205.—Coral head, 4 June 1918; 1 juv., 19.5 mm, USNM 68939.

ANTIGUA: Falmouth Bay, Black's Point, Smithsonian Bredin Exped. 112-59, 30 April 1959; 1 juv., 27 mm, USNM 122437.

VENEZUELA: Cumana, Capt. Couthouy, 1859; 1 ♂, 79 mm, 2 ♀♀, 35 and 117 mm, MCZ 760.—Cumana, Capt. Couthouy, 1859; 1 ♀, damaged, MCZ 732.

Diagnosis.—Front trispinous. Palm of large cheliped with 2-3 well-developed spines along distal half of dorsal margin. Endopod of uropod elongate oval, about twice as long as wide.

Description.—Four short series of tufts of hair, two series on either side of midline, in third quarter of dorsal oval. Median area of dorsal carapace behind cervical groove subdivided by two indistinct longitudinal ridges. Front trispinous. Rostrum spinous, elevated proximally, directed slightly upward, extending 0.33-0.6 times length of eyestalks. Two tufts of hair immediately behind rostral base. Lateral spines directly over antennal peduncle, 0.75 times length of rostrum, curving inward. Eyestalks flattened, extending almost to distal margin of first segment of antennular

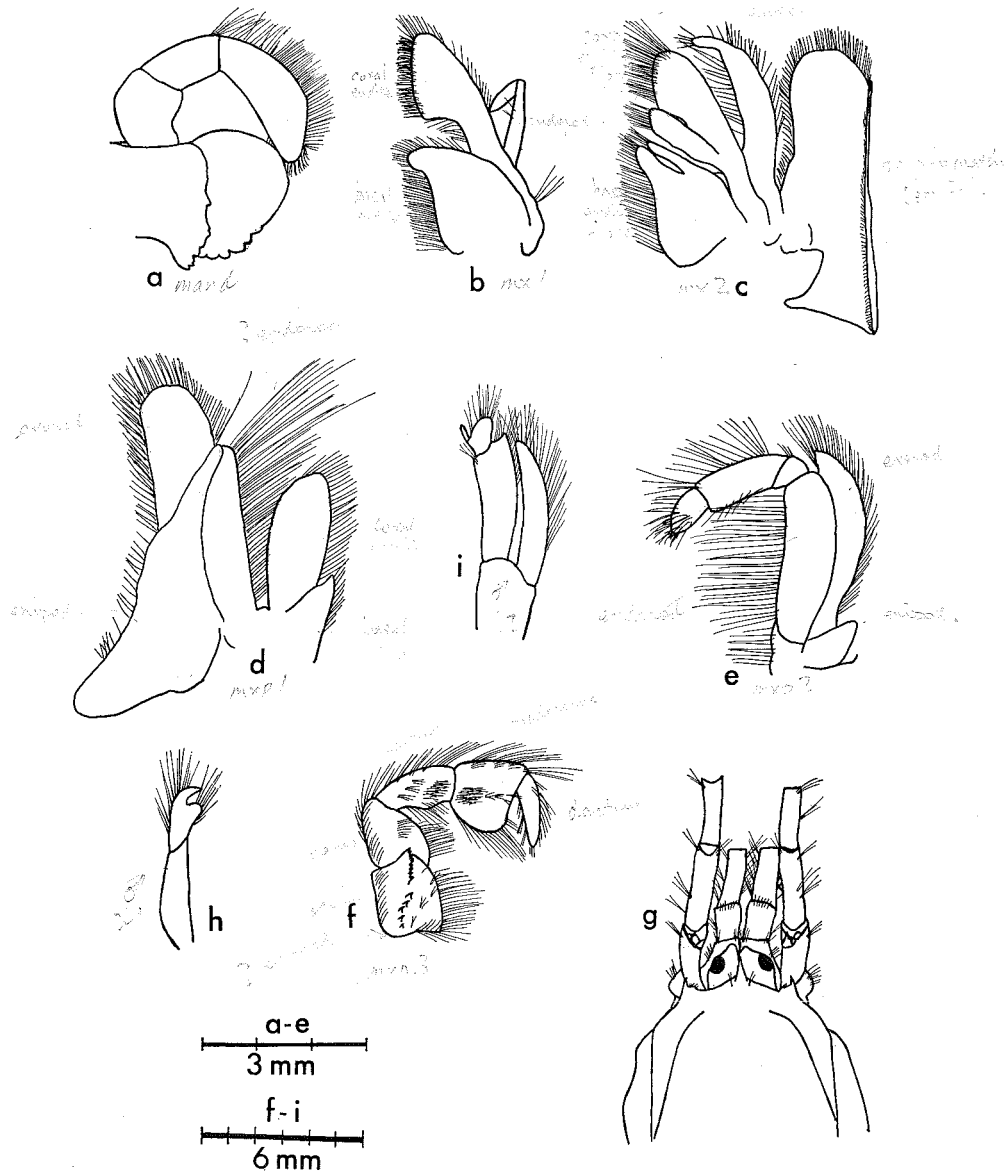


FIGURE 3. *Callianassa acanthochirus* (composite from south Floridian material): a, mandible; b, first maxilla; c, second maxilla; d, first maxilliped; e, second maxilliped; f, third maxilliped; g, dorsum; h, male first pleopod; i, male second pleopod.

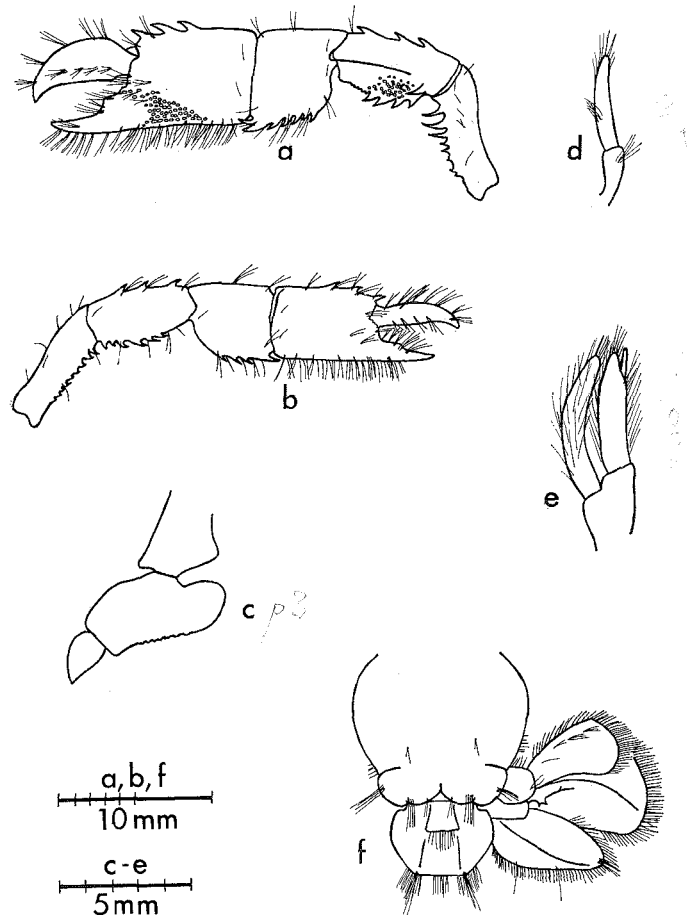


FIGURE 4. *Callianassa acanthochirus* (composite from south Floridian material): a, large cheliped; b, small cheliped; c, P3; d, female first pleopod; e, female second pleopod; f, tail fan.

peduncle, length 1.2-1.7 times width; subtriangular projection distally, indistinct in smaller specimens; pigmented area bulbous, subterminal, covering about 0.33 of exposed dorsal surface of eyestalk.

Third segment of antennular peduncle 1.5-2.0 times length of second segment, 0.67-0.84 times length of fourth antennal joint. Fourth antennal segment 1-1.5 times length of fifth segment. Antennal flagellum 3-4 times length of antennular. Second antennular segment reaching 0.2 length of fourth antennal segment. Scattered tufts of setae laterally on antennal

peduncle, small spinous projection dorsally on third segment. Antennular peduncle with moderate setation laterally.

Mandible with 4-5 low rounded teeth on incisor process, 4-9 teeth on molar process. Coxal endite of first maxilla wide distally, mesial margin straight, basal endite with rounded distal lobe. Exopod of first maxilliped elongate, with distinct indentation on mesial margin, basal endite narrowing proximally, epipod narrow distally, broadly rounded laterally. Exopod of second maxilliped longer (1.35) than first segment of endopod. Merus and ischium of third maxilliped narrow, combined length of both segments 2-3 times greatest width, dorsal and ventral margins of ischium not converging proximally, distinct spinous crest on distal half of mesial surface with 10-14 spines, distalmost spine largest, 3-5 free spines in line proximal to crest; propodus expanded, width 0.9-1.3 times width of ischium, small rounded lobe on distal edge just above ventral margin, remainder of distal edge straight; width of dactylus 0.25-0.4 times width of propodus.

Large cheliped strongly armed. Ischium with 8-10 well-developed spines on ventral margin, largest situated proximally. Length of merus 1.33-2.0 times width, 2-3 spines on dorsal margin, 5-6 on ventral edge, proximo-ventral spine not aligned with others, originating above other spines on lateral surface of merus, ventral margin serrate distally, lateral surface of merus blistered just above proximal spines, most noticeable in larger specimens. Carpus slightly wider (1-1.5) than long, distinctly shorter (0.55-0.9) than palm, 6-10 strong ventral spines, distal spine originating just above second spine, directed slightly outward. Dorsal margin of palm with two or three strong spines on distal half, ventral margin cristate, distal margin of palm along ventral half of articulation with dactylus serrate mesially and laterally, oblique blistered area on lateral surface of palm extending from center of ventral margin to notch between fingers. Cutting edge of propodal finger with single, strong, quadrate tooth near base, remainder of edge entire distally, inconspicuously serrate proximally. Dactylus curved downward, length 0.63-0.93 times length of palm, cutting edge entire or inconspicuously serrate distally with rounded tooth proximally.

Small cheliped similar to large, spination weaker. Ischium with 8-9 ventral spines. Merus with 2-3 spines on dorsal margin, 4-6 on ventral margin; lacking distoventral serrations, blistered area, and offset proximo-ventral spine. Carpus with 4-7 ventral spines, distal spine not above second, not directed outward. Palm as in large cheliped except lacking blistered area, weakly serrate at articulation of dactylus. Fingers weaker than in large cheliped, particularly dactylus. Propodal finger narrow, weak proximal tooth or entire. Cutting edge of dactylus entire.

Sexual dimorphism has not been noted in the chelipeds of this species.

Palm of P2 broad, convex, fingers symmetrical. Propodus of P3 bilobed, narrow posterior lobe. P4 subchelate, P5 weakly chelate. Coxae of P2

TABLE 1
BRANCHIAL FORMULA OF *C. acanthochirus* (STIMPSON)

Gill type	Maxillipeds			Walking legs				
	1	2	3	1	2	3	4	5
Pleurobranchs	-	-	-	-	-	-	-	-
Arthrobranchs	-	*	2	2	2	2	2	-
Podobranchs	-	-	-	-	-	-	-	-

* A single rudimentary gill may be present.

and P3 with small mesially directed spine in center of anterior surface. Coxa of P4 with laterally directed spine anteriorly. Branchial formula shown in Table 1.

A1 divided by transverse ridge on dorsal surface; anterior margin rounded, slightly depressed, posterior section widening toward posterior margin. Lateral margins of A6 bilobed, anterior section wider than posterior, margin strongly convex.

Telson wider than long (1.12-1.33), general outline rounded, lateral margins subdivided into two straight-edged areas; proximolateral margins directed slightly outward, distolateral margins converging, posterior margin straight or slightly convex, fringed with setae, secondary tufts of hair located at rounded posterior corners, dorsal surface with proximal trapezoidal area, distal edge with fringe of hair, two small depressions centrally, adjacent to convex area, stronger depression immediately distal to convex area.

Pleopods of first two abdominal somites sexually dimorphic. First pleopod of male uniramous, two-segmented, distal segment with acute tip curving over rounded lobe. Second pleopod of male biramous with bladelike exopod, rounded at tip, endopod three-segmented; elongate, bladelike basal segment, second segment subtriangular with small finger-like distal segment articulating mesially. First pleopod of female uniramous, two-segmented, distal segment elongate, rounded at tip. Second pleopod of female with exopod similar to that of male, endopod two-segmented, distal segment triangular, articulating distomesially on first segment to form weak chela. *Appendix interna* of third through fifth pleopods subtriangular in outline, hooks located along mesial surface.

Endopod of uropod elongate oval, twice as long as wide, extending more than 1.6 times length of telson beyond edge of telson, distal margin fringed with hair, tuft of elongate hair situated on rounded distal tip, central rib on dorsal surface well developed. Exopod of uropod 1.2 times length of endopod. Upper exopodal plate 0.7 times length of lower, very thick distally, distal margin convex, densely fringed with setae. Suture distinct. Lower exopodal plate strongly curved distally, densely fringed

with setae, median rib on dorsal surface well developed, two acute basal spines present.

Color.—Orange brown on carapace, third maxillipeds, and chelipeds. Same on dorsal surface of P2-P4. Antennae and antennules with red articulating membranes. Remainder of animal dull white.

Range.—Miami; Florida Keys (Stimpson); Dry Tortugas; Puerto Rico; Jamaica (Schmitt); Barbados (Schmitt); Antigua; Venezuela.

Type-Locality.—Florida Keys.

Type.—Not traced.

Discussion.—The characters described by Stimpson (1866) differ little from those of present material. He described only two spines on the dorsal margin of the merus and three on the palm, but, as noted above, some variation is possible.

Schmitt (1924) described a small specimen from Barbados as ? *Glypturus acanthochirus*, and reexamination of the specimen did not make a more definitive specific identification possible. Other small specimens of *C. acanthochirus* which have been examined have dorsal spines on the palm, but there is no indication of such spines in this specimen. The spination on the remainder of the cheliped resembles that of *C. acanthochirus*, and several other features (endopod and exopod of uropod, posterior edge of telson, discernible pigmentation) show similarities. However, the cristate borders of the palm, proximal telsonal margins, and proximal maxillipedal segments would support an identification as *C. longiventris*. The lack of adult morphological characters makes positive identification impossible until the morphology of juveniles is better known.

Adults of *C. acanthochirus* are very distinct in the area under study. However, they appear to be closely related to *C. armata* A. Milne-Edwards as described from the Fiji Islands. This species can be separated from *C. acanthochirus*, since *C. armata* has a heavy, broad rostrum, a smooth palm, a triangular telson, and a subtriangular propodus of the third maxilliped.

A. Milne-Edwards (1870) suggested a relationship between *C. armata* and *C. turnerana* White from the west coast of Africa. The latter species can be readily separated from either *C. armata* or *C. acanthochirus* by the presence of the three-pointed rostral projection and the lack of dorsal armature on the palm.

Remarks.—The species is commonly taken on intertidal mud flats in the Miami area, and Stimpson (1866, 1871) commented that it was common in the Florida Keys and Dry Tortugas. Large specimens have been taken, commonly reaching 80-100 mm in total length. The burrows are well constructed and of an appropriately large diameter.

Copepods of the family Clausidiidae have been found inhabiting the gill chambers of several large specimens.

Callianassa branneri (Rathbun, 1900)

Figs. 5, 6

Glypturus branneri Rathbun, 1900: 150, pl. 8, figs. 5-8; 1901: 93.—Borradaile, 1903: 548.—Rathbun, 1920: 328, fig. 3.—Verrill, 1922: 33, pl. 1, fig. 2, pl. 8, figs. 1a-e.—Schmitt, 1924: 93.—De Man, 1928b: 19 (= *Callianassa* in text).—Schmitt, 1935a: 194, fig. 55.

Callianassa branneri, Schmitt, 1935b: 4.—Gurney, 1944: 82, figs. 16, 17.—Weimer & Hoyt, 1964: 764.

Glypturus siguanensis Boone, 1927: 85, fig. 17.

Material Examined.—BERMUDA: Castle Harbor, Mowbray, 4 October 1902; 1 ♂, 104 mm, MCZ 12873.—St. David's Island, Vaughan's or White's Bay, F. A. Chace, 18 June 1936; 2 ♀♀, 43 and 93 mm, 1 ♂, damaged, MCZ 9259.

FLORIDA: Miami, Virginia Key, west side, mud flat, T. Biffar, summer 1967; 25-30 spec., destroyed.—Miami, Key Biscayne, Bear Cut, sand beach, T. Biffar, summer 1967; 4-5 spec., destroyed.—Miami, Key Biscayne, Bear Cut, near rocky point, P. B. Robertson, 10 June 1968; 1 ♂, 88 mm, UMML 32.4192.—Miami, Key Biscayne, east shore, 1 m, E. McSweeney, summer 1967; 1 chela, destroyed.—Miami, Key Biscayne, Crandon Park, on beach, T. Biffar, 1 April 1969; 1 ♂, damaged, UMML 32.4194.—Miami, Key Biscayne, sand bar, 1 m, T. Biffar, summer 1967; 1 spec., destroyed.—Miami, Virginia Key, Norris Cut, R. Work, summer 1967; 1 spec., destroyed.—Miami, Virginia Key, Norris Cut, T. Biffar, summer 1967; 2 spec., destroyed.—Missouri Key, T. L. McGinty, 28 March 1945; 1 ♀, 71 mm, USNM 81994.—Dry Tortugas, W. L. Schmitt, Sta. 43-30, 5 August 1930; 1 ♂, 59 mm, USNM 122439.—Dry Tortugas, Long Key beach, 20 August 1924; 1 ♂, 65 mm, USNM 122440.—"Florida, Gray Fund, G. Wurdemann, January 1859;" 1 ♂, damaged, MCZ 12877.

BAHAMAS: South Bimini, Nixon's Harbour, Humes and Gooding, 2 June 1959; 1 ♂, 53 mm, 5 ♀♀, 43-81 mm, USNM 104204.—Little San Salvador, West Bay, sand beach, Tor Samuelson, 27 March 1968, Sta. N56-68; 1 ♂, 45 mm.

PUERTO RICO: Hucares, FISH HAWK Sta., 14 February 1899; 1 spec., damaged, USNM 24664.

TOBAGO: E. of Pigeon Point, *Thalassia* beds near mangrove swamp, Smithsonian Bredin Exped. Sta. 30-59, 10 April 1959; 1 ♀ (ovig.), 83 mm, USNM 122441.

BRAZIL: Mamanguape stone reef, A. W. Greeley, 22 June 1899; 1 ♂, 52 mm, USNM 23756 (Holotype).

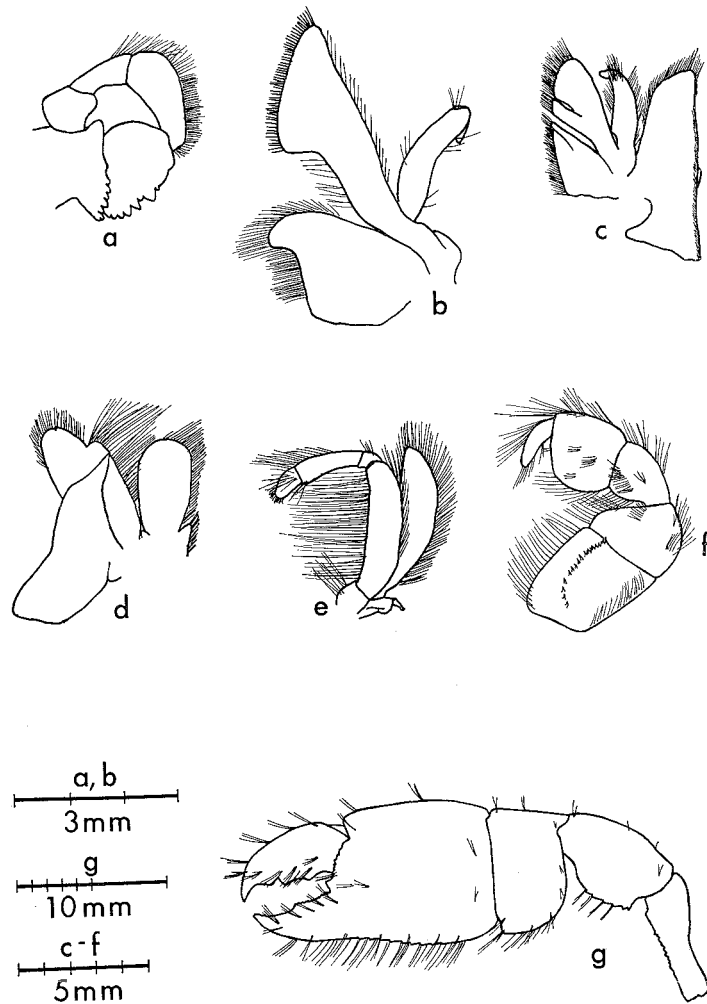


FIGURE 5. *Callianassa branneri* (composite from south Floridian material): a, mandible; b, first maxilla; c, second maxilla; d, first maxilliped; e, second maxilliped; f, third maxilliped; g, large cheliped.

Diagnosis.—Front with three short rounded projections. Endopod of uropod quadrate, about as long as telson. Large cheliped strong, dentition of dactylus well developed; elongate truncate tooth proximally, median triangular tooth, inconspicuously serrate distally.

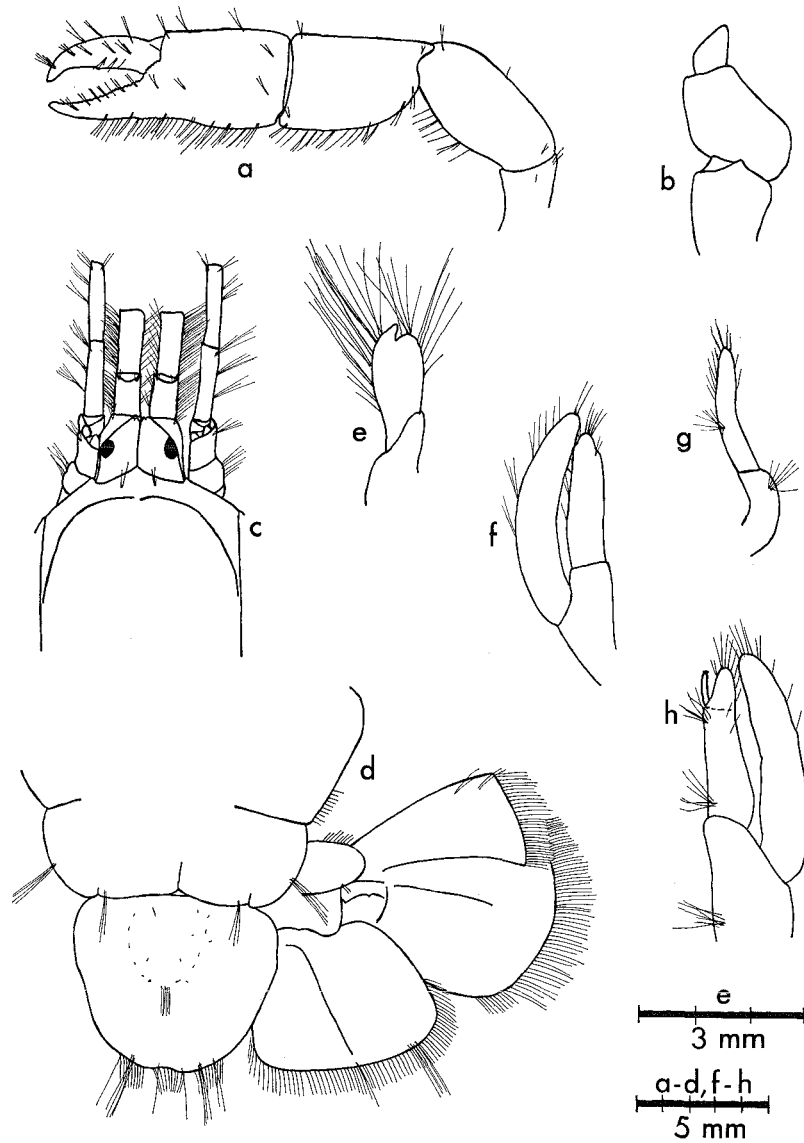


FIGURE 6. *Callianassa branneri* (composite from south Floridian material): a, small cheliped; b, P3; c, dorsum; d, tail fan; e, male first pleopod; f, male second pleopod; g, female first pleopod; h, female second pleopod.

Description.—Rostrum subtriangular, extending 0.1-0.2 times length of eyestalks. Lateral projections just beyond lateral margin of eyestalks, rounded, slightly depressed, 0.33-0.67 times length of rostrum. Eyestalks flattened, almost reaching tip of first segment of antennule, length 1.4 times width, lateral margins rounded, rounded projection mesiodistally, sometimes serrate at tip; pigmented area small, slightly convex, midlateral, covering less than 0.1-0.2 of exposed dorsal surface of eyestalks.

Third segment of antennule 1.1-2.0 times as long as second segment, 0.7-1.2 times length of fourth antennal segment. Fourth antennal segment 0.75-1.0 times length of fifth segment. Antennal flagella 2.1-3.0 times length of antennular. Second antennular segment reaching 0.67-0.75 length of fourth antennal segment. Third antennular segment to 0.5-0.6 fifth antennal segment. Third antennal segment with short, rounded distal projection, scattered tufts of elongate setae laterally on antennal peduncle. Antennular peduncle densely setose laterally.

Mandible with 5-8 rounded teeth in ventral portion of incisor process, 1-2 rounded lobes above, molar process with 4-8 teeth of varying sizes. First maxilla with expanded distal lobe on coxal endite, narrow rounded lobe on basal endite. Epipod of first maxilliped with acute distal tip, rounded laterally, exopod with distinct mesial lobe. Exopod of second maxilliped longer than proximal segment of endopod. Merus and ischium of third maxilliped not expanded, combined length of both segments 1.85-2.35 times greatest width, dorsal and ventral margins of ischium converging slightly proximally, 10 spines in crest on mesial surface, 6-9 free spines proximally; width of propodus 0.75-0.87 times width of ischium, width of dactylus 0.17-0.3 times width of propodus.

Large cheliped strong. Ischium with irregularly spaced denticles on ventral margin. Length of merus 1.3-2.2 times width, ventral margin forming serrate keel, truncate proximally. Length of carpus 0.57-0.75 times length of merus, width of carpus approximately twice median length, 1.3-2.0 times length of dorsal margin, ventral margin curving mesially, serrate. Palm quadrate, length 1.5-2.9 times length of carpus, ventral margin serrate, distal margin serrate along articulation with dactylus. Propodal finger wide across base, cutting edge inconspicuously serrate proximally, low triangular tooth sometimes present in proximal third. Triangular tooth in center of notch between fingers. Dactylus heavy, 0.5-0.9 times length of palm, elongate truncate tooth proximally on cutting edge, may appear as two teeth due to central concavity, smaller triangular tooth distally, remainder of edge inconspicuously serrate.

Ischium of small cheliped lacking ventral serrations. Merus without ventral keel or serrations. Carpus longer than merus, longer than wide, lacking ventral serrations. Palm shorter than carpus, longer than wide,

without ventral serrations. Propodal finger narrow, cutting edge entire. Dactylus longer than palm, curved, cutting edge entire.

No sexual dimorphism of chelipeds noted in this species.

P2 with straight-edged palm, fingers narrow, elongate, symmetrical. Propodus of P3 weakly bilobed, posterior lobe short, wide, giving propodus generally stubby appearance. P4 subchelate, P5 chelate. Branchial formula as in *C. acanthochirus*, rudimentary gill on second maxilliped.

A1 small, not divided by transverse ridge, widening toward posterior margin. Lateral margin of A6 bilobed, anterior lobe comprising 0.67 of somite length, lateral margin slightly convex, posterior lobe rounded, narrower than anterior lobe.

Telson wider than long (1.0-1.22), widest proximally, general outline shieldlike, lateral margins converging, posterior corners smoothly rounded, posterior margin inconspicuously concave or convex medially, fringe of hair at corners and medially, accessory tufts of long hair at corners, prominent convex area proximally on dorsal surface with posterior fringe of hair.

Pleopods of first and second abdominal somites sexually dimorphic. First pleopod of male uniramous, two-segmented, distal segment short, bilobed. Second pleopod of male with bladelike exopod, endopod two-segmented, proximal segment bladelike, distal segment rounded at tip, inconspicuously indented. First pleopod of female uniramous, two-segmented, distal segment bladelike, rounded at tip. Second pleopod of female biramous with elongate, bladelike exopod, endopod two-segmented; proximal segment bladelike, distal segment fingerlike, articulating on mesial margin of first segment, indistinct transverse suture on first segment at level of articulation of second segment. *Appendix interna* of third through fifth pleopods subtriangular in outline, hooks located along mesial surface.

Endopod of uropod quadrate, slightly wider than long, extending about as far as posterior margin of telson, medial ridge almost reaching distal margin, fringe of short hair along margin, tuft of elongate hair at mesio-distal corner. Exopod of uropod wide, slightly longer than endopod (1.1 times). Upper exopodal plate 0.9-0.95 times as long as lower plate, distal edge convex with dense fringe. Suture present but not distinct. Lower exopodal plate densely fringed along distal margin, median ridge not extending as far as distal margin of upper plate, two weak basal spines present.

Color.—Body dull white, major chela and dorsum of other walking legs light pink or rosy. Dorsal oval may have pink tint.

Range.—Bermuda (Verrill); southeastern Florida, including Keys and Dry Tortugas; Bimini; Little San Salvador; Puerto Rico (Rathbun, Boone, Schmitt); Barbados (Schmitt); Curaçao (Rathbun); Tobago; Brazil (Rathbun).

Type-Locality.—Mamanguape stone reef, Brazil.

Type.—USNM 23756.

Discussion.—Approximately one-third of the specimens examined have a small tooth on the propodus of the large cheliped. In other specimens, the cutting edge is serrate, without any marked dentition. The dactylus of the large cheliped often has a single truncate tooth proximally, but this may be divided into two rounded teeth. Serration of the ventral margins of chelipedal segments is best developed on large specimens. Small specimens may lack serration on the ischium and carpus. Contrary to previous descriptions, the rostrum may be rounded rather than acute, and horizontal rather than depressed.

Synonymizing *Callianassa siguanensis* with *C. branneri* has been suggested previously (Schmitt, 1935b). Boone's original description was almost strictly a comparison of the new species to *C. branneri*. Characters used to distinguish *C. siguanensis* include the lack of lateral projections on the front, the more tapering form of the eyestalks, the smaller size of the dactylus of the third maxilliped, the dentition of the dactylus of the large cheliped, and the denser brush of setae on the fourth pereopods. Of these characters, only the difference in the size of the dactylus of the third maxilliped cannot be accounted for by the lack of an adequate sample from which the range of variation could be determined. It is now known that these characters, plus the other characters measured by Boone, fall within acceptable limits for *C. branneri*. Boone's distinction, based on the maxillipedal character, is in error because she stated that the width of the dactylus is 0.5 times the width of the propodus in *C. branneri*, rather than 0.17-0.3 times as noted in the present study. The value for Boone's specimen falls within this range. Since variation within *C. branneri* can account for all differentiating characters of *C. siguanensis*, the latter species must be synonymized.

Direct comparison of a very limited number of specimens has shown that *C. jousseaumei* Nobili and *C. variabilis* Edmondson show numerous morphological similarities to *C. branneri*, and judging from Edmondson's (1944) discussion of these species, *C. indica* De Man must also be included in this group. Edmondson recognized the variability of the third maxillipeds and male first pleopods, which might allow *C. indica* and *C. jousseaumei* to be synonymized, but he believed *C. variabilis* to be distinct. The exact relationship of these species remains unclear, and further study is indicated.

Remarks.—This is a wide-ranging species, common on the intertidal flats of southeastern Florida. Burrows are found both on protected and wave-washed beaches; the latter have coarse quartz sand and a high content of

shell fragments. The burrows are extensive and large, averaging about 20 mm in diameter.

Callianassa fragilis Biffar

Figs. 7, 8

Callianassa fragilis Biffar, 1970: 45, fig. 3.

Material Examined.—FLORIDA: Miami, Virginia Key, west side, mud flat, T. Biffar, summer 1967; 5 spec., destroyed.—Miami, Virginia Key, west side, mud flat, R. McDermott, spring 1967; 6 spec., destroyed.—Miami, Virginia Key, mud flat, biology class, 26 July 1969; 1 ♂, 22 mm, UMML 32.4193.

PUERTO RICO: Punta Arenas, sand flat, W. G. Hewatt, 12 June 1946; 1 ♂, 27 mm (Holotype), 1 ♂, damaged, USNM 82367.

ANTIGUA: Falmouth Bay, Black's Point, Smithsonian Bredin Exped. 112-59, 30 April 1959; 1 ♀, 16.5 mm, USNM 128788.

VENEZUELA: Cumana, Capt. Couthouy, 1859; 2 ♂♂, 40 and 39 mm, MCZ 760.

Diagnosis.—Total length less than 45 mm. Merus of large cheliped with proximoventral hook. Antennular peduncle extending beyond antennal peduncle. Telson shield-shaped, with posteromedian concavity. Endopod of uropod wide oval, extending beyond posterior margin of telson.

Description.—Rostrum and lateral projections short rounded triangles. Rostrum extending only 0.07-0.23 times length of eyestalks. Lateral projections just beyond margin of eyestalks, not extending as far anteriorly as rostrum. Eyestalks elongate, extending almost to end of first antennular segment, length 1.3-2.3 times width, lateral margin more or less straight, directed at slight oblique angle inward, distal margins straight, more mesially directed, with mesiodistal triangular projection; pigmented area central, subterminal, covering about 0.06 of exposed dorsal surface of eyestalks, irregular in shape.

Length of third segment of antennule 2.2-3.7 times length of second antennular segment, 1.25-1.7 times length of fourth antennal segment. Fourth antennal segment 1.15-1.55 times length of fifth antennal segment. Antennal flagellum 2.75-4.2 times length of antennular. Second antennular segment extending to 0.55 length of fourth antennal segment. Third antennular segment to just beyond distal end of fifth antennal segment. Third segment of antenna with inconspicuous rounded lobe, peduncle sparsely setose. Second and third antennular segments sparsely fringed with setae on lateral surfaces.

Mandible with 10-12 teeth in incisor process, teeth progressively larger toward ventral end, molar process with two strong ventral teeth, four

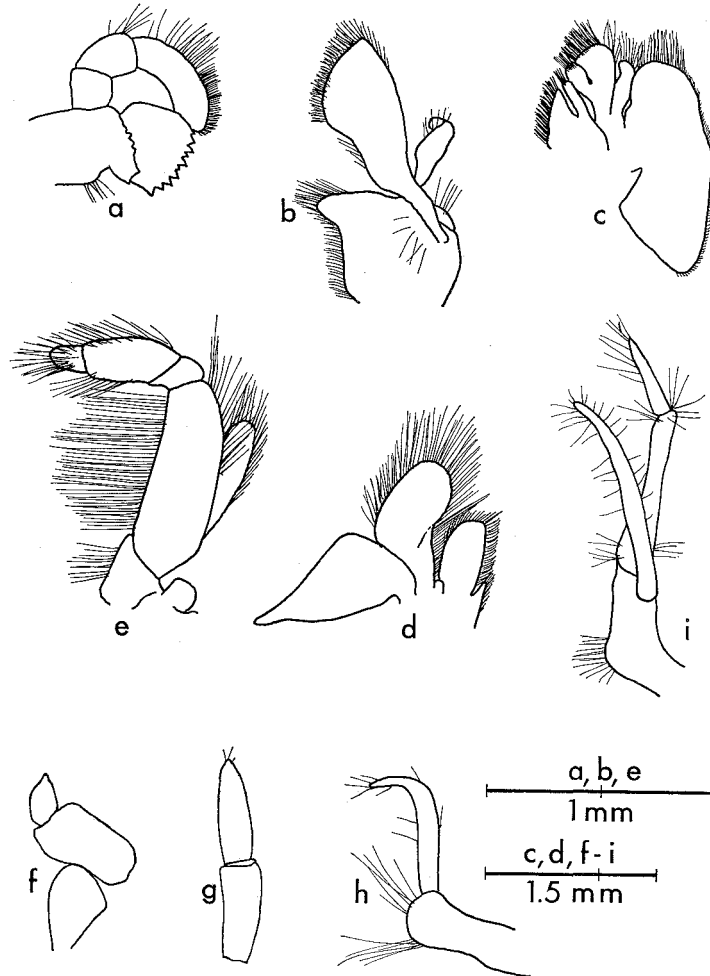


FIGURE 7. *Callianassa fragilis* (composite from south Floridian material): a, mandible; b, first maxilla; c, second maxilla; d, first maxilliped; e, second maxilliped; f, P3; g, male first pleopod; h, female first pleopod; i, female second pleopod.

smaller teeth dorsally. Basal endite of first maxilla expanded distally, rounded, coxal endite narrow with narrow, rounded distal lobe. Basal endite of first maxilliped convex distally, exopod quadrate distally, with indentation on mesial margin, epipod truncate distally, narrowly rounded laterally. Exopod of second maxilliped only 0.75 times length of first

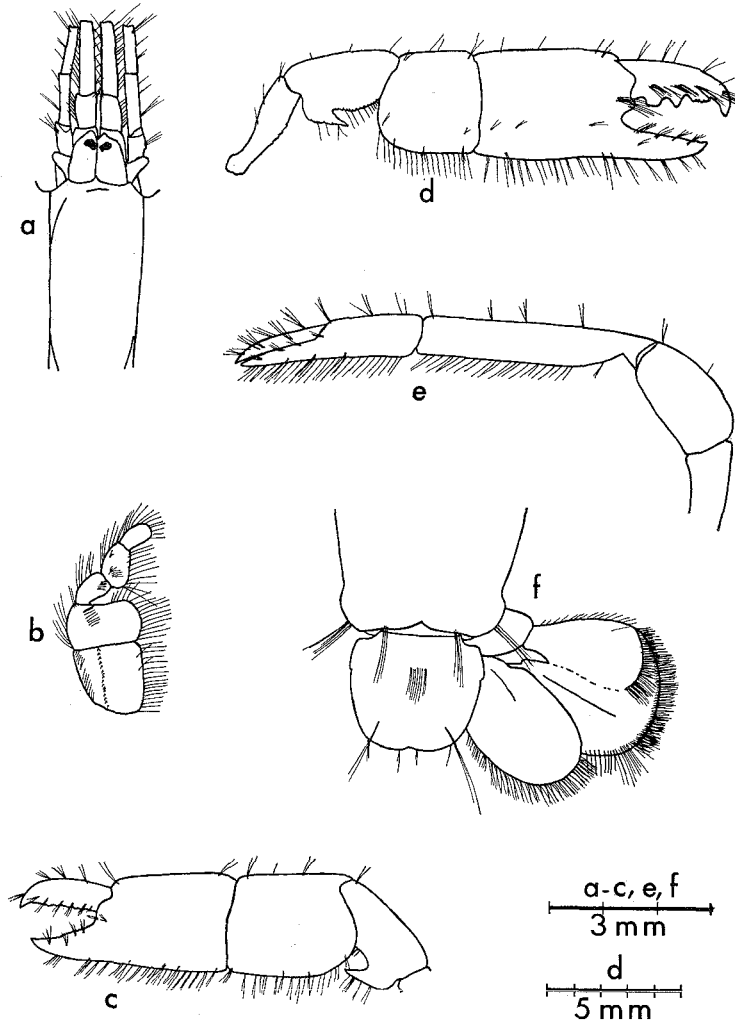


FIGURE 8. *Callianassa fragilis* (composite from south Floridian material): a, dorsum; b, third maxilliped; c, female large cheliped; d, male large cheliped; e, small cheliped; f, tail fan.

segment of endopod. Merus and ischium of third maxilliped wide, length of segments 1.4-1.6 times greatest width, dorsal and ventral margins of ischium converging proximally, mesial surface with 16-18 weak denticles, merus subrectangular, dorsal and ventral margins broadly rounded; propo-

dus widest proximally, width 0.43 times width of merus; width of dactylus 0.4-0.67 times width of propodus.

Ischium of large cheliped of male with four or five inconspicuous serrations ventrally. Merus more than twice (2-2.2) as long as wide, proximo-dorsal margin serrate in larger specimens or entire, proximoventral margin produced into distally directed hook; hook with 3-4 strong serrations ventrally, tip acute or subacute, remainder of ventral margin with 11 denticles separated by tufts of hair. Length of carpus 0.68-0.9 times length of merus, longer medially due to convex proximal margin, width of carpus 1.1-1.4 times dorsal length, ventral margin entire. Palm longer (1.3-1.8) than carpus, length greater (1.15-1.3) than width, ventral margin entire. Propodal finger shorter than dactylus, entire. Notch between fingers concave, extending proximally into palm, subtriangular tooth present dorsally. Dactylus 0.6-0.82 times length of palm, truncate teeth proximally and distally with three or four rounded serrations on cutting edge of distal tooth, proximal tooth entire or serrate, triangular tooth medially, tip of dactylus strongly curved, not hooked.

Ischium and merus of cheliped of female like those of male. Carpus longer than wide (1.14-1.22), length equalling length of merus, almost (0.9-0.95) as long as palm. Palm narrowing distally, slightly narrower than carpus. Propodal finger with serrate cutting edge. Notch not extending proximally, lacking triangular tooth. Dactylus slightly curved, lacking strong dentition, cutting edge serrate.

Ischium and merus of small cheliped lacking ventral denticles. Ventral margin of merus inconspicuously concave proximally, lacking hook. Carpus elongate, length 5-6 times width. Palm narrow, length 0.4 times length of carpus. Propodal finger almost as long as dactylus, minute serrations on cutting edge. Dactylus straight, cutting edge entire.

Fingers of P2 elongate, propodal finger wider proximally, palm convex. Propodus of P3 bilobed, dactylus with subacute tip. P4 simple, P5 chelate. Branchial formula as in *C. acanthochirus*, second maxilliped lacking rudimentary gill.

A1 short, lacking transverse ridge, margin rounded anteriorly, lateral margins diverging posteriorly. A2 elongate, lateral integument curving mesially ventrally covering part of sternum. Lateral margins of A6 weakly bilobed, margins of anterior three-fourths slightly convex, fringed with fine hair, posterior lobe rounded.

Telson shield-shaped, width 1.16 times length, lateral margins convex, slight notch in proximal third, remainder of margin smoothly rounded including posterior corners, median concavity in posterior margin, dorsal surface convex except for shallow depression centrally and flattened area immediately adjacent to lateral margins, tufts of elongate setae on dorsal surface just proximal to each posterior corner.

First pleopod of male uniramous, two-segmented, distal segment elongate, subacute at tip. No indication of second pleopod. First pleopod of female uniramous, two-segmented, distal segment bladelike, rounded at tip. Second pleopod biramous, exopod bladelike, rounded at tip, shorter than endopod (0.88), endopod similar, with transverse articulation 0.65 total length from proximal articulation. *Appendix interna* of third through fifth pleopods subtriangular, hooks only on small area of mesial surface near apex.

Endopod of uropod wide oval, length 1.6 times width, extending 0.33 times length of telson beyond posterior margin of telson, mesial margin fringed with regularly spaced setae, distal margin with slightly denser fringe, median ridge proximally, becoming indistinct centrally. Exopod of uropod extending just beyond endopod, upper exopodal plate 0.8 times length of lower plate, distal margin convex, fringed with hair laterally, mesiodistal corner with fringe of strong setae. Suture indistinct. Lower exopodal plate with convex margin, dense distal fringe of setae, shortest in dorsal row, mesiodistal corner with series of strong setae forming fringe, lateral margin fringed with hair, single small basal spine or lacking.

Color.—Transparent except for subcutaneous yellow-orange on dorsal abdominal surface and white chelipeds.

Range.—Southeastern Florida (Biffar); Puerto Rico (Biffar); Antigua (Biffar); Venezuela (Biffar).

Type-Locality.—Punta Arenas, Puerto Rico.

Type.—USNM 82367.

Discussion.—Characters which may be used to separate this species from *C. atlantica* were noted previously (Biffar, 1970). A second small species with a hook on the merus of the large cheliped is now known to exist in the western Atlantic. I have seen specimens of this undescribed species from several localities along the eastern coast of the United States. The new species is much like both *C. atlantica* and *C. fragilis*, but can be distinguished from either species by the presence of a weak hook on the merus of the small cheliped and of two spinules on each posterolateral corner of the telson.

Callianassa grandimana Gibbes, 1850

- Callianassa grandimana* Gibbes, 1850: 194.—Stimpson, 1866: 47; 1871: 122.—Kingsley, 1899: 823.—De Man, 1928b: 19.—Schmitt, 1935b: 2.
Glypturus grandimanus, Rathbun, 1900: 151.
Glypturus grandimana, Borradaile, 1903: 548.
 (Non) *Glypturus grandimanus*, Balss, 1924: 179, figs. 3, 4 (= *C. hartmeyeri* Schmitt).

Description.—The following description is taken from Gibbes (1850: 194): “The second segment [ischium] is slender and narrow near its articulation with the first, and is dilated and incurved as it advances, with distant granules on its lower edge; the third segment [merus] is broader, dilated so as to form below a sharp serrated edge, which is truncated as it approaches the posterior articulation, inner surface of the segment is nearly plane, on the middle of the outer is a longitudinal obtuse ridge, the carpus is united with the preceding segment by a small articulating surface near its upper edge, somewhat inflated externally, the breadth, or rather the depth, nearly twice as great as the length, the posterior lower angle rounded, forming an edge without any trace of serrature; the hand broader, or rather deeper, than the carpus, and its length, exclusive of the finger, is nearly double that of the carpus, inflated on the internal surface, and more so on the external, lower edge ciliate, and with few small distant serrations; whole surface of hand, as well as carpus, smooth and polished.”

Type-Locality.—Key West, Florida.

Type.—“Charleston Cabinet,” (= Gibbes’s collection). Present location unknown.

Discussion.—This species has caused some trouble for previous workers. Because of the short description, lack of illustrations, and loss of the type, most authors have preferred to wait until the fauna of south Florida is better known before reaching any decision concerning the status of the species. It is not yet possible to validate *C. grandimana*, but there are indications that it may be identical to *C. branneri*. A definite statement will be withheld pending future success of collections at the type-locality. Several previous attempts have failed to produce an animal, although numerous burrows were excavated. The burrows were of a large and substantial nature similar to those made by any of the larger species in south Florida.

Schmitt (1935b) noted several unwarranted assumptions made by previous authors concerning the morphology of *C. grandimana*. Stimpson (1866, 1871) made passing reference to *C. grandimana* in a discussion of *C. acanthochirus*, but he made no assumptions concerning undescribed morphology, and he separated *C. grandimana* and *C. acanthochirus* on available characters. Apparently as a result of Stimpson’s comparison, Rathbun (1900) separated *C. grandimana* from *C. branneri* because of the former’s supposed spinous front and chelipeds, and the unequal length of the uropodal segments. Such a separation was without basis. Balss (1924) continued the error, but his description and illustration clearly showed no similarity to Gibbes’s description. Finally, De Man (1928b) related *C. grandimana* to *C. longiventris*, another trispinous species, and he appeared to accept Balss’s description as that of *C. grandimana*. The

TABLE 2
A COMPARISON OF *C. grandimana* GIBBES WITH OTHER SOUTH FLORIDIAN SPECIES OF *Callianassa*

Chelipedal segments	<i>grandimana</i>	<i>acanthochirus</i>	<i>branneri</i>	<i>fragilis</i>	<i>guassutunga</i>	<i>latispina</i>	<i>longiventris</i>	<i>marginata</i>	<i>quadracuta</i>	<i>rathbunae</i>	<i>trilobata</i>
Ischium	distant granules	-	+	+	- ♀ + ♂	+	-	-	-	-	- ♂ + ♀
Merus	serrate, truncate	-	+	-	-	-	-	-	-	-	+
	inner-flat	+	+	+	+	+	+	+	+	+	+
	outer-ridge	+	+	+	+	+	+	+	+	+	+
Carpus	W nearly 2 × L	1.0-1.5	1.3-2.0	0.8-1.4	1.7-1.8	1.3-1.7	1.4-1.7	0.8-1.1	1.2-1.5	1.25-2.0	0.75-1.1
	not serrate	-	+	+	+ ♀ - ♂	- ♂ + ♀	-	+	+	+	- ♂ + ♀
Palm	W > C(W)	+	+	- ♀ + ♂	+	+	+	+	+	+	- ♀ + ♂
	L nearly 2 × C(L)	1.1-1.8	1.5-2.9	1.1-1.8	1.8-2.0	2.2-2.8	1.8-2.0	1.3-1.8	1.6-1.96	1.45-2.3	1.05-1.55
	few serrations	-	+	-	+	-	-	-	-	+	- ♀ + ♂
	smooth	-	+	+	-	+	+	+	-	+	+

W = width; L = length; C(W) = width of carpus; C(L) = length of carpus; - = substantial difference; + = possible match (a species is so marked if the character can occur, even though not in a majority of specimens).

resulting confusion requires a reexamination of the original description to determine precisely what is known about the species.

Table 2 is a comparison of the characters described by Gibbes with the same characters for the ten species of *Callianassa* now known from south Florida. As Schmitt (1935b) noted, Gibbes's descriptions, although short, have proven accurate, and it is probable that he would not have overlooked distinctive features when describing the cheliped.

After careful comparison and evaluation, it becomes apparent that only *C. branneri* fits all the characters ascribed to *C. grandimana*. *Callianassa acanthochirus*, *C. marginata*, *C. rathbunae*, and *C. longiventris* have strong spines on the ischium, and *C. quadracuta* has numerous denticles. The form of the ventral margin of the merus fits only *C. branneri* and *C. trilobata*. *Callianassa guassutunga* and *C. latispina* are eliminated because of the well-developed proximal spine, *C. fragilis* because of the proximal hook, and *C. quadracuta* because the proximal margin is not truncate. The margin is entire in *C. marginata* and spinous in *C. acanthochirus*, *C. longiventris*, and *C. rathbunae*. The carpal dimensions eliminate *C. acanthochirus*, *C. marginata*, *C. trilobata*, *C. fragilis*, and *C. quadracuta*, and the characters of the palm eliminate all but *C. branneri* and *C. rathbunae*.

The known range of *C. branneri* brackets Key West, since specimens have been taken from Miami, Missouri Key, and Dry Tortugas, Florida. Only one other species, *C. acanthochirus*, has been reported commonly in the Keys (Stimpson, 1866), and this species is readily excluded from consideration as a synonym of *C. grandimana*. Obtaining specimens from Key West would do much to establish the position of *C. branneri* in relation to *C. grandimana*, and it is hoped that future collections will be successful in this locality.

Callianassa guassutunga Rodrigues, 1966

Figs. 9, 10

Callianassa guassutunga Rodrigues, 1966: 45, figs. 41c-60.

Material Examined.—FLORIDA: Miami, Virginia Key, west side, mud flat, T. Biffar, 23 March 1967; 1 ♀, 77 mm, destroyed.—Miami, Virginia Key, west side, mud flat, T. Biffar, 26 April 1967; 1 ♂, 110.5 mm, destroyed.—Miami, Virginia Key, west side, mud flat, S. Dobkin, 29 February 1964; 1 ♂, 65 mm, USNM.

PUERTO RICO: Mayagüez, V. Biaggi, Jr., 1934; 1 ♂, 73 mm, USNM 77462.

Diagnosis.—Front trispinous. Palm of large cheliped with three spines on lateral surface just proximal to notch, merus with bifurcate projection on proximoventral margin. Endopod of uropod subtriangular.

Description.—Front trispinous. Rostrum flattened, acute, extending 0.25-0.33 times length of eyestalks, directed horizontally. Lateral spines just beyond lateral margins of eyestalks, small, curving mesially, approximately 0.4-0.8 times length of rostrum. Eyestalks flattened, longer (1.7-1.9) than wide, extending almost to end of first antennular segment, slight distal projections on eyestalk of male, eyestalks of female lacking projection, rounded anteriorly; pigmented area bulbous in both sexes, area of male large, distolateral, covering 0.4-0.6 of exposed dorsal surface of eyestalk, female cornea smaller, distomedial, covering about 0.2 of exposed surface.

Second segment of antennular peduncle shorter (0.5-0.9) than third segment. Third antennular segment 0.8-1.0 times length of fourth antennular segment. Fifth antennular segment shorter (0.8-0.95) than fourth segment. Antennular flagellum 1.6-2.3 times length of antennular. Second antennular segment reaching to 0.6-0.8 length of fourth antennular segment. Third antennular segment to 0.6-0.7 fifth antennular segment. Third segment of antenna with rounded distolateral projection. Second and third segments of antennule with dense rows of elongate setae on lateral surfaces.

Mandible with second segment of palp elongate, 12-13 teeth along edge of incisor process, 3-5 acute teeth in molar process. First maxilla with broad tip on basal endite, distal edge more or less straight, coxal endite with rounded distal lobe, straight mesial margin. Basal endite of first maxilliped subrectangular, exopod with elongate distal lobe, oval proximal area, epipod pointed distally, quadrate laterally. Exopod of second maxilliped slightly longer than first segment of endopod. Third maxilliped operculiform, combined length of ischium and merus 1.9-2.0 times greatest width, dorsal and ventral margins of ischium converging slightly proximally, mesial spinous ridge weakly developed, 8-12 separate acute denticles proximally, 5-7 close-set denticles distally, merus triangular with concave distal margin; propodus wide, 0.9 times greatest width of merus; width of dactylus 0.2-0.3 times width of propodus.

Ischium of large cheliped of male inconspicuously serrate ventrally. Width of merus 0.5 times length, ventral margin strongly serrate medially, bifurcate spine proximoventrally, distal tooth shorter. Carpus shorter than merus (0.57-0.67) or palm (0.5-0.55), length 0.55-0.6 times width, ventral margin serrate. Palm quadrate, ventral margin serrate, distal margin of palm weakly serrate along articulation of dactylus, lateral surface smooth except for 2-3 distally directed spines just proximal to notch. Propodal finger without major dentition, weakly serrate or with 7-10 acute, triangular teeth medially. Heavy triangular tooth in notch just below articulation of dactylus. Dactylus strong, length 0.8-0.95 times length of palm, cutting edge with elongate truncate tooth proximally separated from median triangular tooth by notch, edge inconspicuously serrate distally, separated from median tooth by notch.

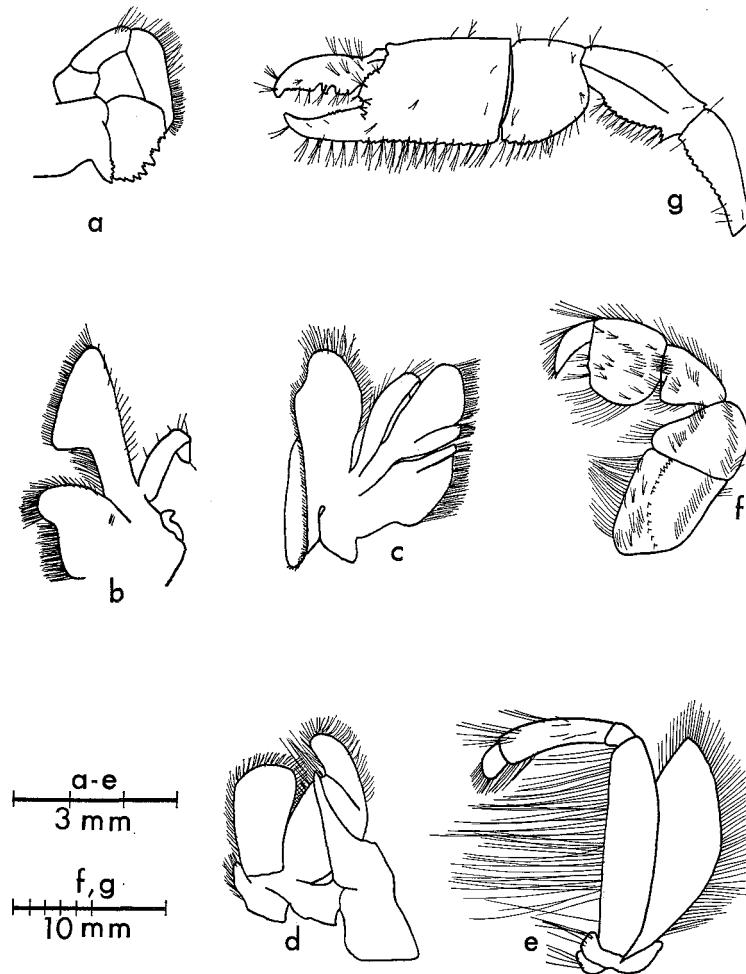


FIGURE 9. *Callianassa guassutunga* (composite from south Floridian material): a, mandible; b, first maxilla; c, second maxilla; d, first maxilliped; e, second maxilliped; f, third maxilliped; g, large cheliped.

Large cheliped of female without ventral serration on ischium, carpus, and palm. Bifurcate spine on merus weaker. Palm narrowing slightly distally. Propodal finger weaker, especially at tip, cutting edge strongly serrate. Dactylus similar to that of male.

Ischium and merus of small cheliped not serrate ventrally. Merus lacking bifurcate spine. Carpus elongate, narrow. Palm narrow, lacking spines on

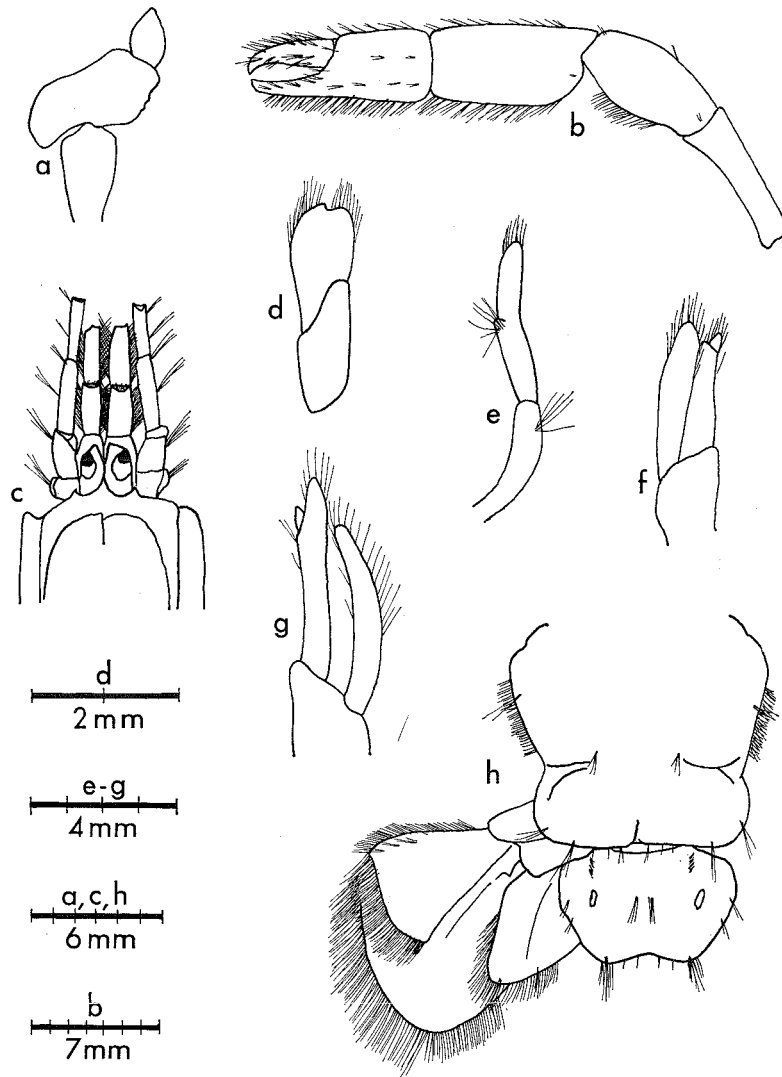


FIGURE 10. *Callianassa guassutinga* (composite from south Floridian material): a, P3; b, small cheliped; c, dorsum; d, male first pleopod; e, female first pleopod; f, male second pleopod; g, female second pleopod; h, tail fan.

lateral surface. Propodal finger narrow, pointed at tip, weakly serrate along cutting edge. Dactylus narrow, straight rather than curved at tip, inconspicuously serrate along cutting edge.

P2 with broad carpus and merus, fingers of chela symmetrical. Propodus of P3 bilobed with elongate posterior lobe. Coxae of P1-P3 with incurved spine on anterior surface. P4 weakly subchelate, P5 chelate. Branchial formula as in *C. acanthochirus*, arthrobranchs on third maxilliped weakly developed, second maxilliped with rudimentary gill.

A1 without subdivisions, rounded anteriorly, widening toward posterior margin. Lateral margin of A6 bilobed, anterior lobe including 0.75 total length of somite, narrower than A5, posterior lobes small but well defined.

Telson distinctly wider (1.3-1.8) than long, anterolateral margins more or less straight, distolateral margins converging, posterior corners prominent, rounded, with prominent tufts of hair just inside margin, posterior margin concave, dorsal surface of telson with proximal convex area, smaller convex elevation located on either side of convex area, inconspicuous ridges extending from distal corners of central area to posterior corners of telson, shallow groove between ridges.

Pleopods of first and second abdominal somites sexually dimorphic. First pleopod of male small, two-segmented, distal segment rounded with shallow indentation at tip. Second pleopod of male biramous with bladelike exopod, rounded at tip, endopod shorter than exopod, two-segmented; proximal segment bladelike, distal segment rounded, articulating at tip of proximal segment. First pleopod of female uniramous, two-segmented, distal segment bladelike, rounded at tip. Second pleopod of female biramous, exopod bladelike, narrowly rounded at tip, endopod slightly longer than exopod, proximal segment bladelike, rounded distally, small, triangular distal segment articulating mesiodistally. *Appendix interna* of third through fifth pleopods narrow, elongate, hooks along mesial surface.

Endopod of uropod subtriangular, width 0.8 times length, extending 0.5-1.0 times length of telson beyond distal margin of telson, margin fringed with setae, short accessory fringe of long setae at distal tip, weak dorsal ridge present. Exopod of uropod longer (1.3) than endopod. Length of upper exopodal plate 0.8 times length of lower, elevated distally, densely fringed with setae, weak fringe along lateral margin, series of strong setae in mesiodistal corner of plate. Suture distinct. Lower exopodal plate broadly rounded, fringed with fine setae along most of margin, small accessory fringe of strong setae in mesiodistal corner, weak dorsal ridge near suture, two acute basal spines present.

Color.—Variable. Entire body of large male deep red, except two elongate oval areas on telson and median section of carapace white in fresh material. Smaller female lacking red, animal dull white.

Range.—Southeastern Florida; Puerto Rico; Brazil (Rodrigues).

Type-Locality.—São Sebastiao, Brazil.

Type.—Department of Zoology, University of São Paulo, No. 2728.

Discussion.—The description given by Rodrigues is most complete, and the characters differ little from those of present material. However, in specimens from south Florida, the telson is not always as angular on its lateral margins as Rodrigues indicated in his illustration, and the dentition of the propodus and of the distal edge of the dactylus is not as strong. The proximal spination of the merus may consist of two close-set but separate spines rather than an obviously bifurcate projection.

An affinity with *C. rathbunae* is very evident. Rodrigues mentioned nine characters which can be used to separate the species. These characters include the form of the telson and uropods, the morphology of the chelipeds, and the shape of the eyestalks.

Remarks.—In the Miami area, *C. guassutunga* was found inhabiting a mud flat which is exposed at low tide. The flat is rarely exposed to wave action, and it is on the lee side of an island which effectively shelters the flat from a direct flow of offshore currents. This habitat may be contrasted with the offshore sublittoral situation in which *C. rathbunae* was found.

Callianassa latispina Dawson, 1967
Figs. 11, 12

Callianassa latispina Dawson, 1967: 190, fig. 1.

Material Examined.—LOUISIANA: Grand Isle, soft mud, 7.5 fms, C. E. Dawson, 30 August 1959; 1 ♂, 56 mm, USNM 105398 (Holotype).—Grand Isle, soft mud, 7.5 fms, C. E. Dawson, 4 February 1959; 1 ♂, 27 mm, USNM 103755.

FLORIDA: SILVER BAY Sta. 4568, 24°50'N, 82°13'W, 14 fms, 8 December 1962, 40-ft flat trawl; 1 spec. from fish stomach (*Syacium gunteri*), destroyed.

HONDURAS: Off Trujillo, PILLSBURY Sta. 623, 16°00'N, 86°08'W, 28 fms, 21 March 1968, 10-ft trynet; 1 ♀, 36 mm, UMML 32.3787.—Off Trujillo, PILLSBURY Sta. 624, 15°59.5'N, 86°05.5'W, 22-26 fms, 21 March 1968, 10-ft otter trawl; 1 ♂, 17.5 mm, UMML 32.3788.—Off Trujillo, PILLSBURY Sta. 629, 15°58.2'N, 86°09'W, 22 fms, 21 March 1968, 40-ft otter trawl; 1 ♀, damaged, UMML 32.3789.—Off Trujillo, PILLSBURY Sta. 630, 15°59.2'N, 86°02'W, 20 fms, 21 March 1968, 40-ft otter trawl; 5 ♀♀, 13-33 mm, UMML 32.3790.

Diagnosis.—Sixth abdominal somite with short anterolateral keel. Exopod and endopod of uropod extending about as far as distal margin of telson. Ischium of large cheliped sometimes dilated distoventrally, merus with elongate spine proximoventrally. Propodus of third maxilliped not expanded, merus with distoventral spinous projection.

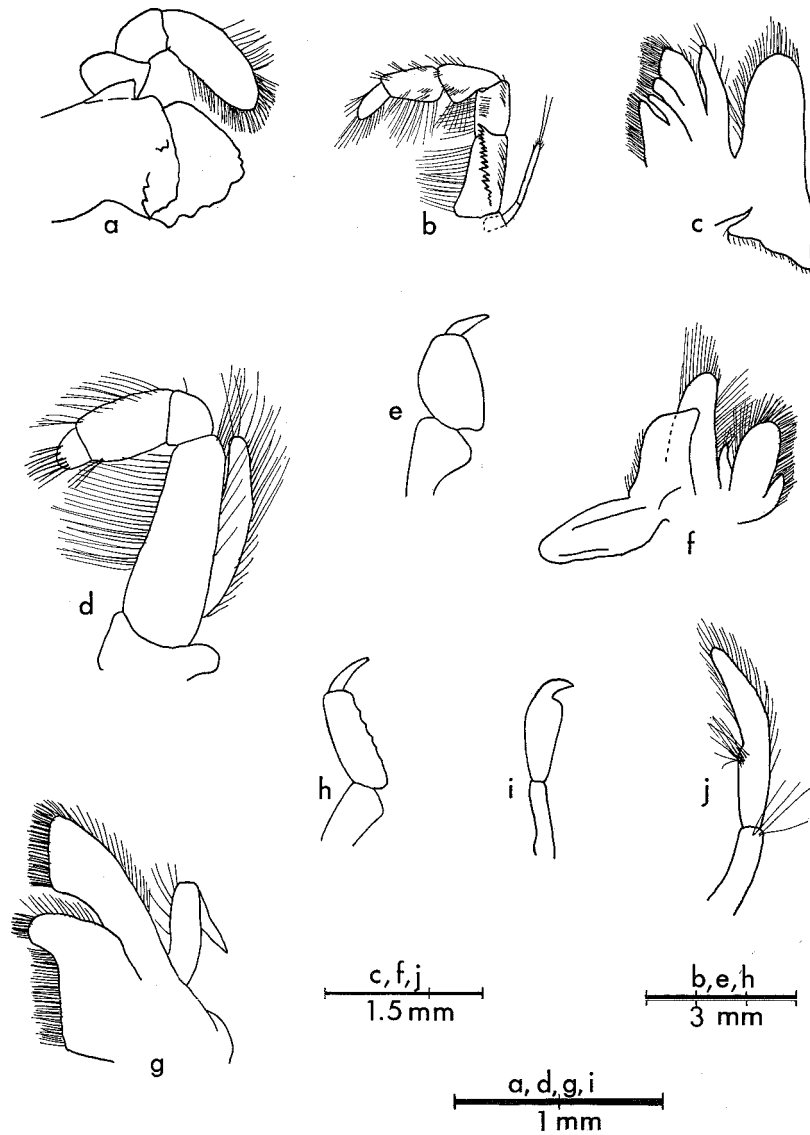


FIGURE 11. *Callianassa latispina* (composite from types and Honduran material): a, mandible; b, third maxilliped; c, second maxilla; d, second maxilliped; e, P3, broad form; f, first maxilliped; g, first maxilla; h, P3, narrow form; i, male first pleopod; j, female first pleopod.

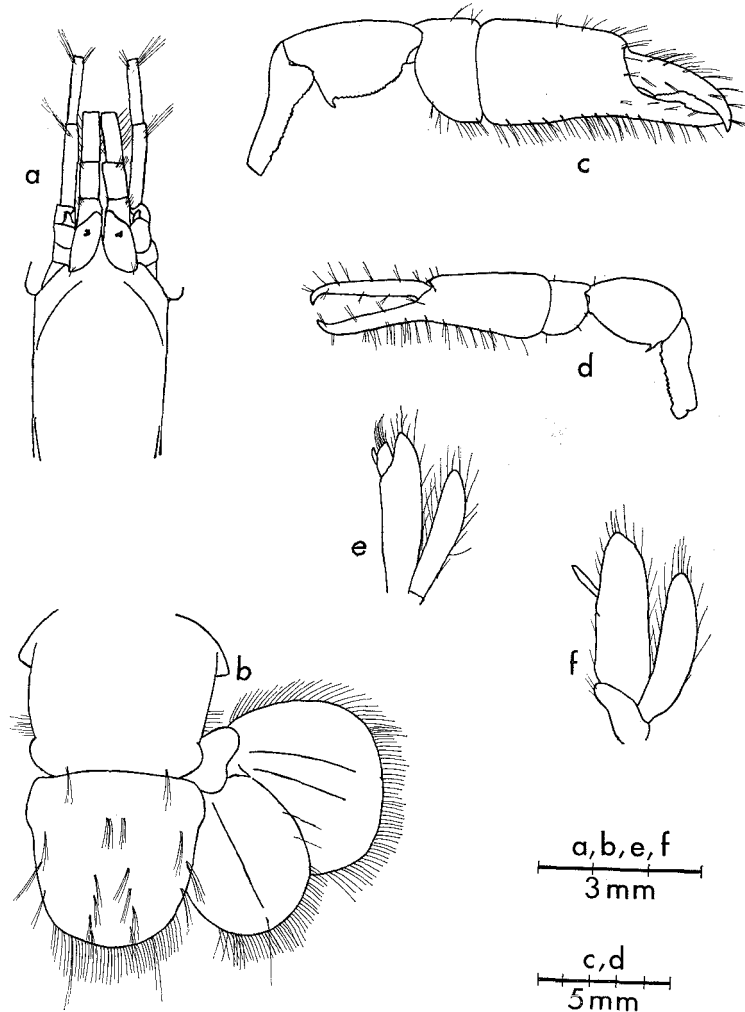


FIGURE 12. *Callianassa latispina* (composite from types and Honduran material): a, dorsum; b, tail fan; c, large cheliped; d, small cheliped; e, male second pleopod; f, female second pleopod.

Description.—Dorsal carapace sometimes with calcified elevation present near posterior margin. Rostrum acute, wide proximally, extending 0.4-0.7 times length of eyestalks, flattened, slightly depressed. Lateral projections depressed subacute triangles, situated adjacent to lateral margin of eyestalks. Eyestalks flattened, length 1.6-2.6 times width, distinctly shorter

than first antennular segment, lateral margins convex proximally, concave midlaterally, rounded distally with rounded mesiodistal projection, dorsal surface concave in larger specimens; pigmented area rounded, central, sub-terminal, covering 0.02 of exposed dorsal surface of eyestalks.

Third segment of antennular peduncle 1.1-1.75 times length of second segment, 0.4-0.7 times length of fourth antennal segment. Fourth antennal segment 1.2-1.85 times length of fifth segment. Antennal flagellum 2.0-3.8 times length of antennular. Second antennular segment reaching to 0.4-0.5 length of fourth antennal segment. Third antennular segment to 0.83-1.0 fourth antennal segment. Third segment of antenna with subacute dorsal projection, peduncle with few setae. Second and third segments of antennule with scattered setae laterally and mesially.

Mandible with six or seven rounded teeth on incisor process, molar process bifurcate ventrally, 4-6 irregular teeth. Coxal endite of first maxilla with rounded distal lobe, basal endite little expanded distally. Exopod of first maxilliped lacking mesial indentation, basal endite short, oval, epipod quadrate distally. Second maxilliped with short thick endopod, exopod slightly shorter (0.8-0.9) than first segment of endopod. Ischium and merus of third maxilliped narrow, combined length of both segments 3.0-4.25 times greatest width of either segment, dorsal and ventral margins of ischium diverging slightly proximally, well-developed spinous ridge on mesial surface with about 16 teeth decreasing in size proximally, margins of merus straight, spinous projection at distoventral corner; propodus not dilated, width 0.63-1.1 times width of merus; dactylus wide, 0.4-0.6 times width of propodus. Narrow two-segmented exopod present on third maxilliped of some specimens, basis also with calcified endite and serrate mesiodorsal projection, coxa with calcified endite, proximodorsal epipod.

Ischium of large cheliped serrate ventrally, distoventral expansion in large specimens forming serrate lobe. Merus 1.5-2.35 times as long as wide, rounded serrations along ventral margin, proximoventral corner produced into short curved spine, distoventral margin sometimes with strong blunt hook directed distally or two small rounded projections. Length of carpus 0.4-0.6 times length of merus, 0.6-0.8 times width of carpus, lower margin very finely serrate in males, entire in females. Palm longer (1.2-1.6) than wide, length 2.2-2.8 times length of carpus, narrowing distally, with fine ventral serrations in male, entire in females. Propodal finger long, narrow, cutting edge with low irregular tooth medially, sometimes proximal rounded tooth as well, smaller specimens lacking dentition except for inconspicuous serrations proximally. Dactylus narrow, curving downward distally, length 0.77-0.86 times length of palm, single triangular tooth proximally, inconspicuously serrate distally.

Ischium of small cheliped with minute, widely spaced denticles. Merus more distinctly oval, lacking ventral serrations, proximal curved spine

present. Carpus more elongate, narrower than in large cheliped. Palm much longer than wide (2.7), narrowing distally. Propodal finger straight, curved at tip, cutting edge entire. Dactylus curved at tip, cutting edge entire.

Fingers of P2 asymmetrical, dactylus curved, palm convex. Propodus of P3 variable, never bilobed; if narrow, ventral margin straight, slightly expanded proximally; if broad, ventral margin convex, proximoventral corner more angular, dactylus elongate, with acute tip. P4 simple, propodus elongate, dactylus elongate, acute. P5 subchelate with S-shaped dactylus. Branchial formula as in *C. acanthochirus*, all gills well developed, rudimentary gill present on second maxilliped.

A1 with hourglass shape, anterior section narrower, margins converging, posterior section longer, margins strongly diverging. A6 narrower than A5, anterolateral margin expanded to form short keel, midlateral margin slightly convex, small rounded lobe posteriorly.

Telson longer than wide (1.02-1.32), slight proximolateral lobe, remainder of margin smoothly rounded, posterior margin convex, fringed with long setae, shallow median groove in midline of dorsal surface with four tufts of setae arranged in linear series on either side of midline, three tufts of longer setae along lateral margins of telson.

First and second pleopods sexually dimorphic. First pleopod of male uniramous, two-segmented, slender tip of distal segment curving toward broadly rounded, shorter lobe. Second pleopod of male biramous, blade-like exopod shorter (0.8) than endopod, endopod three-segmented; basal segment bladelike, second segment subrectangular, articulating on mesial margin of first segment, fingerlike third segment on mesial margin of second segment. First pleopod of female uniramous, bladelike second segment thicker proximally, rounded at tip. Second pleopod of female biramous, exopod bladelike, shorter than endopod; endopod two-segmented, proximal segment broad, bladelike, distal segment fingerlike, articulating on mesial margin of first segment, hooks at tip. *Appendix interna* of third through fifth pleopods fingerlike, hooks only at tip, endopod extending beyond exopod.

Endopod of uropod wide oval, length 1.3-1.5 times width, not extending beyond distal margin of telson, fringe of regularly spaced setae distally and mesially, weak central ridge extending almost to distal margin. Exopod of uropod slightly longer (1.1) than endopod, lateral and distal margins with fringe of setae. Upper exopodal plate indistinguishable except distally, no suture present, two weak ridges extending almost to distal margin, single basal spine present.

Color.—Variable. Majority of specimens with white body and chelipeds, abdomen yellow or yellow-orange internally. Two specimens with red abdomens, one of these also red on thorax, walking legs, and chelipeds. Dawson (1967) reported bright crimson chelipeds.

Range.—Grand Isle, Louisiana (Dawson); off southwestern Florida; Honduras.

Type-Locality.—Grand Isle, Louisiana, 7.5 fathoms.

Type.—USNM 105398.

Discussion.—Since both type-specimens are males, the above includes the first description of females of *C. latispina*. In addition, the Honduran specimens exhibit some differences from the original material. They do not have a well-developed keel on the sixth abdominal somite, although the keel is still recognizable, and they lack the distal hook on the merus of the large cheliped. The triangular tooth on the propodal finger is also lacking. The shape of the propodus of P3 is generally narrower.

Dawson noted morphological similarities between *C. latispina* and *C. minor* Gourret (chelipeds), *C. sibogae* De Man (first abdominal somite), and *C. indica* (carpus of the third maxilliped). *Callianassa minor* also shows other similar characters (form of the uropods, eyestalks, and pleopods), but perhaps the most interesting similarity is the presence of an exopod on the third maxilliped. Only one additional species, *C. novaebritanniae* Borradaile (and its variety), has been described with such an exopod. It was the opinion of Borradaile (*in De Man*, 1928a) that the presence of an exopod did not justify creation of a new subgenus unless other systematically important characters occurred in the same species. Gurney (1944) noted the uniqueness of this character, but did not suggest any role for it in future revisions of the genus. Until such a revision is attempted, the value of this character probably will not be determined. For the present, it can be noted that the exopod differs in length and morphology from species to species, and within *C. latispina*, it may or may not be present. This may suggest the independent development or retention of an exopod more than once within the genus.

Remarks.—*Syacium gunteri* Ginsberg feeds on the bottom in depths of 10-50 fathoms (Fraser, personal communication). The specimen of *C. latispina* from the fish stomach was in excellent condition, suggesting fairly recent consumption. Therefore, it seems probable that the range of the species can be extended to include the general area of the record.

The specimens from off the coast of Honduras were taken in trawls which brought up large chunks of coral. When broken apart, the coral was found to contain numerous passages. Each passage was lined with mud, and live animals were removed from these passages. The origin of these passages is unknown, but they are complex. They resemble the branching callianassid burrows common on intertidal flats, in that the burrow's opening is restricted.

Callianassa longiventris A. Milne-Edwards, 1870

Figs. 13, 14

Callianassa longiventris A. Milne-Edwards, 1870: 92.—Rathbun, 1901: 92.—Borradaile, 1903: 547.—De Man, 1928a: 24, fig. 12-h; 1928b: 19.—Schmitt, 1935b: 4, pls. 1-4.—Gurney, 1944: 85, figs. 1 and 2.
(Non) *C. longiventris* Borradaile, 1902: 752, pl. 58, figs. 2 and 2b, (= *C. longiventris* var. *borradailei* De Man).

Material Examined.—BERMUDA: 5 mi southwest of reefs of Somerset, 2 m, T. Tucker, 15 July 1964; 1 ♂, 71.5 mm, USNM 122449.

FLORIDA: Long Reef, 25°25.2'N, 80°7.9'W, 4-5 m, G. Hendrix, 20 May 1967; 1 ♀, damaged, destroyed.—Long Reef, 25°25.2'N, 80°7.9'W, 4-5 m, T. Biffar, 8 June 1967; 2 ♀♀, damaged, destroyed.

JAMAICA: Montego Bay beach, E. Andrews, 28 June 1910; 1 ♂, 87 mm, 1 ♀, 96 mm, USNM 70799.

Diagnosis.—Front trispinous. Pigmented area of eyestalks bulbous, covering 0.33 of exposed dorsal surface of eyestalks. Palm of major cheliped cristate dorsally and ventrally, propodal finger with low, triangular tooth near base, merus with 3-5 ventral spines directed distally. Telson trapezoidal, shorter than uropods. Endopod of uropod triangular.

Description.—Dorsal carapace strongly convex, posterior half of dorsal oval with 3-4 scattered tufts of hair on either side of midline. Rostrum spinous, acute, extending 0.75-1.0 times length of eyestalks, directed slightly upward. Two tufts of hair located just behind base of rostrum. Lateral spines over antennal peduncle, strong, acute, curving mesially, 0.5 times rostral length; base of spine with square, steplike area medially, lateral margin with smooth slope, "non-calcified strip" described by De Man (1928a) situated between level of edge of carapace and top of "step," strip not as opaque as carapace or spine. Eyestalks subcylindrical, extending almost to, or just beyond, tip of first segment of antennular peduncle, length 1.9 times width, small quadrate projections mesiodistally; pigmented area distolateral, bulbous, covering over 0.33 of exposed dorsal surface.

Third segment of antennule 1-1.2 times length of second segment, 0.5-0.6 times length of fourth antennal segment. Fifth antennal segment 0.7-0.85 times length of fourth segment. Antennal flagellum 3-4 times length of antennular. Second segment of antennular peduncle reaching 0.5 length of fourth antennal segment. Third antennular segment to just beyond base of fifth antennal segment. Antennular peduncle with dense lateral setation.

Incisor process of mandible with five rounded teeth ventrally, five teeth on molar process. Basal endite of first maxilla with long, straight-edged lobe distally, coxal endite with small, rounded distal lobe, curved mesial margin. Exopod of first maxilliped distinctly bilobed, basal endite broad,

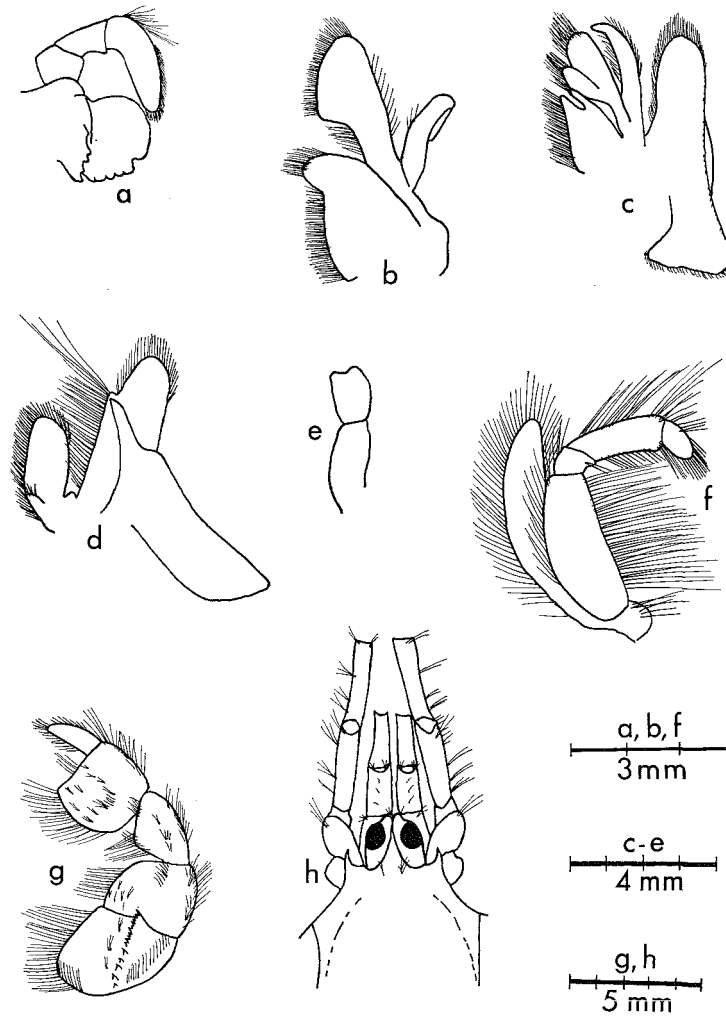


FIGURE 13. *Callianassa longiventris* (composite from south Floridian material): a, mandible; b, first maxilla; c, second maxilla; d, first maxilliped; e, male first pleopod; f, second maxilliped; g, third maxilliped; h, dorsum.

rounded distally, epipod narrowing distally. Exopod of second maxilliped slightly longer than first segment of endopod. Third maxilliped operculiform, combined length of ischium and merus 1.7-1.8 times greatest width of either segment, mesial surface of ischium with well-developed ridge of

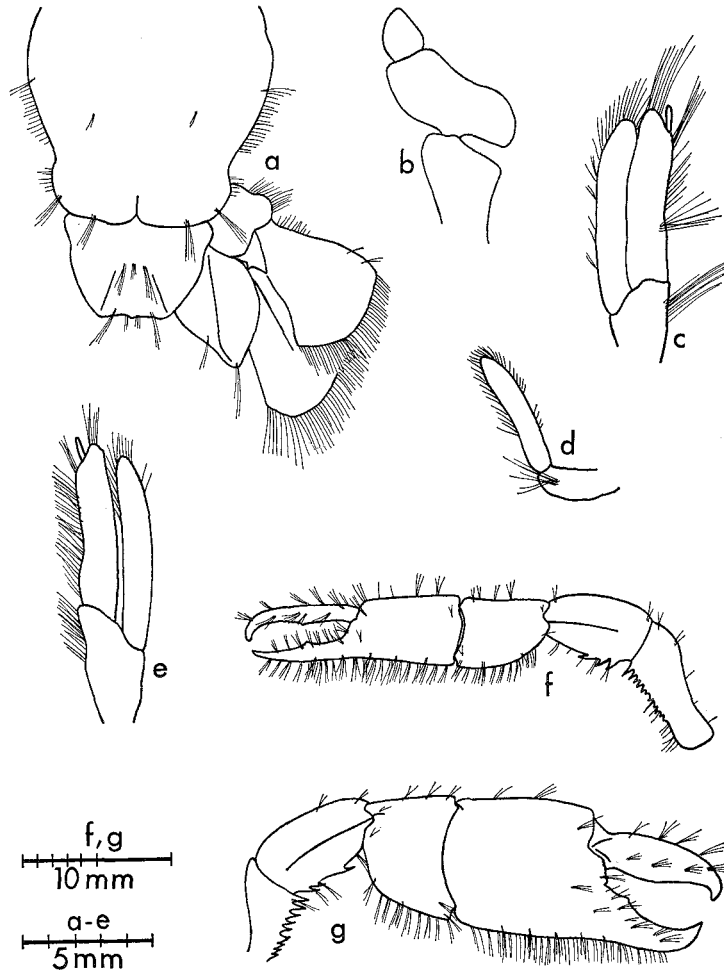


FIGURE 14. *Callianassa longiventris* (composite from south Floridian material): a, tail fan; b, P3; c, female second pleopod; d, female first pleopod; e, male second pleopod; f, small cheliped; g, large cheliped.

spines distally, five free spines proximally; propodus as wide as ischium or merus; width of dactylus 0.2-0.3 times width of propodus.

Ischium of large cheliped with 7-9 strong spines ventrally, two distal-most spines longest. Length of merus 1.7-2.2 times width, 3-5 distally directed spines ventrally, distal-most spine also most curved, separated from others or close-set. Length of carpus 0.6-0.7 times width, 0.6-0.7 times

length of merus, lacking ventral serrations. Palm slightly longer (0.95-1.15) than wide, 1.8-2.0 times length of carpus, without ventral serrations, dorsal and ventral margins cristate. Propodal finger strongly curved upward at tip, one low triangular tooth in proximal quarter of cutting edge, small triangular incision midway between tooth and ventral edge of articulation of dactylus, weak serrations proximal to incision, remainder of edge entire. Dactylus almost as long (0.8-1.0) as palm, more or less hooked distally, hint of low triangular tooth in proximal third of cutting edge, remainder of edge cristate.

Ischium and merus of small cheliped very similar to those of large cheliped, spination slightly weaker. Merus with 1-3 ventral spines. Carpus and palm narrower, more elongate. Propodal finger without distal curvature, median triangular tooth present. Dactylus narrow, almost hooked at tip, low median tooth evident, remainder of edge inconspicuously serrate.

Sexual dimorphism unknown in chelipeds of this species.

Palm of P2 heavy, margins rounded. Propodus of P3 bilobed, posterior lobe not extending beyond ventral margin of carpus. Branchial formula as in *C. acanthochirus*, gills on third maxilliped poorly developed, rudimentary gill on second maxilliped.

A1 divided by transverse ridge, anterior quarter narrower, anterior margin smoothly rounded, posterior section slightly elevated, gradually widening toward posterior border. Lateral margins of A6 bilobed, anterior lobe convex laterally, distinctly wider than posterior lobe.

Telson trapezoidal, width 1.2 times length, widest proximally, small proximolateral lobes, lateral margin concave posterior to lobe, convex distolaterally, posterior corners obtusely triangular, posterior margin with rounded median projection, weak ridges on dorsal surface between median fringe and distolateral corners.

First pleopods sexually dimorphic. First pleopod of male two-segmented, distal segment short, bilobed. Second pleopod of male biramous, exopod bladeliike, rounded distally, endopod two-segmented; proximal segment bladeliike, second segment small, fingerlike, articulating mesiodistally on first segment. First pleopod of female uniramous, two-segmented, distal segment bladeliike, rounded at tip. Second pleopod of female similar to that of male. *Appendix interna* of third through fifth pleopods subtriangular in outline, hooks along mesial surface.

Endopod of uropod triangular with convex margins, narrow rounded tip, length 1.2-1.7 times width, extending well beyond distal margin of telson, median ridge strong. Exopod of uropod extending well beyond endopod. Upper exopodal plate 0.8 times as long as lower, distal margin elevated, strongly convex, heavily fringed. Suture distinct. Lower exopodal plate strongly convex mesiodistally, fringed distally, ridge on dorsal surface adjacent to suture, single subacute basal spine present.

Color.—Extremely colorful when alive. Tip of claws and ischium orange, remainder of chelipeds with chocolate brown markings, articulating membranes bright red. Other walking legs yellow-orange. Mouthparts and antennal peduncles reddish. Carapace with brown markings, outlined in pale red.

Range.—Bermuda; southeastern Florida; Jamaica (Schmitt); Martinique (Schmitt).

Type-Locality.—Martinique.

Type.—Not traced. Probably Muséum National d'Histoire Naturelle, Paris, France.

Discussion.—Although the description of *C. longiventris* given by A. Milne-Edwards (1870) was in general terms, it applies well to present material. De Man later reexamined one of the type-specimens, and his subsequent redescription (1928a) of the species was more specific. He described only one character not found in present material: a bilobed tooth on the cutting edge of the dactylus of the large cheliped. However, a slight concavity in the proximal section of the cutting edge would be sufficient to produce such an appearance. De Man also compared his specimen with the illustration of *C. longiventris* Borradaile from the Indian Ocean. The latter species was separated as a variety, *C. longiventris* var. *borradailei* De Man, based on five characters. It is beyond the scope of the present study to determine the validity of this separation.

Remarks.—The specimens from southeastern Florida were taken on the lee side of a fringe reef 2-3 miles offshore from the northernmost keys. The depth was approximately 3-4 m, and the bottom was sand interspersed with turtle grass (*Thalassia testudinum*). The majority of the burrows were on the open sandy bottom between grass beds, although some burrows were found in the beds. The openings were about 1 m apart, and only one or two openings per burrow were evident. The animals remained in the mouth of the burrow until disturbed. They would then withdraw and return several minutes later.

Callianassa marginata Rathbun, 1901

Figs. 15, 16

Callianassa marginata Rathbun, 1901: 92, fig. 15.—Borradaile, 1903: 547.—Bouvier, 1925: 472.—De Man, 1928b: 29.—Schmitt, 1935a: 195, fig. 56; 1935b: 4.

? *Callichirus marginatus*, Bouvier, 1905: 804.

Material Examined.—FLORIDA: Off Miami Beach, mud bottom, 30-40 fms, R. Young, spring 1965; 1 spec., 13 mm, USNM 122452.

MEXICO: Arrowsmith Bank, 50-100 fms, GERDA Sta. 944, 21°05'N, 86°21'W, 27 January 1968, 10-ft otter trawl; 1 spec., destroyed.

PUERTO RICO: Mayagüez Harbor, 172 fms, FISH HAWK Sta. 6066, 20 January 1899, 9-ft B. T.; 1 ♂, 18.8 mm, 1 ♀, damaged, USNM 23778 (Holotype).—Mayagüez Harbor, 75-76 fms, FISH HAWK Sta. 6063, 20 January 1899, 9-ft B. T.; 1 ♀, 17.8 mm, USNM 24666.—Mayagüez Harbor, 33 fms, FISH HAWK Sta. 6064, 20 January 1899, dredge; 1 juv., 11 mm, USNM 24667.—Off Aguadilla, 137 fms, FISH HAWK Sta. 6055, 18 January 1899, dredge; 1 ♀, damaged, 1 juv., 9 mm, USNM 24665.

BARBADOS: 50-200 fms, J. B. Lewis, NR1-1; 1 ♀, 8 mm, USNM 110209.—50-200 fms, J. B. Lewis, NR10-3; 1 ♀, 10 mm, USNM 110210.—50-200 fms, J. B. Lewis, NR10-4; 1 spec., damaged, USNM 110211.—50-200 fms, J. B. Lewis, NR14-1; 1 ♀, damaged, USNM 110212.—50-200 fms, J. B. Lewis, NR19-5; 1 ♂, 8 mm, USNM 110213.

COLOMBIA: 310-350 fms, PILLSBURY Sta. 783, 11°22'N, 73°44'W, 31 July 1968; 1 ♀ (ovig.), 16 mm, UMML 32.4190.

Diagnosis.—Rostrum spinous, 0.5-0.75 times length of eyestalks. Lateral projections subrectangular. Telson about as long as wide, with postero-medial spinelike projection. Uropods elongate, extending well beyond telson. Total length less than 50 mm.

Description.—Branchiostegite textured. Rostrum spinous, acute, extending about 0.5-0.75 times length of eyestalks, projecting beyond eyestalks in juvenile specimens, spine directed slightly upward. Lateral projections broad, rounded, situated over antennal peduncle. Eyestalks bulbous in small specimens, concave dorsally in larger specimens, as wide as long, much shorter than first segment of antennular peduncle, margin convex laterally, inconspicuous rounded projection distally; pigmented area variable, rounded or irregular, subterminal, covering 0.05 of exposed dorsal surface of eyestalk.

Third segment of antennule 2.2-3.4 times length of second segment, 0.8-1.5 times length of fourth antennal segment. Fourth antennal segment 1.25-1.75 times length of fifth segment. Length of antennal flagellum 5-6 times length of antennular. Second antennular segment reaching 0.25 length of fourth antennal segment. Third antennular segment to 0.5 fifth antennal segment. Distinct spine on dorsal surface of third antennal segment, shorter rounded projection laterally on second segment, peduncle with few setae. Antennular peduncle with sparse, scattered setation.

Mandible with 5-7 rounded teeth in incisor process, central teeth largest, 4-5 small teeth in molar process. Basal endite of first maxilla slightly wider distally, rounded, coxal endite small, with rounded distal lobe. First maxilliped with oval basal endite, narrow bladelike exopod, small triangular epipod. Second maxilliped with short exopod, only 0.45 times length of

first segment of endopod, endopod short, segments wide. Third maxilliped narrow, combined length of ischium and merus 2.0-3.4 times greatest width of either segment, dorsal and ventral margins of ischium not converging proximally, ischium slightly wider proximally, spinous crest well developed with 10-13 irregular teeth distally, four strong spines in center of ridge, 4-8 smaller spines proximally, merus shield-shaped, distinct corner distoventrally; propodus narrow, width 0.4-0.7 times width of merus; dactylus narrow, width 0.3-0.57 times width of propodus.

Ischium of large cheliped with 6-9 spines ventrally. Length of merus 1.7-2.2 times width, lacking ventral serrations. Carpus subtriangular, shorter (0.85-0.95) than merus, length 0.9-1.2 times width, dorsal and ventral margins cristate. Length of palm 1.3-1.8 times length of carpus, length 1.1-1.4 times width, lacking ventral serrations. Propodal finger straight, with two low, rounded teeth medially. Dactylus strong, length 0.7-0.9 times length of palm, single rounded tooth centrally on cutting edge, remainder irregularly serrate.

Ischium of small cheliped with eight small spines ventrally. Merus as in large cheliped, lacking ventral serrations. Carpus more elongate, triangular, lacking ventral serrations. Propodus narrow, propodal finger and dactylus elongate, narrow, cutting edges entire.

Sexual dimorphism unknown in chelipeds of this species.

Chela of P2 asymmetrical, dorsal and ventral margins of palm slightly convex, dactylus curving inward. Propodus of P3 lacking posterior lobe, narrow, elongate. P4 simple with elongate propodus and dactylus, P5 chelate. Branchial formula as in *C. acanthochirus* except second arthrobranch lacking on third maxilliped, no rudimentary gill on second maxilliped.

A1 small, divided by transverse ridge, anterior half with straight anterior edge, rounded corners, lateral margins straight, parallel; posterior half wider, widening toward posterior margin. A6 elongate, lateral margins inconspicuously bilobed, anterior lobe 0.8 total length of somite, lateral margin almost straight, fringed with setae, sublateral keel under posterior 0.25 of lobe; posterior lobe as wide as anterior, rounded laterally.

Telson approximately as wide as long, widest proximally, rounded proximolateral lobes, remainder of lateral margins straight, converging posteriorly, posterior corners smoothly rounded, two spinules present, distinct median indentation in posterior margin, acute projection extending posteriorly from indentation, posterior margin fringed with regularly spaced setae, dorsal surface of telson with shallow groove distomedially, dorso-lateral areas convex.

First pleopod of male uniramous, one-segmented, hooked distally, rounded at tip. Second pleopod of male lacking. First pleopod of female two-segmented, distal segment bladelike, rounded at tip. Second pleopod

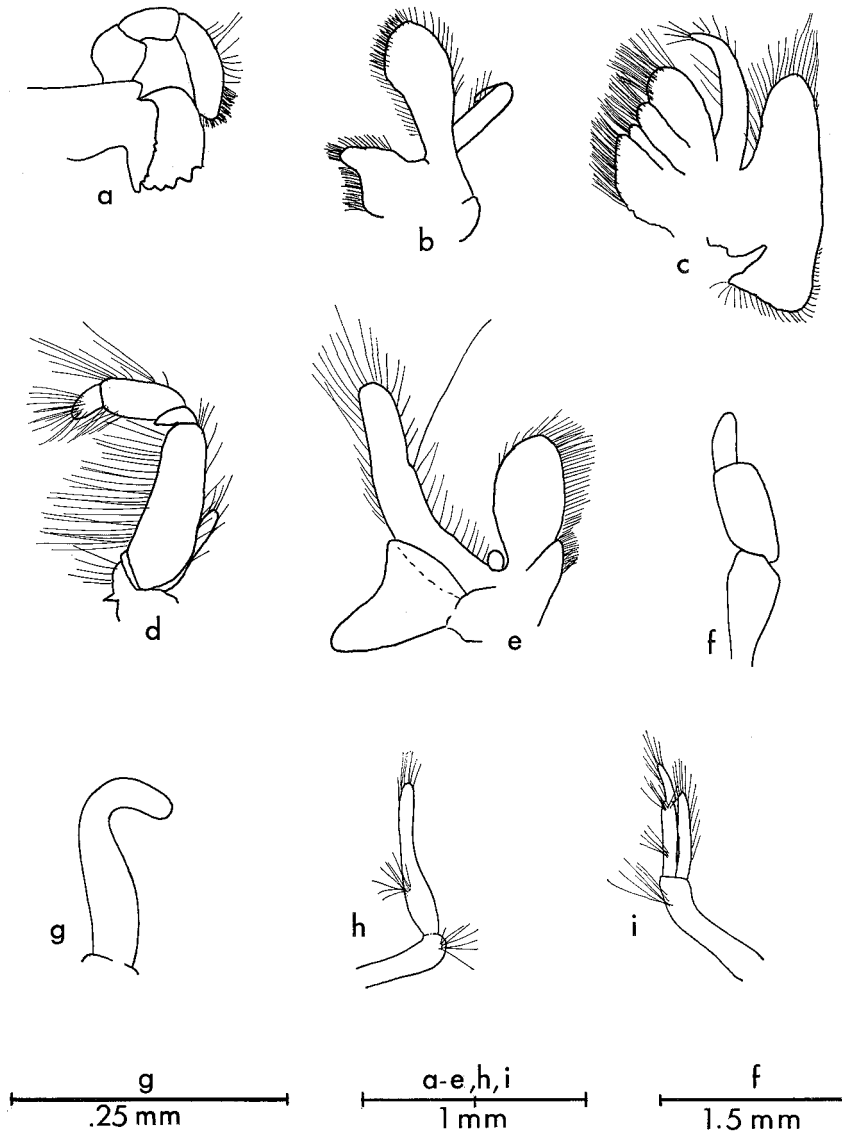


FIGURE 15. *Callianassa marginata* (composite from Puerto Rican and Colombian material): a, mandible; b, first maxilla; c, second maxilla; d, second maxilliped; e, first maxilliped; f, P3; g, male first pleopod; h, female first pleopod; i, female second pleopod.

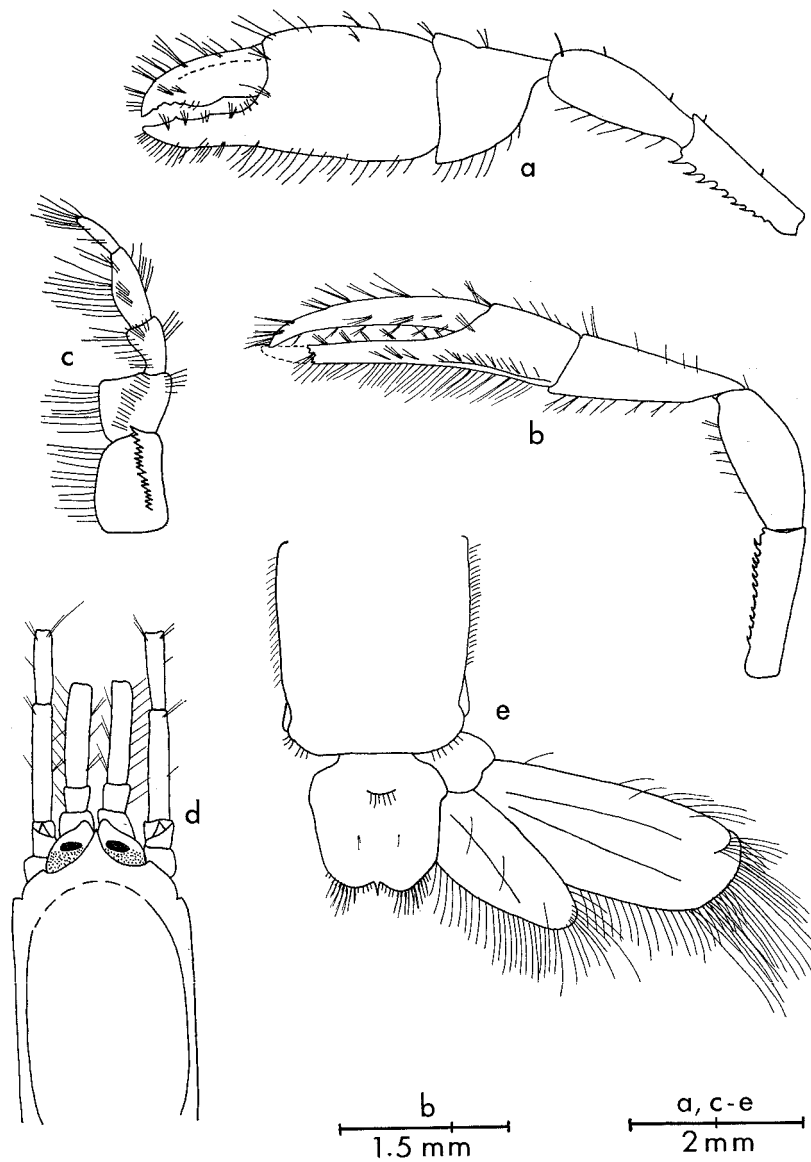


FIGURE 16. *Callianassa marginata* (composite from Puerto Rican and Colombian material): a, large cheliped (after Rathbun, 1901); b, small cheliped; c, third maxilliped; d, dorsum; e, tail fan.

biramous, proximal segment angular, exopod narrow, cylindrical, shorter than endopod, endopod cylindrical, distinctly narrower distally. *Appendix interna* of third through fifth pleopods rod-shaped, hooks only on small area at distal tip.

Endopod of uropod elongate oval, length 1.9-2.0 times width, extending 0.33 times length of telson beyond posterior margin of telson, mesial and distal margins fringed with long setae, accessory fringe of short, heavy setae at distal tip, dorsal surface with weak median ridge. Exopod of uropod narrow, elongate, 2.5 times as long as wide, length 1.5 times length of endopod. Upper exopodal plate 0.95 times length of lower plate. Suture lacking or indicated by weak ridge. Lower exopodal plate fringed with regularly spaced setae mesially and distally, distal margin with dense accessory fringe of very long setae, weak median rib on dorsal surface, no basal spine present.

Color.—Entire animal light brown or light orange, dorsal carapace white.

Range.—Southeastern Florida; Arrowsmith Bank; Puerto Rico (Schmitt); Barbados (Schmitt).

Type-Locality.—Mayagüez Harbor, Puerto Rico, 172 fathoms.

Type.—USNM 23778.

Discussion.—*C. marginata* is one of five small species now known from the western Atlantic. It is easily distinguished from *C. atlantica*, *C. latispina*, and *C. fragilis*, since it lacks a proximoventral expansion of the merus of the large cheliped. The elongate uropods of *C. marginata* readily separate the species from *C. minima*, which has short rounded uropods.

Remarks.—This species is found at depths ranging from 22-350 fathoms on sandy or muddy bottoms.

Callianassa quadracuta Biffar

Figs. 17, 18

Callianassa quadracuta Biffar, 1970: 40, fig. 2.

Material Examined.—FLORIDA: Miami, Virginia Key, west side, mud flat, T. Biffar, summer 1967; 1 spec., damaged, destroyed.

VENEZUELA: Cumana, J. P. Couthouy, 1859; 1 ♀, 74.5 mm, 2 ♀♀, damaged, 1 ♂, 69 mm, MCZ 732.—Cumana, J. P. Couthouy, 1859; 2 ♀♀, 27 and 39 mm, 1 ♀ (ovig.), 62 mm, 2 ♂♂, 68 mm (Holotype) and 75 mm, MCZ 760.—Cumana, L. Agassiz; 1 ♀ (ovig.), 70 mm, MCZ 12872.

Diagnosis.—Chelipeds of first walking legs similar in size, carpus with two acute distodorsal and two acute distoventral projections, dorsal margin

of palm acute distally. Endopod of uropod triangular, extending well beyond distal margin of telson. Telson distinctly wider than long. Dactylus of third maxilliped wide distally, width 0.75-0.9 times width of propodus.

Description.—Two weak ridges, one on either side of midline, running parallel to body axis in anterior quarter of dorsal carapace, terminating before reaching front. Short median ridge narrowing anteriorly, continuous with rostrum. Convex area as wide as eyestalk located over base of eyestalk, narrowing posteriorly. Row of four tufts of hair in groove between convex area and rostral ridge. Posterior area of dorsal carapace with ridge along midline. Rostrum acute, triangular, extending 0.09-0.22 times length of eyestalks, slightly depressed. Lateral projections subtriangular, inconspicuous, at lateral margin of eyestalk. Eyestalks flattened, extending beyond distal margin of first antennular segment, length 1.8-2.8 times width, lateral margins inconspicuously concave, distal margin straight, mesiodistal projection denticulate at tip; pigmented area lateral, subterminal, covering about 0.1 of exposed dorsal surface of eyestalks.

Length of third antennular segment 0.75-0.95 times length of second segment, 0.6-0.8 times length of fourth antennal segment. Fourth antennal segment 1.06-1.5 times length of fifth segment. Antennal flagellum 2.5-4.35 times length of antennular. Second antennular segment extending to 0.9 length of fourth antennal segment. Third antennular segment to 0.75 fifth antennal segment. Second segment of antenna with rounded distolateral projection. Second and third antennular segments with dense rows of elongate setae laterally.

Proximal segment of palp of mandible broad, incisor process of mandible with 10 truncate teeth, some inconspicuously serrate, molar process entire, bifurcate ventrally. Basal endite of first maxilla slightly expanded distally, distal margin straight, coxal endite with indication of distal lobe, mesial margin straight. Basal endite of first maxilliped rounded, mesial margin of exopod indented, epipod subtriangular. Exopod of second maxilliped longer (1.3) than first segment of endopod. Merus and ischium of third maxilliped wide, combined length of both segments 1.54-1.87 times greatest width of either segment, dorsal and ventral margins of ischium converging proximally, spinous ridge on mesial surface with seven free spines distally, distalmost largest, remainder of ridge with about eight denticles; propodus not expanded, width 0.6-0.7 times width of ischium; width of dactylus measured distally 0.75-0.9 times width of propodus.

Chelipeds of first pereopods subequal. Ischium of larger left cheliped short, with 18 subacute denticles ventrally, small spine distally. Merus with two inconspicuous denticles proximally on ventral margin, five denticles medially, length of merus 1.53-1.74 times width. Carpus shorter (0.79-0.92) than merus, length 0.65-0.86 times width, dorsal margin cristate

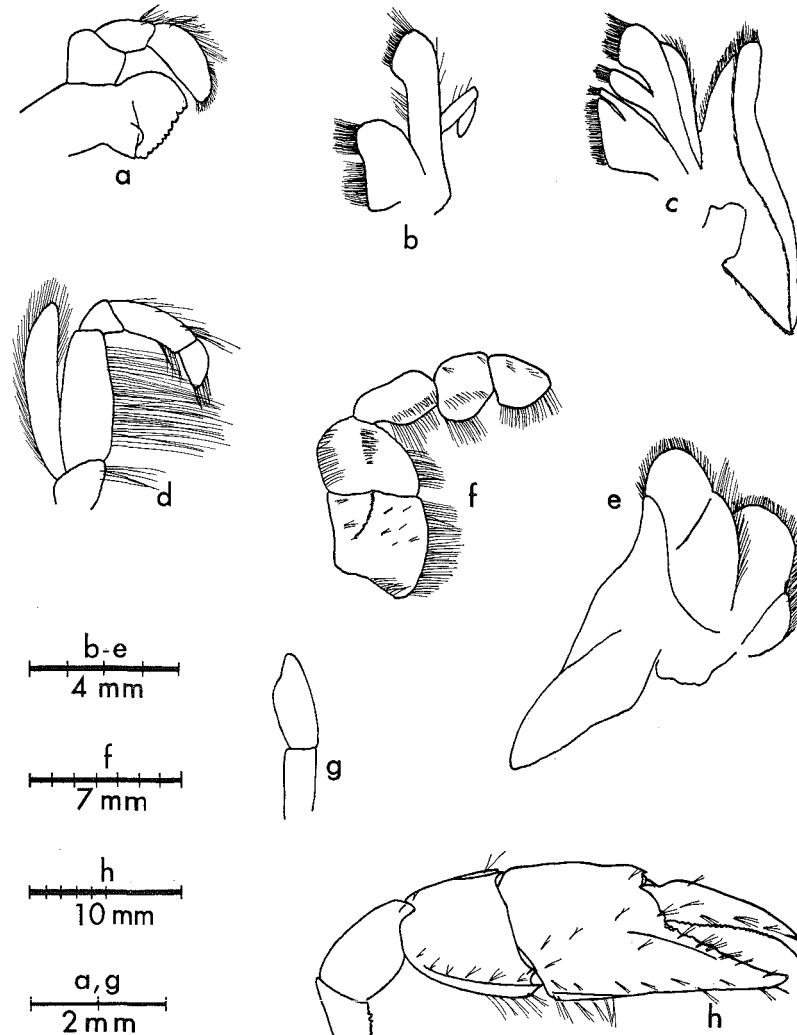


FIGURE 17. *Callianassa quadracuta* (composite from type-material): a, mandible; b, first maxilla; c, second maxilla; d, second maxilliped; e, first maxilliped; f, third maxilliped; g, male first pleopod; h, small cheliped.

proximally, dividing centrally into two ridges with acute distal termination, ventral margin entire, secondary ridge just above margin on lateral surface, acute distal termination, second acute projection at ventral margin of articulation with palm. Palm longer (1-1.32) than wide, longer (1.6-1.96) than carpus, ventral margin entire, rounded, dorsal margin cristate

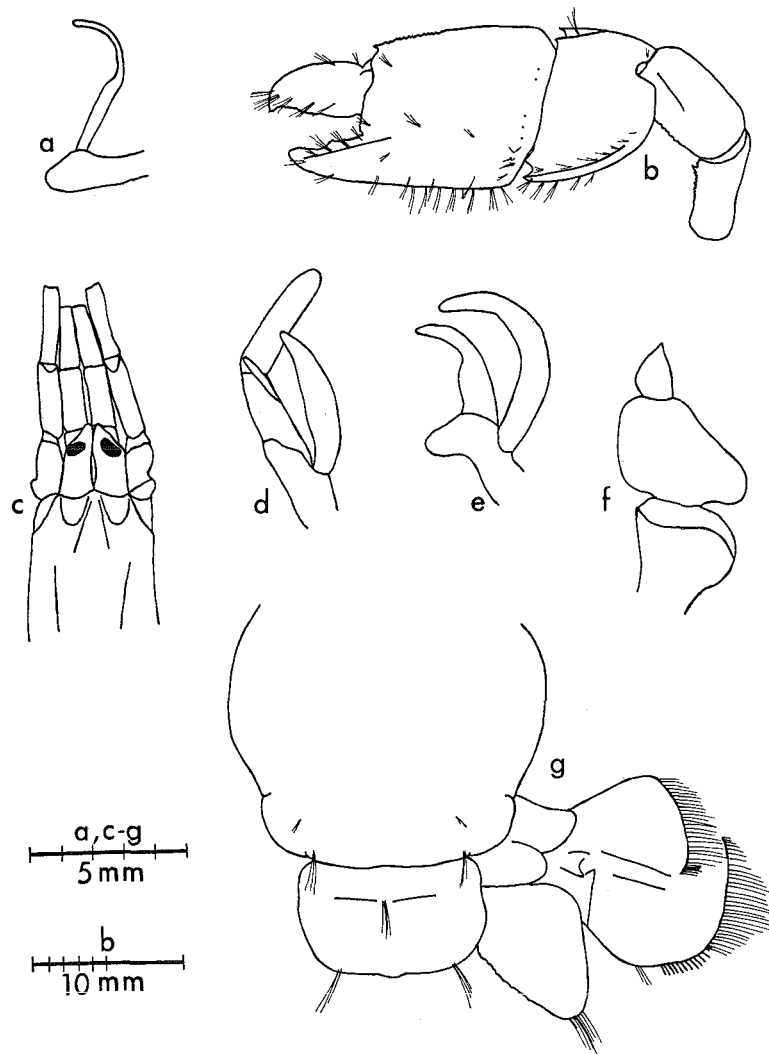


FIGURE 18. *Callianassa quadracuta* (composite from type-material): a, female first pleopod; b, large cheliped; c, dorsum; d, male second pleopod; e, female second pleopod; f, P3; g, tail fan.

on proximal half, distal half with minute denticles, acute distal termination, distal margin inconspicuously serrate along articulation with dactylus, lateral surface slightly blistered proximal to notch between fingers, series of raised tufts of hair proximoventrally. Propodal finger strong, blunt at

tip, much shorter than dactylus, series of 15 rounded denticles proximally on cutting edge ending at median triangular tooth, remainder of cutting edge inconspicuously serrate, weak ridge running along lateral surface below cutting edge and for short distance on palm. Dactylus strong, length 0.6-0.75 times length of palm, blunt, curving inward distally, cutting edge entire on proximal third, serrate on remainder.

Ischium of smaller right cheliped as in left, ventral margin with 16 irregular denticles, single spine distally. Merus as in left, length 1.45-1.8 times width. Carpus as in left with four acute projections distally, length 0.76 times width, length 0.85-0.95 times length of merus. Length of palm 1.17-1.52 times length of carpus, notably shorter and more oblique than palm of left cheliped, dorsal margin lacking distal serrations, ridge on propodal finger and palm more distinct. Propodal finger subacute distally, curving slightly inward, cutting edge with 10 irregular serrations. Dactylus slender, subacute distally, length 1.05-1.2 times length of palm, cutting edge with series of rounded denticles decreasing in size distally.

Fingers of P2 asymmetrical, propodal finger wider proximally, dactylus curved inward. Propodus of P3 with narrow rounded lobe proximally, slightly wider than long, dorsal margin slightly convex. P4 simple, P5 chelate. Branchial formula as in *C. acanthochirus*, all gills well developed, gill of second maxilliped with gill lamellae.

A1 divided by transverse ridge, anterior quarter subrectangular, widening posteriorly, margins of posterior area diverging. Lateral margins of A6 bilobed, anterior lobe distinctly wider than posterior, lateral margins convex.

Telson distinctly wider (1.46-1.76) than long, lateral margins with slight indentation in proximal third, remainder convex, distolateral corners smoothly rounded, posterior margin with median convex projection, dorsal surface of telson convex, lacking proximal convex area at midline, distinct transverse ridge on proximal half interrupted medially by tuft of hair.

First pleopod of male uniramous, two-segmented, distal segment elongate, rounded distally, slight indentation on mesial margin. Second pleopod of male biramous, exopod bladelike, subacute at tip, endopod two-segmented; proximal segment with pliable flap running along distal half of lateral margin, distal segment bladelike, rounded at tip. First pleopod of female uniramous, two-segmented, proximal segment extending horizontally beyond level of articulation of second segment, distal segment bladelike, narrow distally, rounded at tip. Second pleopod of female biramous, peduncle extending horizontally beyond level of articulation of endopod, exopod bladelike, curving inward, longer than endopod, endopod bladelike, thicker proximally, with only one segment. *Appendix interna* of third through fifth pleopods subtriangular with hooks along mesial surface.

Endopod of uropod triangular, length 1.2-1.7 times width, distal tip extending 2.1 times length of telson beyond posterior margin of telson,

margins slightly irregular due to widely spaced setae, dense fringe at distal tip, no median ridge on dorsal surface. Exopod of uropod longer than endopod. Upper exopodal plate 0.8 times length of lower plate, dense fringe of setae distally, mesiodistal margin with two rows of approximately 14 strong setae. Suture distinct. Lower plate fringed with setae distally, series of strong short setae dorsally, mesiodistal margin with row of 12 strong spinelike setae, dorsal ridge lacking, one strong basal spine present.

Color.—Thorax and chelipeds white, remainder unknown in fresh material, entire animal beige when preserved in alcohol.

Range.—Southeastern Florida (Biffar); Venezuela (Biffar).

Type-Locality.—Cumana, Venezuela.

Type.—MCZ 760.

Discussion.—The affinity of this species with *C. aequimana* Baker and *C. novaebritanniae* has been noted previously (Biffar, 1970).

Remarks.—*Callianassa quadracuta* has been taken only once in Miami, from an exposed sandy beach at low tide. The habitat in Venezuela is unknown.

Callianassa rathbunae Schmitt, 1935

Figs. 19, 20

Callianassa rathbunae Schmitt, 1935b: 15, pls. 1-4.

Material Examined.—FLORIDA: Miami, Key Biscayne, east shore, dredged from sandy bottom about 100 m offshore, G. Hendrix, 22 March 1969; 1 ♂, 95 mm, USNM.—Miami, Key Biscayne, east shore, dredged from sandy bottom about 100 m offshore, T. Biffar, 26 March 1969; 1 ♀, 82 mm, USNM.

JAMAICA: Bluefields, washed up after storm, summer 1899; 2 ♂♂, 61 mm (Holotype) and 59 mm, USNM 23010.

Diagnosis.—Front trispinous. Endopod of uropod rhomboid. Upper exopodal plate about as long as lower exopodal plate. Ischium and merus of large cheliped with numerous spinous projections ventrally. Carpus of small cheliped elongate, length 2.1-2.25 times width.

Description.—Front trispinous. Rostrum acute, spinous, extending 0.4-0.75 times length of eyestalks, directed slightly upward. Lateral spines acute, curving inward and upward, 0.8-0.9 times length of rostrum, located over antennal peduncle. Dorsal oval with two lateral elevations in anterior third of oval, additional median elevation sometimes also present in anterior third. Branchiostegite with pronounced calcified areas anteriorly,

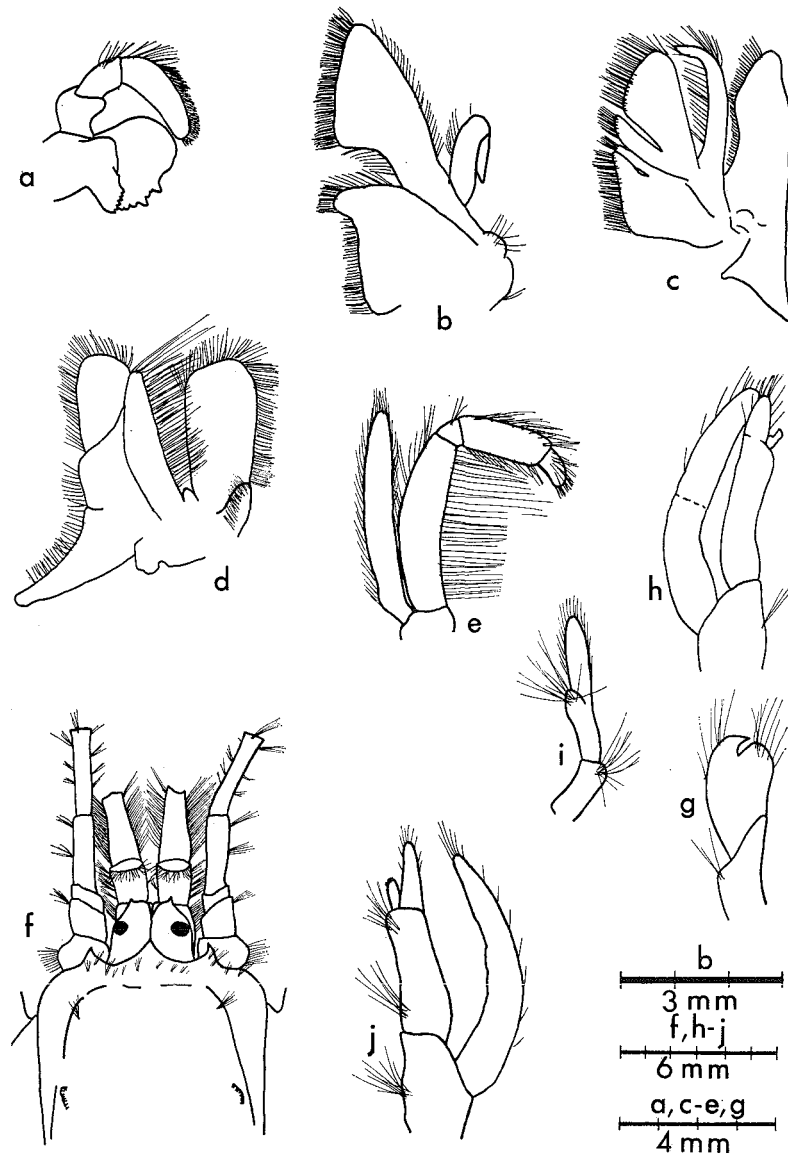


FIGURE 19. *Callianassa rathbunae* (composite from type-material): a, mandible; b, first maxilla; c, second maxilla; d, first maxilliped; e, second maxilliped; f, dorsum; g, male first pleopod; h, male second pleopod; i, female first pleopod; j, female second pleopod.

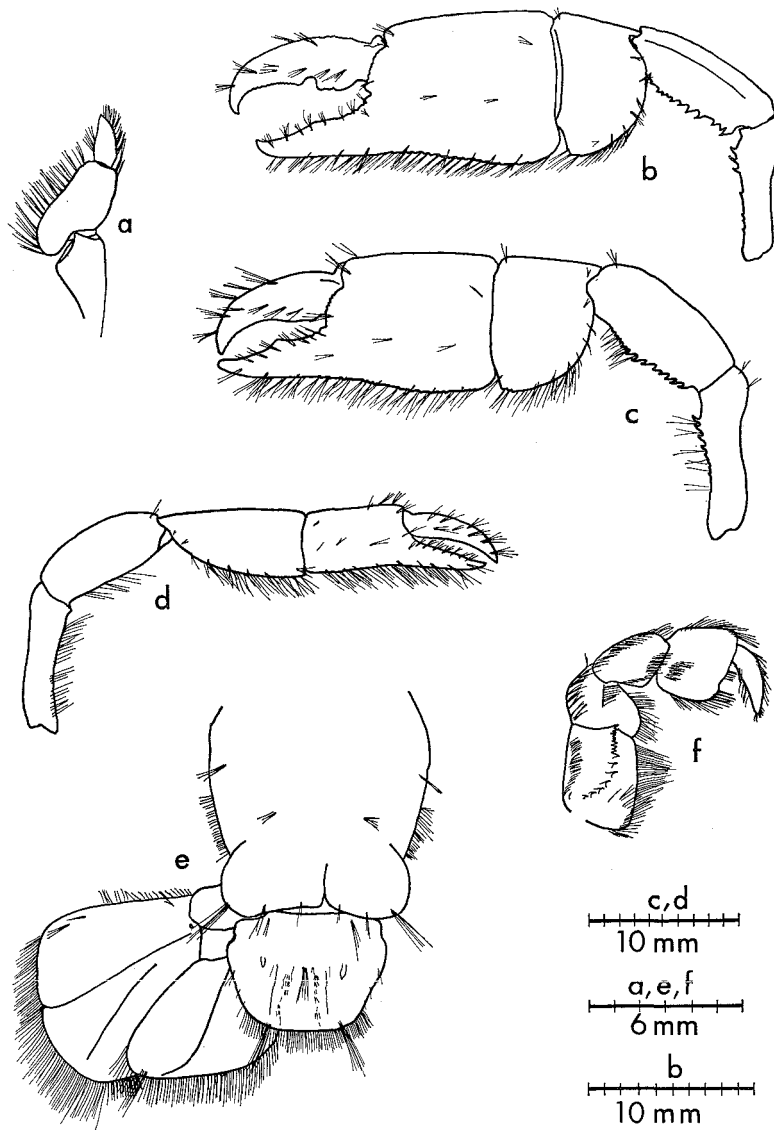


FIGURE 20. *Callianassa rathbunae* (composite from type-material): a, P3; b, male large cheliped; c, female large cheliped; d, small cheliped; e, tail fan; f, third maxilliped.

areas with two or three central tubercles. Eyestalks about as long as first antennular segment, sometimes extending slightly beyond, length 1.38-1.56 times width, lateral margin slightly concave, convex distolaterally, mesial margins not contiguous, diverging, broadly rounded, mesiodistal projection acute or rounded, curving outward, projection small and on dorsal surface in largest specimen; pigmented area midlateral, small, covering 0.1 of exposed dorsal surface of eyestalk.

Third antennular segment 1.64-1.86 times length of second segment, 0.7-0.9 times length of fourth antennal segment. Fourth antennal segment 1.01-1.3 times length of fifth segment. Antennal flagellum 2.4-3.0 times length of antennular. Second antennular segment with scattered mesial setation, moderately dense setation laterally, distal end of segment reaching to 0.22 length of fourth antennal segment. Third antennular segment with moderate mesial setation, dense laterally, segment extending almost to, or just beyond, proximal end of fifth antennal segment.

Mandible with 5-6 irregular rounded teeth in incisor process, 5-6 subacute teeth ventrally on molar process, one tooth sometimes above, and separated from, others. First maxilla with small rounded lobe on coxal endite rounded distally. Exopod of second maxilliped extending slightly distally, acute, narrowly rounded laterally, exopod with mesial lobe, basal endite rounded distally. Exopod of second maxilliped extending slightly beyond first segment of endopod. Merus and ischium of third maxilliped not expanded, combined length 2.1-2.33 times greatest width, spinous crest on mesial surface of ischium with 10-13 spines, 5-9 free spines proximally; propodus expanded, width 0.98-1.12 times width of merus; width of dactylus 0.23-0.26 times width of propodus.

Large cheliped sexually dimorphic. Cheliped of male as follows: ischium with 7-14 projections on ventral margin, projections spinous distally, denticulate proximally. Length of merus 2.15-2.6 times width, dorsal margin smooth, ventral margin with 10-12 spinous projections, strongest spine proximally, proximal spines sometimes angular, directed distally. Length of carpus 0.5-0.64 times width, 0.57-0.6 times length of merus, ventral margin serrate mesially except for three or four serrations disto-ventrally. Palm longer (1.67-2.3) than carpus, about as long (0.94-1.12) as wide, ventral margin serrate, serrate distally along articulation with dactylus, dorsal margin serrate distally, mesial surface with calcified blisters proximal and ventral to notch between fingers. Propodal finger narrow, weakly serrate proximally, no major dentition, hint of central triangular tooth. Dactylus about as long (0.95-1.14) as palm, extending beyond propodal finger, cutting edge with proximal, truncate serrate tooth, central notch, distal serrations.

Cheliped of female similar. Ischium with 14 projections, spinous distally, denticulate proximally, merus with 14, proximal spines of merus weaker

than in male. Length of carpus 0.67 times length of merus, 0.8 times own width. Palm longer (1.44) than carpus, longer (1.12) than wide, propodal finger wider than that of male, central triangular tooth stronger, five rounded serrations proximally. Dactylus shorter (0.9) than palm, extending about as far as propodal finger, cutting edge irregular, hint of rounded tooth proximally.

Small cheliped lacking spination on ischium and merus, ischium inconspicuously serrate proximally, carpus and propodus lacking serrations. Length of merus 2.3 times width. Carpus elongate, length 1.1-1.2 times length of merus, 2.12-2.25 times width of carpus. Length of palm 0.67 times length of carpus, 1.4 times width of palm, propodal finger straight, weakly serrate proximally. Dactylus just longer (1.0-1.15) than palm, cutting edge entire.

Chela of P2 with symmetrical fingers, margins of palm convex. Propodus of P3 bilobed, rounded, narrow posterior lobe. P4 weakly subchelate, P5 chelate. Branchial formula as in *C. acanthochirus*, rudimentary gill on second maxilliped.

A1 indistinctly divided by transverse groove. A2 with well-developed posterolateral expansion extending over part of A3. Lateral margins of A6 bilobed, anterior lobe including anterior 0.75 of somite, lateral margin convex, posterior lobes rounded.

Telson wider (1.22-1.33) than long, widest in anterior third, lateral margins bilobed in anterior third, straight or inconspicuously concave distolaterally, posterior margin more or less straight, fringed with hairs, dorsal surface of telson with central depression, distinct ridges on either side, series of tufts of setae mesially on ridges, posterior corners with fringe of elongate setae.

First pleopod of male uniramous, two-segmented, distal segment broad with acute outer lobe curving over rounded inner lobe. Second pleopod of male biramous, exopod bladelike, endopod two-segmented; proximal segment bladelike, rounded distally, distal segment fingerlike, articulating mesiodistally, hooks at tip. First pleopod of female uniramous, two-segmented, distal segment thick proximally, bladelike, rounded distally. Second pleopod of female biramous, exopod bladelike, rounded distally, endopod three-segmented; second and third segments articulating at same level, second segment subtriangular, third segment fingerlike with distal hooks. *Appendix interna* of third through fifth pleopods subtriangular with hooks along mesial margin.

Endopod of uropod rhomboid, extending beyond telson, rounded distolaterally, distal margin fringed with fine setae, tuft of elongate setae and series of short, strong setae distolaterally, distinct dorsal ridge present. Exopod of uropod slightly longer than endopod, rounded. Upper exopodal plate about as long as lower, dense fringe of setae distally. Suture distinct.

Lower exopodal plate fringed with fine setae, stronger setae mesiolaterally, one inconspicuous basal spine present.

Color.—Thorax dark blue-black internally (exclusive of gut), abdominal somites light pink. Telson, uropods, chelipeds, and dorsal surface of pereopods light pink. Antennal and antennular flagellae red. Third maxilliped dull orange-brown.

Range.—Miami; Jamaica (Schmitt).

Type-Locality.—Bluefields, Jamaica.

Type.—USNM 23010.

Discussion.—This represents only the second record for the species and the first report of a female. *Callianassa rathbunae* closely resembles *C. guasutunga* as noted previously under the discussion of the latter species.

Remarks.—An Army Corps of Engineers' dredging project to counteract beach erosion on one of Miami's beaches apparently disrupted a segment of sand flat-grass bed habitat which had been inhabited by a large number of *Callianassa*. Many specimens were washed ashore in the area of the dredging, and others were piped ashore along with the other dredged material. The vast majority of the inhabitants of the area, judging solely by the material available on the beach, were *C. branneri*. Of about 40 specimens taken, only the two specimens of *C. rathbunae* were found.

Callianassa trilobata Biffar

Figs. 21, 22

Callianassa trilobata Biffar, 1970: 36, fig. 1.

Material Examined.—SOUTHEASTERN FLORIDA: Miami, Matheson Hammock Park, sand beach, T. Biffar, summer 1967; 4 spec. (2 ovig. ♀♀), destroyed.—Miami, Fair Isle, beach, T. Biffar, summer 1967; 1 chela, destroyed.—Miami, Virginia Key, Bear Cut beach, R. Manning, 12 April 1959; 1 ♀, 66 mm, USNM 128790.—Biscayne Bay, H. L. Clark, March-April 1937; 1 juv., 35.5 mm, MCZ 9697.

SOUTHWESTERN FLORIDA: Tampa Bay, SW of Bayboro Harbor, 2-4 m, R. Stokes, 16-17 January 1968; 2 ♀♀, 77 and 80.5 mm, EJ-68-1 (FBCML).—Tampa Bay, off Bayboro Harbor, 2.5-3.5 m, Stokes and Lyons, 22 February 1968; 1 ♀, damaged, EJ-68-7 (FBCML).—Tampa Bay, off Pinellas Point, 2-3 m, R. Stokes, 18 January 1968; 8 ♀♀, 39.5-77.5 mm, 1 ♂, 76 mm (Holotype), 1 juv., damaged, EJ-68-2 (FBCML).—Lemon Bay (off Englewood), S.S. (Zoo. Res. Supply, Englewood, Florida), March 1937; 1 ♀, 55 mm, USNM 128791.

Diagnosis.—Front with three low, rounded projections. Telson trilobed laterally, much wider than long. Large cheliped of male with triangular ventral keel on merus. Eye of fresh specimen with white spot in center of pigmented area.

Description.—Pair of transverse rows of hair tufts on either side of midline in dorsal oval halfway from midline to *lineae thalassinicae* at level of incurving of cervical groove, single pair of tufts at center of oval, one on either side of midline. Dorsal carapace posterior to cervical groove elevated along midline, strongly convex. Rostrum and lateral projections short, rounded triangles. Rostrum 0.17 times length of eyestalks. Lateral projection adjacent to lateral margin of eyestalk, extending 0.5 times rostral length. Eyestalks flattened, not reaching tip of first antennular segment, length 1.45-2.0 times width, lateral margins slightly convex, distal margins convex, lacking distal projections, mesial margins contiguous along entire length; pigmented area central, subterminal, slightly convex, elongate longitudinally, covering about 0.5 of exposed dorsal surface of eyestalk, cornea small, in anterior quarter of pigmented area, covering about 0.2 of pigmented area.

Third segment of antennule 1-1.4 times length of second segment, 0.6-0.9 times length of fourth antennal segment. Fourth antennal segment 1.25-1.85 times length of fifth segment. Antennal flagellum 2.5-4.3 times length of antennular. Second segment of antennule reaching 0.6 length of fourth antennal segment. Third antennular segment to 0.25 fifth antennal segment. Third antennal segment with rounded distolateral projection, scattered elongate setae laterally. Second and third segments of antennule with dense rows of elongate setae laterally, moderately dense mesially.

Palp of mandible with elongate, curved second segment, incisor process with 16-18 acute teeth of varying sizes extending along entire margin, molar process bifurcate ventrally, tips acute, remainder of process entire. Basal endite of first maxilla slightly expanded distally, margin rounded, coxal endite with broad, rounded distal lobe, mesial margin straight. Basal endite of first maxilliped narrow, rounded distally, exopod broad, indentation on mesial margin, epipod rounded distally, broadly rounded laterally. Second maxilliped with exopod longer (1.5) than first segment of endopod. Merus and ischium of third maxilliped wide, combined length of both segments 1.5-2.0 times greatest width, dorsal and ventral margins of ischium converging proximally, lacking spinous ridge distally on mesial surface, 3-5 proximally directed free spines proximally; propodus expanded, width 0.73 times width of merus, with small rounded lobe distoventrally; width of dactylus 0.25 times width of propodus.

Ischium of large cheliped of male wider distoventrally, ventral margin with series of subacute denticles, smallest proximally. Length of merus

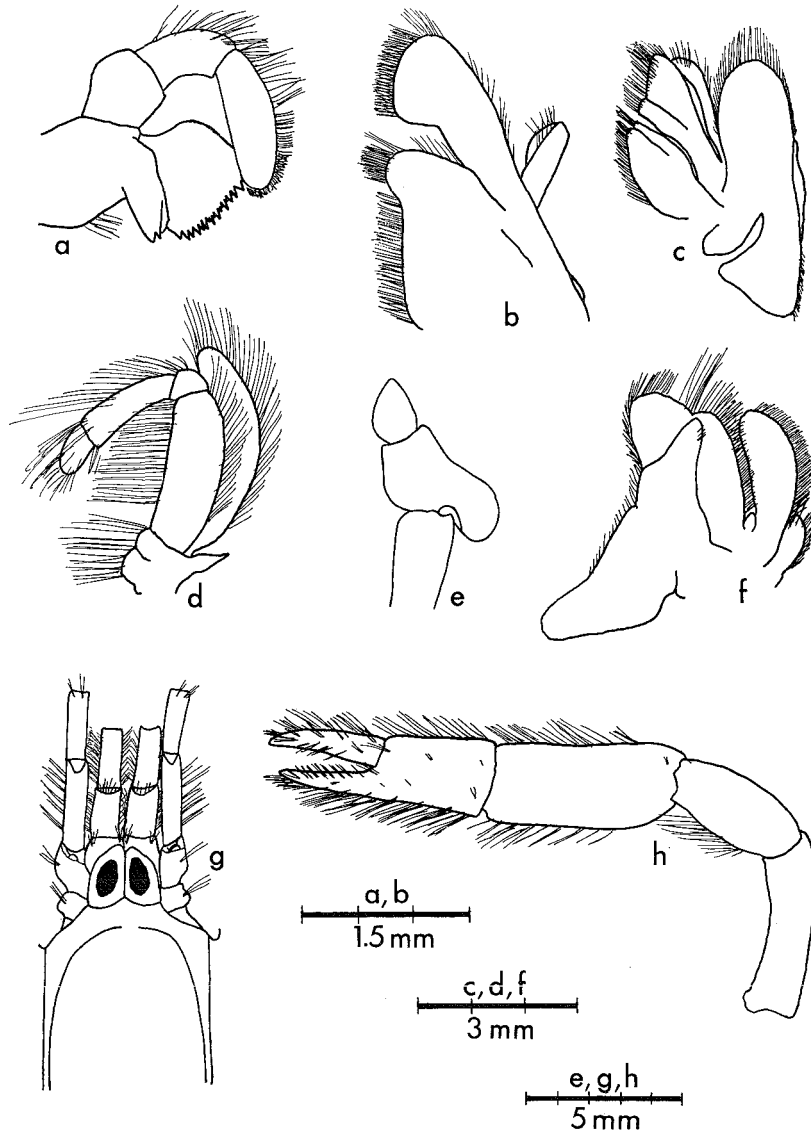


FIGURE 21. *Callianassa trilobata* (composite from type-material): a, mandible; b, first maxilla; c, second maxilla; d, second maxilliped; e, P3; f, first maxilliped; g, dorsum; h, small cheliped.

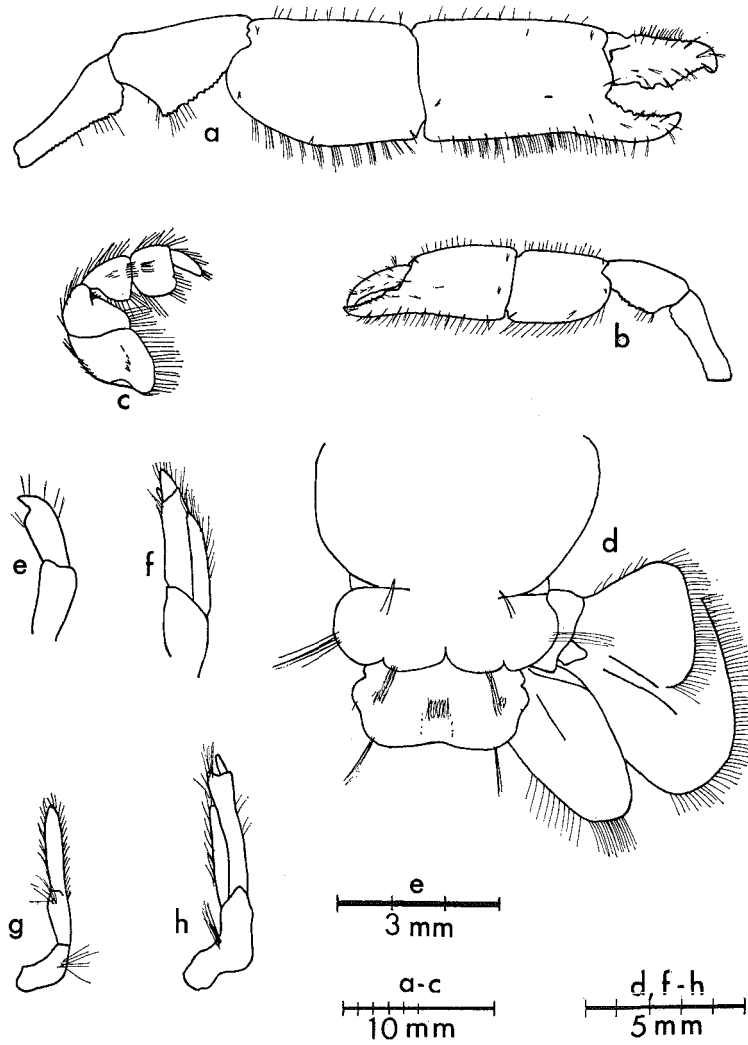


FIGURE 22. *Callianassa trilobata* (composite from type-material): a, male large cheliped; b, female large cheliped; c, third maxilliped; d, tail fan; e, male first pleopod; f, male second pleopod; g, female first pleopod; h, female second pleopod.

1.6-1.8 times greatest width, proximal end of dorsal margin raised, with inconspicuous rounded denticles, ventral margin expanded, forming triangular keel, concave and entire proximally, remainder of margin with strong subacute serrations. Length of carpus 1-1.1 times length of merus, carpus width 0.75-0.95 times length, wider medially due to convex posterior margin, ventral margin of carpus inconspicuously serrate mesioventrally, serrations separated by short fringes of setae. Length of palm 1.35-1.6 times width, 1.2-1.4 times length of carpus, ventral margin serrate mesially. Propodal finger subacute, curving slightly inward, cutting edge with several acute triangular teeth proximally, rounded serrations on remainder of edge, series of blisters running along mesial surface of finger. Length of dactylus 0.5 times length of palm, cutting edge with two irregular, truncate teeth proximally, series of rounded serrations distally, internal surface with series of blisters interspersed with tufts of hair, dorsal margin similar, blisters more acute.

Ventral margin of ischium of large cheliped of female with several inconspicuous denticles. Length of merus 1.5-2.0 times width, dorsal margin convex, ventral keel present, not as strong as in male, fewer denticles on margin distally. Length of carpus 0.9-1.1 times length of merus, length of carpus 0.9-1.3 times width, ventral margin entire. Palm longer (1.05-1.55) than carpus, longer than wide (1.02-1.4), ventral margin entire. Propodal finger blistered on mesial surface below cutting edge, cutting edge with proximal series of small triangular teeth, strong triangular tooth proximal to midpoint of edge, distal series of rounded serrations. Small triangular tooth in notch between fingers. Dactylus narrow, curving inward, length 0.65-0.95 times length of palm, low serrate ridge running transversely across cutting edge proximally, remainder of edge straight, inconspicuously serrate, mesial surface with scattered blisters, dorsal margin lacking blisters found in male.

Ischium of small cheliped lacking ventral serrations. Merus with convex dorsal margin, ventral margin lacking keel or denticles. Carpus narrow, length 2.5 times width. Palm shorter than carpus, narrowing distally. Propodal finger long, narrow, cutting edge inconspicuously serrate. Dactylus straight, narrow, cutting edge entire.

Fingers of P2 short, propodal finger broader than dactylus, palm convex. Propodus of P3 bilobed, proximal lobe wide, rounded, ventral margin concave. P4 subchelate, P5 chelate. Branchial formula as in *C. acanthochirus*, second maxilliped with rudimentary gill.

Abdomen elongate, well developed. A1 divided by transverse dorsal ridge, anterior 0.2 of somite narrow, rounded anteriorly, posterior area widening toward posterior margin. A2 wider than first somite, lateral integument strong, expanded posteriorly forming rounded lobe. Well-developed fringe of hair on posterolateral margins of A3 and A4, length

of each fringe 0.25 times somite width. Fringe on A5 midlateral. Lateral margin of A6 distinctly bilobed by strong transverse groove separating anterior three-quarters from posterior quarter, lateral margin of anterior lobe inconspicuously bilobed with indentation in anterior third, posterior lobes rounded.

Telson distinctly wider (1.14-1.6) than long, lateral margins trilobed; two small lobes in proximal third, larger posterior lobe including posterior corners, posterior margin concave centrally, dorsal surface of telson with depression posterior to fringe of setae, shallow concavity within circle defined by second lobe of lateral margin.

First pleopod of male uniramous, two-segmented, distal segment with acute tip, rounded prominence distomesially. Second pleopod of male biramous, exopod bladelike, acute at tip, endopod three-segmented; first segment of endopod bladelike, wider than exopod, second segment triangular with acute distal tip, third segment small, elongate, articulating mesially at level of second segment. First pleopod of female uniramous, two-segmented, distal segment thick at base, bladelike distally. Second pleopod biramous, exopod narrow, bladelike, endopod two-segmented; first segment bladelike, narrowly rounded at distal tip, second segment small, fingerlike, articulating mesiodistally. *Appendix interna* of third through fifth pleopods subtriangular in outline, hooks located along mesial surface.

Endopod of uropod elongate oval, length 1.6-1.8 times width, more than two times length of telson, extending well beyond distal margin of telson, narrowing distally, fringe of fine setae on mesial margin, denser fringe at distal tip, median ridge on dorsal surface extending only halfway to posterior margin. Exopod of uropod slightly longer than endopod, very broad. Upper exopodal plate 0.6 times length of lower plate, wide distally, heavily fringed, series of strong setae mesiodistally. Suture distinct. Lower exopodal plate longest mesially, with dense fringe of setae, ridge adjacent to suture extending just beyond distal margin of upper plate, single small basal spine present.

Color.—Entire animal white. Eye of fresh specimen with white spot in center of pigmented area.

Range.—Miami (Biffar), Tampa Bay (Biffar), and Lemon Bay, Florida.

Type-Locality.—Off Pinellas Point, Tampa Bay, Florida, 2-3 m.

Type.—USNM 135050.

Remarks.—In the Miami area, this species has been found just above low water on large-grain, sandy beaches which have a high content of organic detritus, much of it being the remains of mangrove roots. In Tampa Bay,

C. trilobata has been collected sublittorally to a depth of 4 meters. The lining of the burrow is rather thick when compared to that of other species in south Florida, and the cylinder will remain intact when freshly exposed. Although only cursory observations have been made, the burrows do not appear to be as complex as those of some other species. Instead, they are largely vertical tunnels.

SUMMARY

A study of the callianassid fauna in south Florida revealed the presence of ten species. Only *Callianassa branneri* (Rathbun) and *C. acanthochirus* (Stimpson) had been reported from this area prior to the commencement of this study. Three new species, *C. trilobata*, *C. fragilis*, and *C. quadracuta*, were discovered and reported earlier (Biffar, 1970). Other species not previously reported from south Florida are *C. marginata* Rathbun, *C. latispina* Dawson, *C. longiventris* A. Milne-Edwards, *C. rathbunae* Schmitt, and *C. guassutunga* Rodrigues. New records for these species from outside the study area are also included.

Nine species of *Callianassa* found in south Florida have also been reported from various areas of the Caribbean. The tenth species has not yet been found outside south Florida. These same species, with the exception of *C. branneri* in Bermuda and *C. latispina* from Grand Isle, Louisiana, range only as far north as south Florida. Unfortunately, because only scattered records are available for most western Atlantic species, it is not yet possible to define clearly their distributions.

The keys provided allow identification of 19 western Atlantic species of *Callianassa*. *Callianassa occidentalis* Bate and *C. grandimana* Gibbes could not be included in the keys, but the latter species is discussed extensively. It appears to be very close to *C. branneri*. A second questionable species, *C. siguanensis* (Boone), is synonymized with *C. branneri*.

More extensive collecting of these animals is needed to increase our knowledge of their specific diversity and intraspecific variation, as well as the extent of any given species' distribution. It is quite probable that a number of new species will be discovered as interest in the group grows.

SUMARIO

EL GÉNERO *Callianassa* (CRUSTACEA, DECAPODA, THALASSINIDEA) EN EL SUR DE LA FLORIDA, CON CLAVES PARA LA IDENTIFICACIÓN DE LAS ESPECIES DEL ATLÁNTICO OCCIDENTAL

Un estudio de la fauna de callianassidos en el sur de la Florida reveló la presencia de diez especies. Sólo *Callianassa branneri* (Rathbun) y *C. acanthochirus* (Stimpson) habían sido reportadas en esta área con anterioridad al inicio de este estudio. Tres nuevas especies, *C. trilobata*, *C. fragilis*

y *C. quadracuta*, fueron descubiertas y reportadas previamente (Biffar, 1970). Otras especies que no habían sido previamente reportadas en el sur de la Florida son: *C. marginata* Rathbun, *C. latispina* Dawson, *C. longiventris* A. Milne-Edwards, *C. rathbunae* Schmitt y *C. guassutiŕga* Rodrigues. También se incluyen nuevos reportes de estas especies fuera del área de estudio.

Nueve especies de *Callianassa* encontradas en el sur de la Florida han sido también reportadas en varias áreas del Caribe. La décima no ha sido aún encontrada fuera del sur de la Florida. Estas mismas especies, con la excepción de *C. branneri* en Bermuda y *C. latispina* de Grand Isle, Louisiana, lo más al norte que llegan en su distribución geográfica es hasta el sur de la Florida. Desafortunadamente, debido a que sólo hay disponibles reportes aislados para la mayoría de las especies del Atlántico occidental, no es aún posible definir claramente sus distribuciones.

Las claves que se dan permiten la identificación de 19 especies de *Callianassa* del Atlántico occidental. *Callianassa occidentalis* Bate y *C. grandimana* Gibbes no pudieron ser incluidas en las claves, pero la última de estas especies es ampliamente discutida. Parece estar muy próxima a *C. branneri*. Una segunda especie dudosa, *C. siguanensis* (Boone), se hace sinónima de *C. branneri*.

Se necesita una colección más extensa de estos animales para aumentar nuestros conocimientos de su diversidad específica y variación intraespecífica, así como la extensión de la distribución de cualquier especie dada. Es probable que un buen número de nuevas especies sean descubiertas a medida que aumente el interés en el grupo.

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NOTE ADDED IN GALLEY: After this publication had gone to press, I received a copy of the formal publication of Rodrigues's dissertation. Because the work is a valuable one and it is now more readily available than the dissertation itself, the citation is given here.

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