

FIGURE 9.—*Upogebia bermudensis*, new species, MCZ 12873, ♂ holotype: *a*, cephalic region, lateral; *b*, anterior carapace, dorsal; *c*, cheliped, right lateral; *d*, chela and carpus, left mesial; *e-g*, legs 2-4; *h*, parts of abdominal segment 6, telson, and uropods, dorsal. (Scales = 1 mm: 1 = *a, c-g*; 2 = *b*; 3 = *h*.)

known to occur there. The new species resembles *U. pillsbury*, new species, described herein from the Gulf of Darien in the southwestern Caribbean Sea, in general features of the carapace, the antennular and antennal peduncles, chelipeds, and telson overreached by uropods, but it is far less spiny. The merus of P2 lacks a proximoventral spine, whereas this spine is

present in *U. pillsbury*. There is also a tremendous difference in size, *U. bermudensis* being tiny by comparison with *U. pillsbury*, although *U. bermudensis* may be immature; the eyes, for example, are large in relation to body size, which may be a juvenile condition.

Mouthparts of the tiny unique holotype have not been

dissected because I hesitate to risk damaging it. Mxp3 apparently has no minute epipod, agreeing in this respect with *U. spinistipula*, which lacks this feature, and it is presumed that the other mouthparts probably fit the standard upogebian pattern as do mouthparts of that species and *U. pillsbury*. The branchial apparatus appears to fit the generic pattern. For other comparisons, see the "Remarks" for *U. pillsbury*.

ETYMOLOGY.—Named for the island of origin.

### *Upogebia brasiliensis* Holthuis, 1956

#### FIGURE 10

*Upogebia brasiliensis* Holthuis, 1956:175, figs. 1, 2.—Gomes Corrêa, 1968:97–109, figs. 22–27, 32, 33 [comparisons].—Ngoc-Ho, 1979:147, 151–153, figs. 3a,b [comparisons, distrib., Georgetown, Guyana, not Esmeraldas, Ecuador].—Coelho and Ramos-Porto, 1987:35 [key, distrib.].—Coelho and Rattacaso, 1988:383 [N and S of Pernambuco but not within].

*Upogebia (Upogebia) brasiliensis*.—Coelho, 1971:231 [habitat].

MATERIAL EXAMINED.—BELIZE: USNM 251424, 1 ♂ (juv.), halfway between Salt Creek and Colson Pt., 1 m, 33°C, 34 ppt, M.L. Jones, sta CB-40A, 16 May 1977.

SURINAM: USNM 251194, ♂ cephalothorax, 1 ♀ ovig., Clevia water side [5°52'N, 55°09'W], R.C. Gongryp.

FRENCH GUIANA: MNHNP Th-517, 1 ♂, 1 ♀, Golfe de Cayenne [mouth of Rivière de Cayenne], F. Geay.

BRAZIL: *Bahia*: MZUSP 8954, 1 ♂, Itaparica, 18 Aug 1970; USNM 251195, 1 ♀ ovig., Prado Praia do Torora, intertidal, M.L. Christoffersen, 12 Oct 1982. *Paraná*: MZUSP (unnumbered), 2 ♂, 8 ♀ (6 ovig.), Antonina, Ponta de Pita, under rocks with mud, R.D.D., 26 Feb 1970. *Santa Catarina*: USNM 152479, 2 ♂, 2 ♀ ovig., São Francisco (also labeled Rio de Janeiro), W.L. Schmitt, sta 47, 30 Oct 1925; USNM 251196, 22 ♀, Ponta da Cruz, São Francisco, littoral in soft granite, W.L. Schmitt, sta 45 and 46, 28 and 29 Oct 1925; USNM 251197, 78 ♂, same; USNM 251198, 76 ♀ ovig., same.

DIAGNOSIS.—Projections to either side of rostrum ending in acute spine. Postocular spine present. Abdominal sternites unarmed; AVI with anterolateral lobe, but lacking hooked anterolateral spine. T subrectangular. Carpus of cheliped with 2 strong spines on anteromesial margin. Merus of P2 without proximal mesioventral spine, but with subdistal dorsal spine; merus of P4 spineless.

DESCRIPTION.—Rostrum triangular, broader at base than length of sides, usually straight in lateral view; tip usually exceeding eyestalks in male but often exceeded by eyestalks in mature female; dorsal pair of strong apical spines followed on each side by 2, rarely 3, spines of nearly equal size; posteriorly divergent lateral ridge bearing crest of about 12 rather blunt-tipped spines, spine on process lateral to rostrum followed first by 4–7 rather strong spines, remainder abruptly decreasing and diminishing almost to obsolescence posteriorly. Shoulder lateral to cervical groove almost never ornamented, very rarely bearing 1 or 2 obsolete tubercles or spines below

intersection with thalassinidean line, latter continuing to posterior margin. Postocular spine present, rarely doubled.

Abdominal sternites unarmed.

T bearing prominent transverse proximal ridge confluent with longitudinal ridge at each side.

Eyestalk stout, occasionally with small subterminal spine mesially or with minute tubercle on upper surface near cornea; cornea narrower than diameter of stalk, directed anterolaterally.

A1 peduncle reaching to about base of terminal article of A2 peduncle, its proximal 2 articles together about as long as terminal article.

A2 peduncle with about  $\frac{1}{2}$  its length extending beyond tip of rostrum; articles spineless; scale moderate, oval, sometimes ending in minute point.

Mxp3 with small epipod.

Epistomial projection rather broad in lateral view, bearing 1 apical projection.

Chelipeds massive. Coxa unspined on mesiodistal margin. Ischium bearing 1 ventral spine or tubercle. Merus with row of 1–5 (rarely 6) short spines on ventral margin, subdistal dorsal spine (rarely doubled) reaching level of postocular spine. Carpus trigonal, shallow longitudinal groove laterally; 0–1 small spine at anterior ventrolateral corner, occasionally preceded by 1 or more smaller spines in male; mesiodorsal crest of 1–5 almost uniform small spines behind variably prominent spine on anterior margin, partly obscured by setae in proximal part of row, and 1–4 short spines obscured by setae on anterodorsal margin mesial to articulation with propodus; 1 moderately strong spine near middle of anteromesial margin, and often a smaller spine dorsal to it; very strong spine below at distoventral corner. Chl about 2.3–3.2 times chh; obsolescent spineless dorsal ridge terminating anteriorly near usually obsolescent subdistal spine (often missing) mesial to it; mesiodorsal row of small spines becoming obsolescent at about  $\frac{1}{3}$ – $\frac{1}{2}$  (rarely  $\frac{2}{3}$ ) length, spines in entire row irregular and often obsolescent; 1–2 distomarginal spines below lateral dactylar condyle and 1–4 below mesial one (spines often obsolescent); lower mesial palmar surface bearing transversely arcuate low ridge near proximomesial corner. Fixed finger usually almost as long as dactyl, slightly downcurved in middle and tapering to slender tip, 3–5 teeth on proximal prehensile edge (tip often broken off in preserved samples). Dactyl in male with corneous tip preceded on prehensile edge by subdistal tooth (often worn) and row of closely crowded moderate but irregular teeth increasing proximally to larger tooth in first  $\frac{1}{4}$  of length, basal section toothless; corneous tip in female preceded on prehensile edge by strong subdistal tooth opposing tip of fixed finger, section proximal to this bearing about 4–7 closely set small teeth increasing proximally, then large tooth often standing alone at  $\frac{1}{4}$  length, basal section toothless; curved extensor surface bearing about 3–4 small tubercles proximally, mesiodorsal surface bearing files of pearliform tubercles diminishing distally, 2 rows in adult male, 1 in adult female.

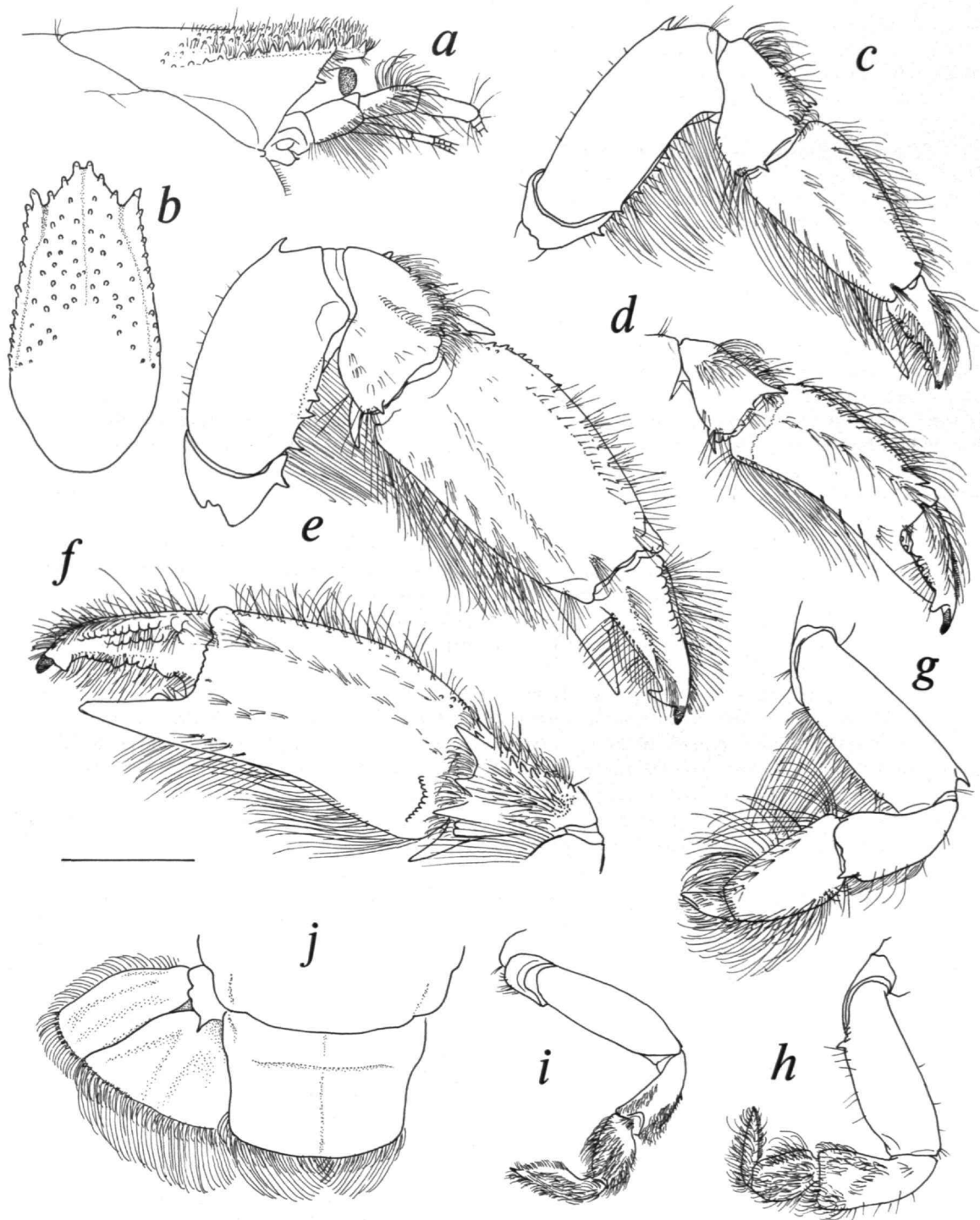


FIGURE 10.—*Upogebia brasiliensis* Holthuis (*a-d, g-j*, USNM 152479, ♀; *e, f*, USP 8954, ♂): *a*, cephalic region, lateral; *b*, anterior carapace, dorsal; *c*, cheliped, right lateral; *d*, chela and carpus, left mesial; *e*, cheliped, right lateral; *f*, chela and carpus, left mesial; *g-i*, legs 2-4; *j*, parts of abdominal segment 6, telson, and uropods, dorsal. (Scale = 3 mm.)

P2 reaching about to distal  $\frac{1}{4}$  of palm; carpus spineless; merus with 1 subdistal dorsal spine and no proximal mesioventral spine. Merus of P3 with cluster of small spines or tubercles ventrolaterally on proximal  $\frac{1}{2}$ , ischium spineless P4 with spineless merus.

U with acute spine on protopod above base of mesial ramus; mesial rib of lateral ramus usually unarmed, bearing at most an obsolescent tubercle proximally, distal margin of both rami bearing more or less evenly spaced granules.

MEASUREMENTS (in mm).—♂, acl 8.3, cl 11.5, chl 9.0, chh 4.0; ♀ ovig., same, 7.7, 10.8, 7.0, 2.6.

COLOR.—Abdomen of most individuals and eggs of ovigerous females bright orange; carapace and central  $\frac{1}{3}$  of median dorsal abdomen slate gray, not so noticeable in field as in white plate some hours after collected, setae on forepart of carapace dirty cream buff; stomach showing, particularly on sides, between slate and indigo; telson mostly transparent; chelae with flush of buff pink or vinaceous pink; legs opaque white (from field notes by W.L. Schmitt, presumably pertaining to the most abundant of two species collected at sta 46, 28–30 Oct 1925, Purdy-Walter Rathbone Bacon Travelling Scholarship).

KNOWN RANGE.—Belize?, Surinam to Santa Catarina, Brazil. The small male from Belize seems to possess characters of the species, but it is from a locality far removed from the continuous distributional range of the species. I place it provisionally in *U. brasiliensis* until its identity can be confirmed by more material from the area.

REMARKS.—There is little doubt that *Upogebia brasiliensis* and *U. macroryae* Williams of the eastern Pacific tropical Panamic Province are geminate species. Williams (1986) pointed out that the main difference between the two is the presence in *U. macroryae* of a row of obsolescent tubercles on the shoulder paralleling the cervical groove below the thalassinidean line, and lack of these tubercles in *U. brasiliensis*. Now that a large series of the latter has been studied, this difference is emphasized, although within that series there is one ovigerous female among 76 that shows the tubercles developed and another has 3 spines on that shoulder. There are other sometimes subtle differences. *Upogebia brasiliensis* attains a larger size at maturity than does *U. macroryae*. The rostrum in *U. macroryae* is more downcurved than in *U. brasiliensis* and the subterminal pair of spines tends to be widely separated from the succeeding pair, whereas the marginal spines on the rostrum of *U. brasiliensis* are evenly distributed in most specimens, although a few, mainly males, resemble *U. macroryae* in reduced degree with respect to this character.

*Upogebia brasiliensis* is highly variable in other respects. The rostrum of mature females is short and often is exceeded by the eyes, whereas the eyes of *U. macroryae* rarely exceed the rostrum and usually fall far short of its tip in mature females. The cornea of *U. brasiliensis* varies in size from usually as broad as the eyestalk to approximately  $\frac{1}{2}$  as broad. The postorbital spine may be asymmetrically doubled, and in an

ovigerous female from Surinam, USNM 251194, this spine is doubled on each side. Occasional doubling of the subdistal dorsal spine on the merus of the cheliped, even tripling of this spine on one ovigerous female from São Francisco, has been observed. The carpus of the cheliped usually bears a dorsal row of spines behind the prominent distodorsal spine in males, whereas females have few spines in this row, and often none at all; the spine on the anterior ventrolateral corner, usually lacking in females, is often strong in males and preceded by 1 or more spines; finally, the 2 spines on the distomesial carpal margin vary in size, usually short and often absent, but the upper and usually smaller of the pair may be doubled, and the lower larger one more rarely may be doubled also. I have not seen both of these spines doubled on the same individual (4 spines).

The palm of the chela in *U. brasiliensis* rarely has the dorsal obsolescent spineless ridge broken up into low spines, and there is considerable variation in the length of the mesiodorsal row of spines paralleling it. The mesial face of the palm in large individuals bears scattered tubercles, and the curved low ridge near the "heel" of the palm often bears 1–3 (very rarely 4) small short spines; rarer still, large males sometimes have 1–4 spines on the ventral heel of the palm near the aforementioned low mesial ridge. Although it is not a specific character, the distal part of the long slender fixed finger is often broken off in material examined, and there is an unusually high proportion of broken fixed fingers and dactyls that show the effects of wear after injury.

In his field notes, W.L. Schmitt recorded finding two specimens of *Upogebia* at Ponta da Cruz near São Francisco, Santa Catarina, sta 27, 7 Oct 1925, in soft granite. After field collecting at inland stations, he returned to this site "to get some pictures and found such a number and excellent chance to study [*Upogebia brasiliensis* except for 3 specimens of *U. omissa*, see under that species] that I have decided to spend a couple of days." He chopped open much soft rock, collected many specimens (see "Material Examined"), and gave a fairly concise summary of upogebioid biology as now understood. In one exposed triangular section of substrate, about a foot (30 cm) on a side, he took 4 pairs (8 specimens) in the upper 6 inches (15 cm). Ovigerous females seemed to be in burrows plugged except for small holes to allow water renewal; outside [above?] the plugs in each burrow was a male. The animals lodged themselves in flooded burrow pockets below the level of vent holes exposed by low tides. The burrows seemed to be occupied for life, for fouling growth around the holes was of long standing. Although exposed animals were good swimmers and quite active in the water, they surely did not leave burrows naturally [habitually?]; he thought they aerated the burrows with a swimming motion, but they could tolerate very stagnant water in which all crabs died. In the lowest part of burrow ramifications was usually a black plug enclosing remains or fragments of one or more dead individuals. The granite in which the animals worked was soft and friable, and Schmitt

wondered if the long finger was the primary digging organ [hence broken tips?]. Finally he asked, "Why do all *Upogebias* have numerous forward pointing spines on the rostrum and broad anterior carapace? Simplest thing in the world; when you try to pull them out of their burrows, they rise up on all 'fours' and push the spines against the top [side?] of the tunnel. You pull the animal to pieces before he comes loose. The harder you pull, the tighter the spines wedge. But if you find the tail sticking out of the burrow when you break it open, it pulls out very easily."

### *Upogebia casis*, new species

FIGURE 11

*Upogebia annae*.—Scott, Reiswig, and Marcotte, 1988:483.

**MATERIAL EXAMINED.**—HONDURAS: USNM 251224, ♂ (holotype), 125 km ENE Cabo Gracias a Dios, 15°15'N, 81°51'W, alcyonarian patch reef with corals and scattered sponges, 18 m, R/V *Pillsbury* sta 1358, 10-ft otter trawl, 1 Feb 1971; USNM 251225, 1 ♀ (allotype), near Cabo de Honduras, 15°29.2'N, 86°02'W–86°04.2'W, rocks, corals, sponges, brachiopods, 35–37 m, R/V *Pillsbury* sta 630, 40-ft trawl, 22 Mar 1968.

JAMAICA: USNM 251226, 1 ♀ ovig., south coast, 17°44'N, 77°47'W, sand, *Halimeda*, inverts. including sponges, 27–29 m, R/V *Pillsbury* sta 1223, 6 Jul 1970; USNM 251227, 1 ♂, 1 ♀, Discovery Bay, forereef, sponge, 48.6 m, P.J.B. Scott, 30 Nov 1984.

DOMINICAN REPUBLIC: USNM 251228, 1 ♂, 20°00'N, 71°41'W, preserved with siliceous sponge, 38 m, R/V *Pillsbury* sta 1148, 5-ft Blake trawl, 15 Jan 1970.

LESSER ANTILLES: RMNH, 1 ♂, 1 ♀ ovig., NE Saba Bank, "Luymes" Saba Bank Exp. sta 124, 17°33'N, 63°22'W, rocky bottom, scattered corals, 24 m, divers, 12 Jun 1972; USNM 251229, 1 ♂ juv., S of Nevis, 17°10'N, 62°38.5'W, algae, corals, 27 m, R/V *Pillsbury* sta 959, 10-ft otter trawl, 19 Jul 1969; USNM 251230, 1 ♂, 1 ♀, NW Antigua on shelf, 17°15.5'N, 62°02.2'W, assorted inverts., 22 m, R/V *Pillsbury* sta 967, 10-ft otter trawl, 20 Jul 1969; USNM 251231, 1 ♂, SW of Dominica, 15°23.3'N, 61°14.1'W, with sponges, 73 m, R/V *Pillsbury* sta 928, 5-ft Blake trawl, 15 Jul 1969; USNM 251232, 1 ♀ ovig. (damaged), W coast Martinique, 14°53.8'N, 61°04.9'W, many inverts, 46 m, R/V *Pillsbury* sta 913, 10-ft otter trawl, 10 Jul 1969.

PANAMA: USNM 7777, 1 ♂, Caribbean Sea near Aspinwall (= Colón), 09°32'N, 79°54'30'W, broken shell, 62.2 m (34 fm), R/V *Albatross* sta 2146, large beam trawl, 2 Apr 1884.

SURINAM: USNM 251233, 1 ♀, 7°19'N, 56°51'W, sponges and inverts, 55–59 m, R/V *Pillsbury* sta 684, 10-ft try net, 14 Jul 1968; USNM 251234, 3 ♂, 1 ♀, 1 juv., same, in sponges, 50–59 m.

**DIAGNOSIS.**—Projections to either side of rostrum ending in acute spine. Postocular spine present. Abdominal sternites

unarmed; AVI with anterolateral lobe but lacking hooked anterolateral spine. T subrectangular. Cheliped merus with subdistal dorsal spine reaching level of postorbital spine; carpus with 2 subequal spines on anterodistal margin. P2 with proximal mesioventral spine on merus reduced to tubercle or absent; merus of P4 spineless.

**DESCRIPTION.**—Rostrum subtriangular, narrow, straight or downturned, tip exceeding eyestalks by at least  $\frac{3}{4}$  again their length; dorsal pair of strong subapical spines followed on each side by 3 strong spines, only about 2 spines mesial to lateral marginal spines, but many setae; lateral ridge parallel to median line in anterior  $\frac{1}{2}$ , then slightly divergent and bowed laterally in posterior  $\frac{1}{2}$ , bearing crest of about 12–14 spines, strongest on process lateral to rostrum and decreasing to tubercles posteriorly. Shoulder lateral to cervical groove bearing 1 or 2 barely perceptible tubercles below intersection with thalassinidean line; latter continuing to posterior margin of carapace. Postocular spine present, rarely doubled.

Abdominal sternites unarmed, terga III and IV with very few setae on posterior margin.

T subrectangular, prominent transverse proximal ridge confluent with broader lateral ridge at each side, distal margin with concavity very shallow.

Eyestalk stout, cornea narrower than diameter of stalk, directed anterolaterally, and with proximolateral margin tending to be subangular rather than rounded.

A1 peduncle reaching as far as midlength of terminal article of A2 peduncle, its proximal 2 articles together slightly longer than terminal article.

A2 peduncle with less than  $\frac{1}{2}$  its length extending beyond tip of rostrum; article 2 bearing tiny subdistal ventral spine; scale moderate, oval with subspinous tip.

Mxp3 bearing epipod.

Epistomial projection rather broadly rounded in lateral view, bearing 1 tiny or 2 subequal apical spines.

Chelipeds with coxa bearing tubercle or variable slender spine on distomesial margin. Ventral margin of ischium bearing tubercle or 1 acute spine distally. Merus with single subdistal dorsal spine reaching level of postocular spine or slightly beyond it; row of 4–8 variably sized and arranged spines on ventral margin. Carpus trigonal, shallow longitudinal groove laterally, with or without small submarginal spine at anterior ventrolateral corner often preceded by 1–3 well-separated obsolescent tubercles; mesiodorsal crest of 1–4 moderate to strong spines behind prominent spine on anterior margin, and sometimes behind these near proximodorsal corner 1–2 small spines at base of ridge extending obliquely across dorsal side of article; 1–3 moderate spines on anterodorsal margin mesial to articulation with propodus; 2 subequal spines near middle of anteromesial margin (and supernumerary small third spine on left carpus of holotype); strong spine at anteroventral corner. Chl about 3 times chh; dorsal ridge obsolescent, distodorsal submarginal spine mesial to it, mesiodorsal row of spines very low and rounded if present,

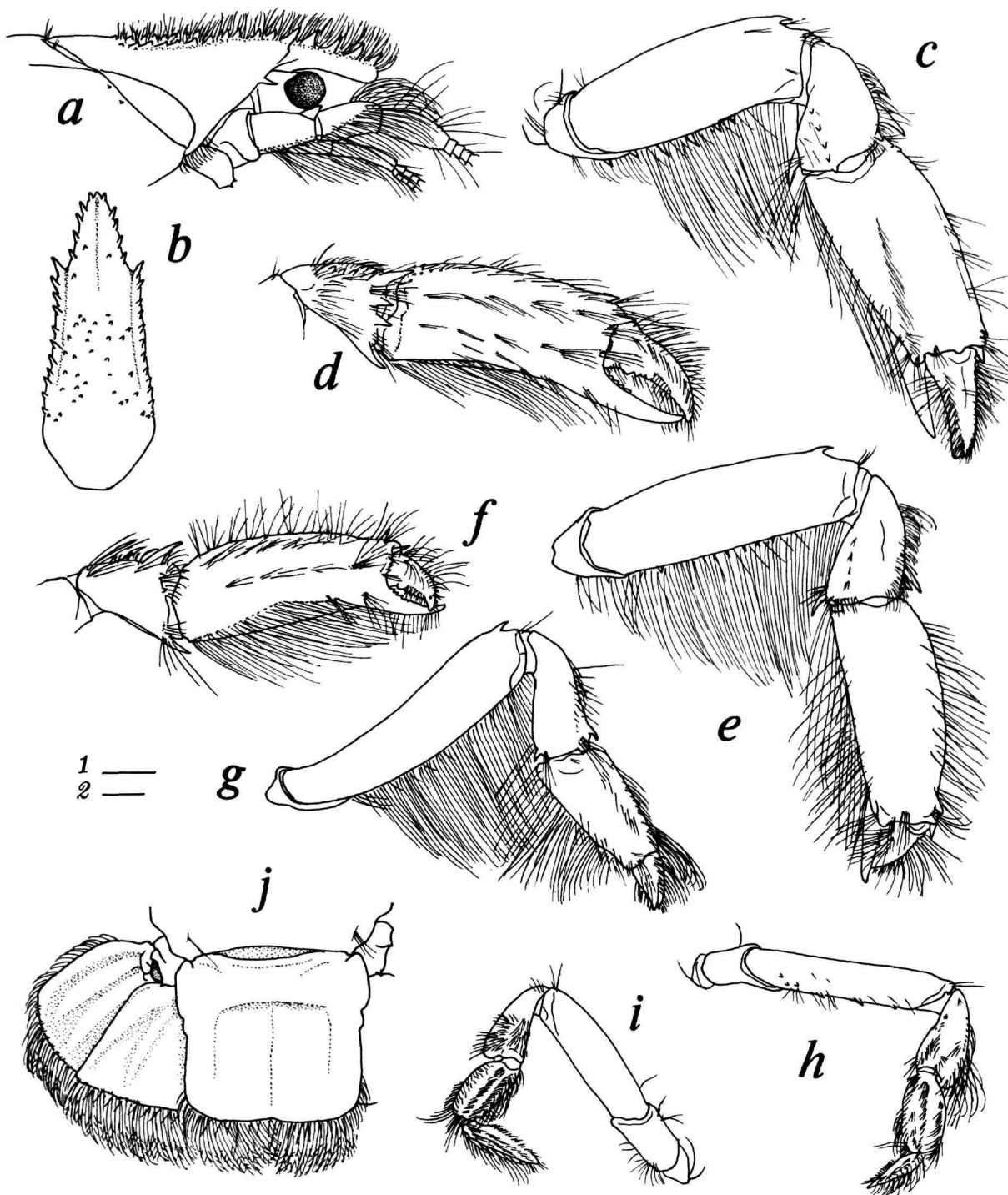


FIGURE 11.—*Upogebia casis*, new species (a-d, g-j, USNM 251224, ♂ holotype; e,f, USNM 251225, ♀ allotype): a, cephalic region, lateral; b, anterior carapace, dorsal; c, cheliped, right lateral, ♂; d, chela and carpus, left mesial, ♂; e, cheliped, right lateral, ♀; f, chela and carpus, left mesial, ♀; g,h (right), i (left), legs 2-4; j, parts of abdominal segment 6, telson, and uropods, dorsal. (Scales = 1 mm: 1 = a; 2 = b-j.)

becoming obsolescent at about  $\frac{3}{4}$  length; variable distomarginal spine below lateral and mesial dactylar condyles, and 0–5 much smaller spines below it on distal margin of palm; mesial surface spineless except for widely scattered obsolescent rugae, each with associated setal tuft; few tubercles proximodorsally and low transversely arcuate ridge near proximomesial corner. Fixed finger nearly as long as dactyl but more slender, slightly downcurved in middle and tapering to moderately slender tip, about 5 small teeth on proximal prehensile edge. Dactyl longitudinally ridged and setose; moderate tooth at  $\frac{1}{4}$  length of prehensile edge preceded by low crest bearing file of fine teeth becoming obsolete near corneous tip, basal section toothless; curved extensor surface sometimes bearing few obsolescent tubercles proximally and worn or tiny subdistal corneous tooth.

Legs elongate and slender. P2 reaching about to distal  $\frac{1}{4}$  of palm; carpus with slender, acute distodorsal spine and similar but smaller subdistal ventral spine; merus with slender subdistal dorsal spine, proximal mesioventral spine asymmetrically absent or reduced to tubercle, and sometimes another tubercle or small spine at  $\frac{1}{3}$  length; coxa with proximomesial ridge, sometimes bearing variable spine. P3 with merus bearing scattered ventral and ventrolateral spines tending to be clustered in proximal  $\frac{1}{2}$ ; ischium unarmed and coxa of male without gonopore, female with flattened low spine lateral to gonopore. P4 with merus and ischium unarmed.

U with tiny acute spine on protopod above base of mesial ramus; lateral ramus with mesial rib bearing slightly raised area proximally.

MEASUREMENTS (in mm).—Holotype ♂, acl 7.2, cl 10.8, chl 7.3, chh 2.4; allotype ♀, same, 6.4, 9.8, 6.4, 1.9; paratypes, Discovery Bay, ♂, same, 6.3, 9.5, 6.3, 1.8, ♀, same, 7.0, 6.7, 4.6, 1.3; Surinam, ♀, same, 8.2, 12.6, 9.1, 2.4.

HABITAT.—“Found excavating chambers in the sponge *Xestospongia* sp. which was living between the branches of a colony of *Madrasis formosa* at 50 m on the fore reef at Discovery Bay, Jamaica” (Scott et al., 1988:483, in account for *U. annae*).

KNOWN RANGE.—Confined to the material examined.

REMARKS.—*Upogebia casis*, new species, is similar to *U. annae*. *Upogebia casis* has a distodorsal spine on the merus of the cheliped that may reach slightly beyond the level of the postorbital spine, but never to the level of spines on the dorsal side of the carapace as in *U. annae*. Anteromesial spines on the cheliped carpus of *U. casis* are variable in number and strength of development, consisting usually of 1 or 2 small spines, but occasionally of 2 rather strong spines as in the holotype, and rarely 3 spines in this position. The merus of P2 has no proximal mesioventral spine in *U. annae* as is usually so in *U. casis*, but may be armed in this position with a tubercle or rarely with a small spine present on one side but not on the other. *Upogebia casis* in this respect thus bridges a great dichotomy among species of this genus in the western hemisphere, a group of species that lacks this spine, and a group that possesses it. The chelae of *U. annae* exhibit almost total suppression of

dorsal ridges, but the chelae of *U. casis* show rudimentary development of the spined mesiodorsal ridge so characteristic of many western Atlantic upogebiid species. Finally, all specimens of *U. casis* are from depths less than 74 m whereas *U. annae* is known from much greater depths, 183–229 m.

ETYMOLOGY.—From the Greek *kasis* (brother or sister).

### *Upogebia molipollex*, new species

FIGURE 12

*Upogebia* (*Upogebia*) *affinis*.—Schmitt, 1935:196 [Puerto Rico specimen only, not fig. 58].

MATERIAL EXAMINED.—PUERTO RICO: AMNH 6820, ♀ (holotype), Guayanilla Harbor, 25 Jun 1915.

DIAGNOSIS.—Dorsal surface of rostrum bearing only marginal spines, projections to either side of rostrum ending in acute spine. Postocular spine present. Abdominal sternites unarmed; AVI bearing slight anterolateral lobe but lacking hooked anterolateral spine. T subrectangular. Cheliped with subdistal dorsal spine of merus reaching beyond level of postorbital spine; carpus with small spine on anteromesial margin. Merus of P2 without proximal mesioventral spine, but with 1 subdistal dorsal spine; merus of P4 spineless.

DESCRIPTION.—Rostrum triangular, lateral margin longer than basal width; nearly straight in lateral view but angled slightly downward, tip exceeding eyestalks; dorsal pair of subapical spines followed on each side by 2 spines of equal size, spines separated by wide equal intervals on right side but third spine slightly more remote from others on left side; no other dorsal spines present. Posteriorly divergent lateral ridge bearing crest of about 10 spines, strongest on process lateral to rostrum and decreasing almost to obsolescence posteriorly; dorsal field of spines on anterior carapace irregular in size and arrangement, largest spines scattered in midlength of field. Shoulder lateral to cervical groove bearing 2 obsolescent granules below intersection with thalassinidean line, latter continuing strongly to posterior margin; area framed by cervical, postcervical, and antennal grooves bearing scattered obsolescent granules. Postocular spine present.

Abdominal sternites unarmed.

T bearing moderate transverse proximal ridge confluent with low longitudinal ridge to either side.

Eyestalk stout, deepest basally, almost horizontal in repose; prominent terminolateral cornea about as long as wide and nearly as wide as stalk.

A1 peduncle reaching about to base of terminal article of A2 peduncle, its proximal 2 articles together slightly longer than terminal article.

A2 peduncle with almost  $\frac{1}{3}$  its length extending beyond tip of rostrum; scale moderate, oval.

Mxp3 bearing epipod.

Epistomial projection rather broad in lateral view, bearing no apical projections.

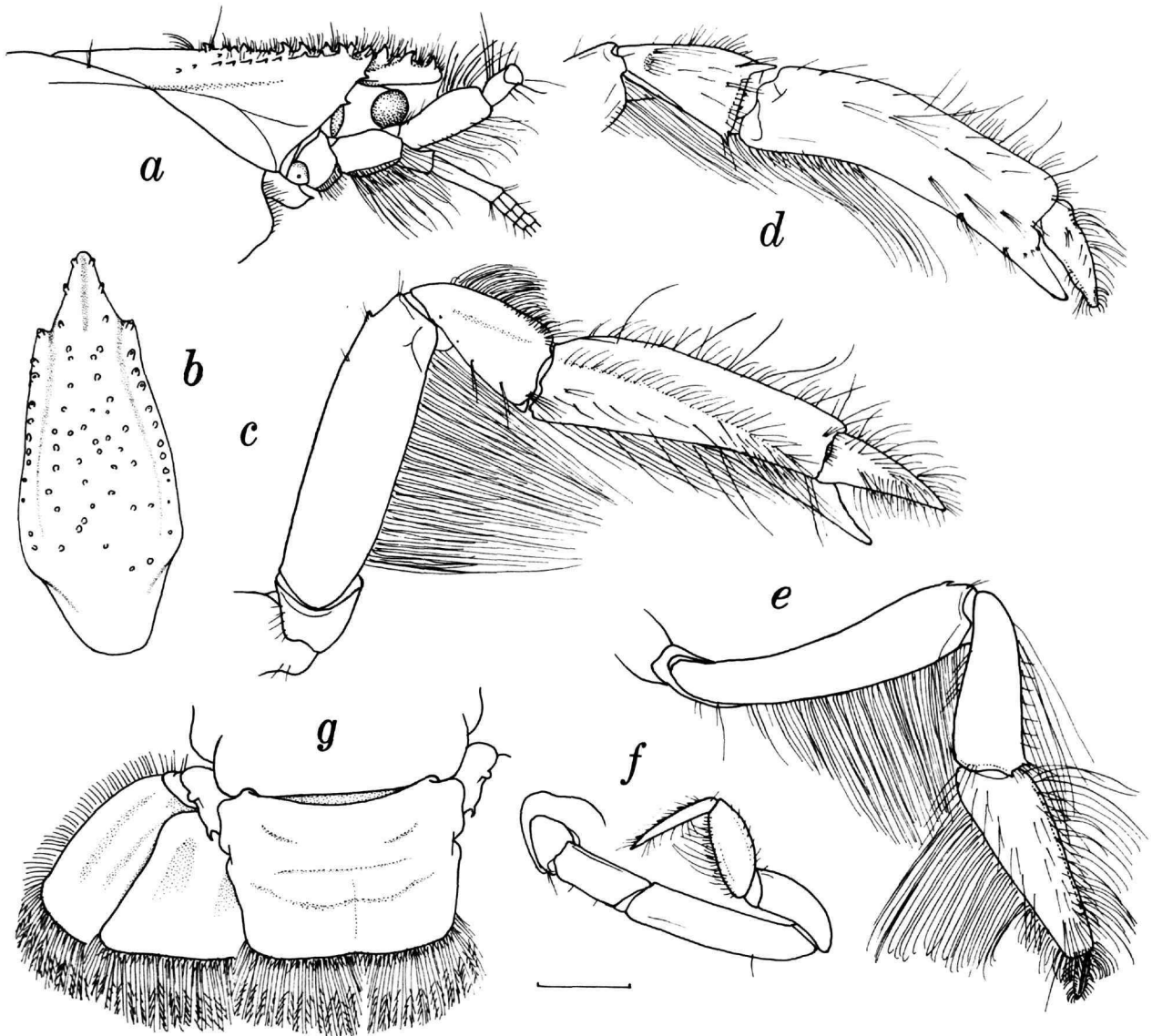


FIGURE 12.—*Upogebia molipollex*, new species, AMNH 6820, ♀ holotype: *a*, cephalic region, lateral; *b*, anterior carapace, dorsal; *c*, cheliped, right lateral; *d*, chela and carpus, left mesial; *e, f*, legs 2, 4; *g*, parts of abdominal segment 6, telson, and uropods, dorsal. (Scale = 1 mm.)

Legs slender. Chelipeds subequal, right slightly stronger. Coxa and ventral margin of ischium spineless. Merus with single obsolescent subdistal dorsal spine beyond level of postocular spine. Carpus roughly trigonal, broad shallow longitudinal groove laterally, anterior ventrolateral corner spineless; mesiodorsal crest unarmed behind acute spine on anterior margin; 2 closely placed small spines on anterodorsal margin mesial to articulation with propodus; 1 small spine near

middle of anteromesial margin, and tiny spine below near distoventral corner. Chl about 3.7 times chh; spineless on dorsal ridge, lateral and mesial surfaces, and ventral keel, although latter with slight swelling at distal  $\frac{1}{3}$  and near base of fixed finger; small spine near distal margin dorsal to left mesial dactylar condyle, margin below dactylar condyle unornamented; mesial surface bearing obsolescent obliquely transverse ridge near proximal margin. Fixed finger straight, shorter than



dactyl, stronger on right than on left side, prehensile edge with broad crushing surface proximally, then abruptly tapered to slender distal part bearing 0 (left)–3 (right) obsolescent teeth, tip rounded. Dactyl with prehensile edge bearing ill-defined row of small teeth and moderately developed swelling opposite base of fixed finger; mesial surface somewhat concave.

P2 reaching about to midlength of palm; carpus with small acute distodorsal and subdistal ventral spine; merus with slender subdistal dorsal spine but without proximal mesioventral spine; coxa unarmed. P3 missing. P4 with spineless merus.

U with acute small spine on protopod above base of mesial ramus; distal margin of both rami with few obsolescent granules.

MEASUREMENTS (in mm).—Holotype ♀, acl 4.2, cl 6.0, chl 3.7, chh 1.0.

KNOWN RANGE.—Known only from the type locality.

REMARKS.—There seem to be no species in the Western Hemisphere that closely resemble the unique holotype of *U. molipollex*. Distinctive characters worthy of special mention include the rostrum with marginal spines only, which resembles *U. aestuari*, new species, in this respect, the carapace with a suggestion of obsolescent granules on the region bounded by the cervical, postcervical, and antennal grooves, and the proximal broadened molar surfaces on prehensile edges of fingers of the chelae. The species resembles *U. annae* in having long slender legs, with the subdistal dorsal spine on the merus of P2 being situated at a level reaching beyond that of the postorbital spine. P3, often a bearer of distinctive characters in this genus, unfortunately is missing on both sides. The left chela is cracked at about the midlength of the palm and may be regenerated as it is smaller than the right chela.

ETYMOLOGY.—From the Latin *mola* (millstone), plus *pollex* (thumb), for the proximal grinding or molar surface on the fixed finger.

### *Upogebia aestuari*, new species

FIGURE 13

MATERIAL EXAMINED.—BELIZE: USNM 251407, 1 ♀ ovig. (holotype), E of Commerce Bight pier, ~8–9 km S of Stann Creek (= Dangriga), transect of 75–80 m, from 1.5 m depth over brown mud above more compact black mud, grading through fine sand to coarser sand and fine gravel at shore, 30°C, 31 ppt, M.L. Jones, sta CB-41C, 17 May 1977.

DIAGNOSIS.—Projections to either side of rostrum ending in small acute spine. Postocular spine present. Abdominal sternites unarmed. T subrectangular. Carpus of cheliped with 2 strong spines on distomesial margin. Merus of P2 bearing strong proximal mesioventral spine and subdistal dorsal spine; merus of P3 with distodorsal spine and 3 strong ventral spines; merus of P4 spineless.

DESCRIPTION.—Rostrum triangular, lateral margin about as long as basal width, nearly straight but angled slightly

downward; tip exceeding eyestalks in normal position by less than width of cornea; dorsal marginal spines inconspicuous, hidden in setae, subapical pair located well short of rostral tip and followed on each side by 3 remote spines, no other dorsal spines present; median tract free of setae. Posteriorly divergent lateral ridge bearing crest of about 10 inconspicuous spines. Shoulder lateral to cervical groove bearing 1 well-developed spine on right side, 2 on left, below intersection with thalassinidean line. Postocular spine present.

Abdominal sternites unarmed.

T subrectangular, transverse proximal ridge confluent with inconspicuous lateral ridge at each side, convex distal margin with slight median indentation.

Eyestalk stout, slightly concave dorsally and convex ventrally in lateral view, almost horizontal in repose; prominent terminal cornea nearly as broad as diameter of stalk at midlength.

A1 peduncle reaching to midlength of terminal article of A2 peduncle, its proximal 2 articles together slightly longer than terminal article.

A2 peduncle with about  $\frac{1}{3}$  its length extending beyond tip of rostrum; article 2 bearing strong subdistal ventral spine; scale moderate, oval.

Mxp3 bearing epipod.

Epistomial projection rather narrowly rounded in lateral view, bearing small spine on anterodorsal aspect.

Chelipeds slender. Coxa unarmed. Ventral margin of ischium bearing 1 spine. Merus with row of 4 small spines on ventral margin, 1 near base and 3 remote from it but equidistant from each other; single subdistal dorsal spine reaching level of postocular spine. Carpus trigonal, shallow longitudinal groove laterally, obsolescent spine at anterior ventrolateral corner; mesiodorsal crest of 3 clearly visible spines behind prominent dorsal spine on anterior margin, and 3 short slender spines on anterodorsal margin mesial to articulation with propodus; strong spine near middle of anteromesial margin, slightly smaller spine dorsal to it, and strong slender spine at distoventral corner. Chl about 3.6 times chh; dorsal ridge spineless except for prominent, anteriorly curved acute spine at base, ridge terminating anteriorly near acute subdistal spine mesial to it; mesiodorsal ridge unspined but bearing few rounded bases of obsolescent tubercles in proximal  $\frac{1}{2}$  of length; dactylar condyles each with acute spine below, spine strong on lateral side, weak on mesial side; mesial surface with row of setal tufts on upper  $\frac{1}{2}$  paralleling mesiodorsal ridge, ventral keel bearing 2 or 3 obsolescent spines on mesial side near midlength, and low transversely arcuate ridge near proximomesial corner. Fixed finger only  $\frac{1}{4}$  length of dactyl and more slender, its ventral margin at base continues the straight ventral margin of palm, but tip gently curved toward opposing dactyl, about 5 tiny rounded teeth crowded along proximal prehensile edge. Elongate dactyl longitudinally ridged, slightly curved, and bearing rows of dense setae; slender, acute corneous tip preceded on prehensile edge by long

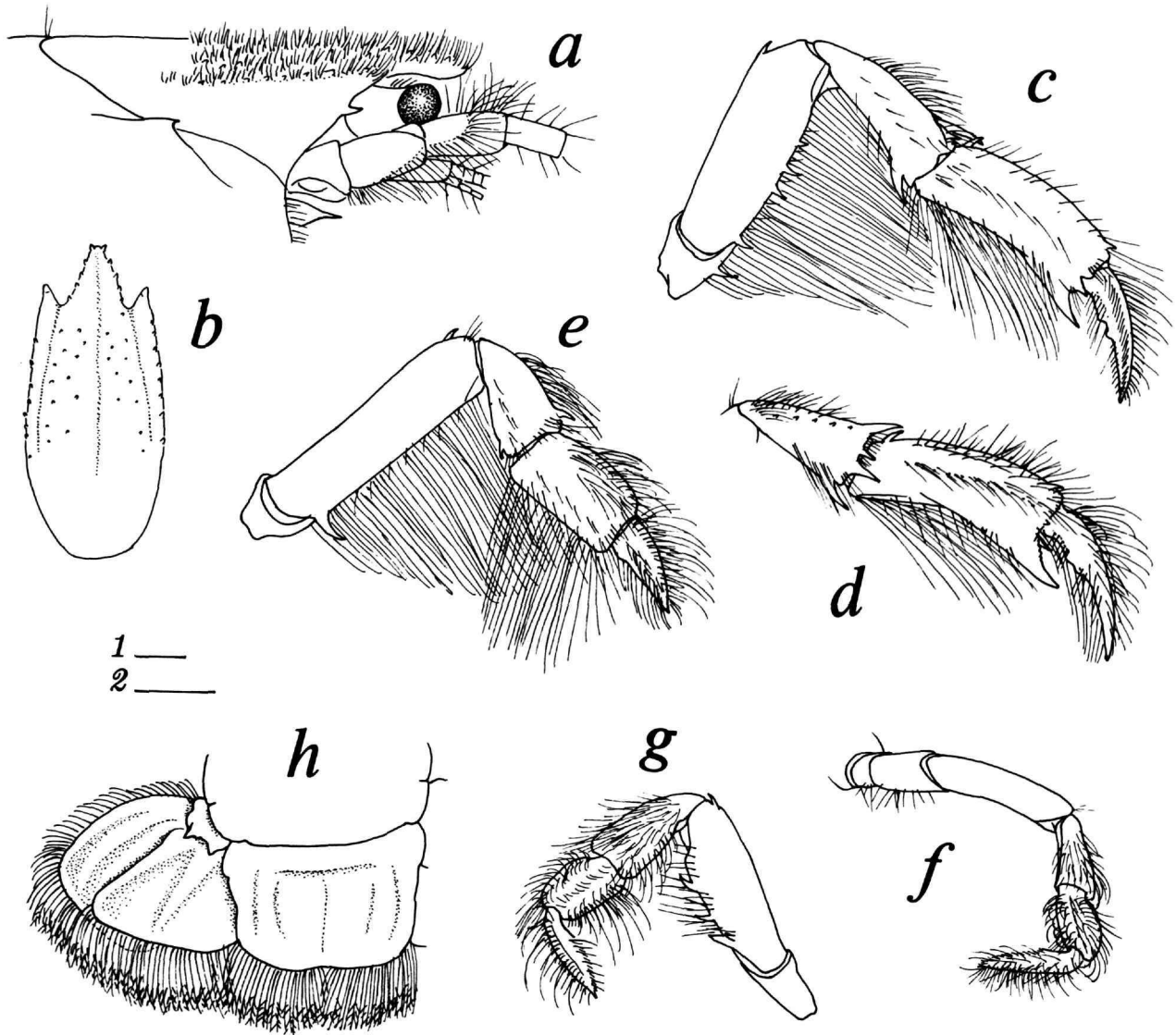


FIGURE 13.—*Upogebia aestuarii*, new species, USNM 251407, ♀ holotype: *a*, cephalic region, lateral; *b*, anterior carapace, dorsal; *c*, cheliped, right lateral; *d*, chela and carpus, left mesial; *e-g*, legs 2-4; *h*, parts of abdominal segment 6, telson, and uropods, dorsal. (Scales = 1 mm: 1 = *a*; 2 = *b-h*.)

unarmed interval, then 2 low teeth approximating tip of fixed finger with their bases extended along longitudinal axis, distal tooth less than  $\frac{1}{2}$  size of proximal tooth, and toothless section basally; curved extensor surface unornamented.

P2 reaching about to distal  $\frac{1}{4}$  of palm; carpus with strong acute distodorsal spine, and smaller acute ventral spine; merus with slender subdistal dorsal spine and strong proximal mesioventral spine; coxa unarmed. P3 with merus bearing distodorsal spine and 3 strong spines on ventral margin. Merus

of P4 spineless.

U with blunt spine on protopod above base of mesial ramus; lateral ramus with mesial rib bearing obsolete spine proximally.

MEASUREMENTS (in mm).—Holotype ♀, acl 3.8, cl 6.0, chl 2.9, chh 0.8.

KNOWN RANGE.—Known only from the type locality.

REMARKS.—M.L. Jones collected this specimen somewhere along a 75–80 m transect mentioned in "Materials Examined." From the outer end to shore, the transect covered roughly four

kinds of bottom described in notes as "brown mud over more compact black mud at the outer ~1.5-m depth; from ~70 to 30 m offshore, fine gray sand over black compact mud, ~18 to 20 cm thick at ~1-m depth; from ~30 to 20 m offshore, gray soft mud (~40 to 50 cm thick) over firm bottom; from ~20 m to shore, fine sand with increasing amounts of coarse sand to fine gravel." This is far more habitat detail than is available for most of the collections available for study, but unfortunately the sector of the transect from which this specimen was taken remains unknown, although sta CB-41c indicates a position removed from the high-tide mark because M.L. Jones usually began digging at that level (a) and followed the tide out as it receded.

Although it bears reduced dorsal spines on the rostrum, but has acute spines on shoulders along the cervical groove, on the chelae, and second and third legs, *Upogebia aestuarii*, new species, seems allied to the relatively spineless *U. marina* in general aspect, and it is near it in the key to Western Atlantic species of the genus. The almost subchelate condition and the suggestion of spines on the ventral keel of the palms, with well-developed anteromesial spines on the carpus of the chelipeds, are reminiscent of morphology found in *U. affinis* and *U. paraffinis*, although in far less accentuated form; however, lack of ventral spines on the rostrum places further distance between *U. aestuarii* and these forms.

ETYMOLOGY.—The specific name from the Latin *aestuarium* (estuary), an adjective in the genitive case, referring to the habitat in which the holotype was found.

### *Upogebia affinis* (Say, 1818)

FIGURE 14

*Gebia affinis* Say, 1818:241.—DeKay, 1844:22.—White, 1847:71 [Say's type, part of abdomen, telson, and left uropod].—Leidy, 1855:150 [New Jersey]; 1888:333 [list].—Smith, 1873:549 [list].—Verrill, 1873:368, pl. 2: fig. 7 [nat. hist.], 519 [food, summer flounder], 520 [food, windowpane], 530 [occurrence juv.].—Kingsley, 1878:327 [distrib.]; 1899:824 [key].—Rathbun, 1905:17 [habitat, New England].

*Upogebia affinis*.—Stebbing, 1893:185 [nat. hist.].—Fowler, 1912:361, pl. 108 [summary].—Hay and Shore, 1918:408, pl. 29: fig. 9 [nat. hist.].—Fish, 1925:158 [plankton].—Pearse, 1945:303 [ecol.]; 1952:235 [bopyrid].—Behre, 1950:21 [occurrence, Louisiana].—Deevey, 1960:41 [plankt. larv. occurrence].—Fingerman and Oguro, 1963:24 [chromatophores].—Dragovich and Kelly, 1964:80 [habitat].—McCloskey and Caldwell, 1965:114 [fungi in foregut].—Williams, 1965a:103, fig. 60 [nat. hist.]; 1965b:197 [host of *Leptalpheus*]; 1974b:16, figs. 44A, B [key]; 1984a:191, fig. 133 [nat. hist.]; 1986:10 [key, distrib.].—Gomes Corrêa, 1968:106 [tabular comparison], 107 [G part, figs. 16–21, 30, 31, not Brazilian material], 108 [key].—L.C. Thompson and Pritchard, 1969:114–129 [osmogreg.].—Rouse, 1970:140 [ovig. ♀, plankt. larv.].—Sikora et al., 1972:519 [food, *Urophycis* spp.].—Van Engel and Sandifer, 1972:157 [occurrence Va.].—Sandifer, 1973a:98–104, figs. 1–4 [larv. stages]; 1973b:243 [plankt. larv.].—Thistle, 1973:1–14 [passim], 23 [diagn. char., key].—Basan and Frey, 1977:55, 58 [creek banks].—Frey and Howard, 1975:283 [nat. hist.].—Dörge, 1977:401, 405, 415 [creek banks].—Williams and Wigley, 1977:9, 43 [distrib.].—Frey and Basan, 1981:117 [habitat].—Ngoc-Ho, 1981:241, 243–247, figs. 6–8 [larvae].—Aller et al.,

1983:571–604 [biochem., burrow water].—Chester et al., 1983:282 [estuarine distrib.].—Pemberton and Frey, 1985:241–257 [burrows].—Andrzejak, 1986:214 [plankt. postlarv. descr.].

*Upogebia (Upogebia) affinis*.—De Man, 1927:50, figs. 19–19g [part, not Barbados and Brazilian specimens]; 1928:22 [list, U.S.A. specimens only], 36 [nat. hist.], 39, 46 [key].—Schmitt, 1935:196, fig. 58 [but not description, see *U. mollipollex*, new species, herein].

MATERIAL EXAMINED.—U.S.A.: *Massachusetts*: USNM 2994, 3 ♀, Wellfleet, H.E. Webster, 1879; USNM 38262, 1 ♀, Martha's Vineyard Sound, U.S. Fish Comm., Verrill, Smith, Todd, 1871; USNM 13970, 4 ♂, 7 ♀, Head of Buzzards Bay, W. Nye, Jr., 17 Sep 1887. *Rhode Island*: USNM 104173, 3 ♀, Wickford, R.U. Gooding, 22 May 1959. *Connecticut*: USNM 31288, 2 ♂, Long Island Sound off Falkner Lt. and Madison, 28.3 m, U.S. Fish Comm., *Fish Hawk* sta 1701, dredge, 17 Sep 1892. *New Jersey*: MNHNP Th-1, 1 ♂, 1 ♀, from Yale [Peabody] Museum; USNM 251722, 1 ♂, Mullica River, transect from Oyster Bed Pt. to Deep Pt., RCB-75-007, Ichthyological Associates sta 1, 25-ft semi-balloon trawl, R.C.B., H.K.H., M.R.N., M.C.W., G.J.M., 21 Apr 1975; USNM 251397, frag. ♂ abdomen, Cape May Point, H.G. [Richards], #1286, 20 Mar 1932; USNM 64739, Maurice River Cove, 4.6 m, H.G. Richards, #415, 14 Apr 1930 [poor condition]. *Virginia*: USNM 58308, 1 juv. (♂?), off Thimble Light, Chesapeake Bay, 28 m, *Fish Hawk* sta 8898, 4 Dec 1920; USNM 41747, 2 ♂, 2 ♀ (1 ovig.), Virginia, H.E. Webster, Union College Collection; USNM 58293, 1 ♂ abdomen, Chesapeake Bay, 38°07'12"N, 76°13'30"W, 38 m, *Fish Hawk* sta 8388, 6 Dec 1915. *North Carolina*: USNM 66612, 4 ♂, 7 ♀ (ovig.), 1 cephalothorax, Gallant Point, Beaufort Harbor, mud flats, Schmitt and Shoemaker, 14 Sep 1928; USNM 251398, 1 ♂, Beaufort, W.H. Conn, Wesleyan Univ. Dept. Biol., Middletown, Conn., No. 667; USNM 67578, 1 ♀, Beaufort, Newport River canal, bopyrid in branchial chamber, trawl, S.F. Hildebrand, 6 Mar 1931; USNM 81910, 1 tiny juv., Beaufort, A.S. Pearse, 11 Aug 1941; USNM 251399, 20 ♀ and spare parts, Beaufort, A.S. Pearse, summer 1944; USNM 251400, 50 ♀ (ovig.) and spare parts, 24 ♂ and spare parts, 1 bopyrid, Beaufort, A.S. Pearse, summer 1944 [poorly preserv.]; ZMK 1 ♀ juv., Bogue Sound, 1/2–2/3 m, Mary E. Petersen, 1 Mar 1965. *South Carolina*: USNM 23278, 1 ♀, Parris Island, U.S. Fish Comm., *Fish Hawk*, 19 Jan [1891]; USNM 31289, 1 ♂, May River near Bluffton (Beaufort Co.), *Fish Hawk*, 17 Jan 1891; USNM 31290, 1 ♀, May River, *Fish Hawk*, 1891. *Georgia*: BMNH 124a, holotype [fragmentary, parts of abdomen and tail fan], Leach Collection, presented by Thomas Say; USLZ 3023, 2 ♀ (ovig.), Cabbage Island, Wassaw Sound, Chatham Co., intertidal in firm muddy sand, R.W. Heard, 4 Sep 1976; USLZ 3009, 11 ♂, Sapelo Island, 29°02'50"N, 90°09'46"W, BLM-WIN-MC, P2E, SOO#9, 13 Jan 1979; USNM 174414, 1 small ♂, off Georgia 31°13'N, 81°13'W, sta 0210-1-SA, 11 m, 21 Feb 1977; USNM 251421, 3 ♂, 5 ♀, St. Catherines Island, middle of North Beach, on surface, B. Winn and P. Small, 9 Oct 1990. *Florida*: FDNR

EJ71418, 1 juv., St. Lucie Co., Hutchinson Island, E of F.P. & L. electrical generating plant, 27°21'23"N, 80°13'24"W, Shipke grab, R. Gallagher, M. Hollinger et al., 15 Sep 1971; FDNR EJ71125, 1 ♀ ovig., Gulf of Mexico, Monroe Co., Ten Thousand Islands, 2.9 naut. mi SW Rogers River, 25°26.7'N, 81°13.1'W, 2.7 m, R/V *Venus*, hydraulic clam dredge, W.C. Jaap and V.P. Williams, 6 Sep 1971; FDNR EJ74387, 1 ♀ ovig., Collier Co., inshore Marco Island, trough at Martinique Waterway entrance, 25°57'45"N, 81°42'51"W, 2.5 m, plug corer, C.M. Courtney, 5 Jul 1974; FDNR EJ71013, 1 ♂, 1 ♀ ovig., Manatee Co., Tampa Bay, Manatee River, 1/4 mi W Pt. Ogdeu, 27°30.7'N, 82°55'W, 1.5 m (5 ft), R/V *Venus*, hydraulic clam dredge, W.C. Jaap and T.A. Frakes, 18 Feb 1971; FDNR EJ67213, 1 ♂ (no legs), Gulf of Mexico, Hillsborough Co., 19 mi W Egmont Key, 27°37'N, 83°07'W, 18 m, R/V *Hernan Cortez*, Hourglass Cruise HC40, sta B, dredge, R. Presley, 2 Jun 1967; FDNR EJ78072, 1 ♂, Hillsborough Bay and Co., 2.5 mi S Hillsborough River mouth, east side of channel, 27°51'N, 82°26'W, 6 m, shrimp trawl, R.G. Taylor and D. Nickerson, 19 Feb 1978; FDNR EJ72032, 1 ♀, Pinellas Co., Old Tampa Bay, off Courtney Campbell Causeway, 2 mi W of Tampa public beach, 27°55'N, 82°38'W, shovel and seine, J.L. Simon, 1972; FDNR EJ71373, 1 ♂, same, Nov 1971; FDNR EJ68030, 1 ♀ ovig., Gulf of Mexico, Pinellas Co., Tampa Bay, NNW west end of Courtney Campbell Causeway, 27°57'N, 82°41.5'W, 1.8 m (6 ft), R/V *Venus* sta 3, hydraulic clam dredge, R.J. Stokes, 15 May 1968; FDNR EJ69271, 3 ♂, 6 ♀ (+ ♀ abdomen), Crystal River, offshore of power generating plant intake canal, Citrus Co., 28°56'N, 82°46'W, 3.3 m, screenwash (6-ft bag placed in sluiceway), R. Parrish, 20 Mar 1969; FDNR EJ69332, 1 ♀, Levy Co., Rum Key, 29°07'N, 83°04'W, 1.5 m (5 ft), R/V *Venus*, hydraulic clam dredge, M.F. Goodcharles, 14 Oct 1969; FDNR EJ70358, 17 ♂, 21 ♀ (2 ovig.), Franklin Co., bay side Alligator Point, shovel, 16 Oct 1970; St. Lucie Co., Indian River: HBOM 89:335, 1 ♂, Big Mud Creek, burrow in sandy mud bottom by A1A bridge, intertidal, by hand, R.H. Gore, 19 Sep 1972; HBOM 89:1172, 1 ♀, Jim Island, mud flat on oyster bar, intertidal, by hand, D. Putnam, 26 Jul 1974; HBOM 90:3098, 1 ♂ juv., Jim Island mud flats, intertidal in worm tubes, by hand, D.S.P., 7 Feb 1977; HBOM 89:3380, 1 ♀, Jim Island, intertidal, by hand, P.H., G.R.K., 23 Mar 1977; HBOM 89:6470, 1 ♀, Little Jim flat near Ft. Pierce Inlet, intertidal sand, seagrass, by hand, R.S. Fox et al., sta RF-88-2, 3 May 1988. USLZ 3500, 2 ♂, 5 ♀ (1 ovig., 4 fragmentary), Ft. Pierce, D.L. Felder, Aug 1989; USNM 251401, 2 juvs., St. Augustine, J.C. Pearson, 21 Jun 1935; USNM 251402, 1 juv., St. Augustine, J.C. Pearson, 8 Jul 1935; USNM 174415, 2 juvs. [near Flagler Beach], 29°27'N, 81°03'W, 20 m, sta 0886-2-7A, frags. (ID probable); USNM 251403, 4 ♂, 3 ♀, Indian River E of Little Jim Is. at marker No. 8 in channel N of Fort Pierce Inlet, 27°28.4'N, 80°18.6'W, muddy sand flat with some grass, yabby pump, R.B. Manning, sta FP-84-6, D.L. Felder, W.D. Lee, 11 Jul 1984; USNM 251183, 1 ♀, Indian River, on A1A causeway between Fort Pierce and Fort Pierce Beach,

27°27.7'N, 80°18.7'W, flat with some grass exposed at low tide, R.B. Manning, sta FP-86-2, D.L. Felder, W.D. Lee, 11 Aug 1986; USNM 251184, 1 juv., same, S of A1A bridge, W side of main channel, yabby pump, R.B. Manning, sta FP-86-5, D.L. Felder, W.D. Lee, 14 Aug 1986; USNM 251185, 1 ♀ ovig., same, sta FP-87-3, 2 Mar 1987; USNM 251186, 1 ♂, N side Fort Pierce Inlet, S side Coon Island, 27°28.2'N, 80°18.2'W, along shore, mud and hard packed sand, yabby pump, R.B. Manning, W.D. Lee, M. Schotte, C. King, sta FP-88-3, 21 Apr 1988; USNM 251187, 1 ♂, 2 ♀, Fort Pierce Inlet, across from Coast Guard Station on hard sand flat adjacent to *Spartina*, W.D. Lee and R.B. Manning, 15 Feb 1990; USNM 169918, 1 ♀ ovig., St. Lucie Co., Hutchinson Island, Big Mud Creek at Indian River, intertidal, seine, R.H. Gore, 27 Mar 1974; USNM 251188, 10 ♂, 15 ♀ (6 ovig.), Miami, R.B. Manning, 22 May 1988; USNM 251189, 1 ♂, 3 ♀ (2 ovig.), Key Biscayne, west side flats, yabby pump, R. Lemaire, 28 May 1988; USNM 77567, 1 ♂, 1 ♀ ovig., Sarasota Bay, W.E. Webster, Kingsley Collection #186; USNM 6461, 3 ♂, 2 ♀, Cedar Keys, in muddy sand between tides, H. Hemphill, Dec 1883; USNM 119331, 1 ♀, Wakulla Co., Panacea, Rock Landing Pier, surface, J. Rudloe, 10 Feb 1966; USNM 93721, 2 ♂, flats W Alligator Point [Alligator Harbor], hosts of types of *Phyllodurus robustus* Pearse 1952, H.J. Humm, 19 Jun 1952; USNM 251190, 1 ♀, A.M. Harrison, 2327, frag. [very poor condition]. *Alabama*: USLZ 3024, 1 ♂, Dauphin Island, Sea Lab jetties in muddy sand, Arthropod and Mollusk class, 11 Nov 1977. *Mississippi*: USNM 251191, 1 ♂, 1 ♀, Deer Island, extreme east end in mud and peat, M.W. Williams, sta M-14, 16 Nov 1943; USNM 251192, 1 ♂, Harrison Co., Biloxi, M.W. Williams, sta 14-11, 15 Dec 1943; USNM 251193, 2 ♂, 2 ♀ (1 ovig.), Little Deer Island, mouth of Biloxi Bay, intertidal, shovel, Jackson Invert. Zool. class, Gulf Coast Res. Lab., Jun 1983; USNM 87378, 1 ♀ ovig., Mississippi Gulf Coast, outlying islands and adjacent waters, J.F. Walker, sta 13, summer 1948; USNM 251723, 1 ♀, Hancock Co., St. Louis Bay, Bay St. Louis, L. Hubricht, 3 Mar 1963. *Louisiana*: USLZ 3012, 1 ♀, 021W500#6, Bay Marsh and Lease, Gulf of Mexico, 29°02'50"N, 90°09'46"W, BLM01-5245-800, 13 Jan 1979; USLZ 3013, 1 ♀, same but 02PE500#7; USLZ 3014, 1 ♀, same but 02PW2000#8; USLZ 3010, 1 juv., S of Miss. R. Delta, 28°34'09"N, 90°24'32"W, BLM-SM-MC, P4N2000#9, D. Felder, summer 1978; USLZ 44, 1 ♂, 29°22.5'N, 92°10.5'W, ARCNI44, 28 Jun 1968; USLZ 3105, 1 ♂, Freeport Sulfur Co., Terrebonne Parish, Caillou Island, 7.2 km (4.5 mi) NE western end of Timbalier Island, sta 5, 10-ft seine, LA, W.W. Forman, L.J. Kennain, 5 Feb 1980; USLZ 3011, 1 ♀ juv., Vermillion Bay, GIRI Dredging Project-sample IV-B, mud #3, 24 Aug 1976; USLZ 3015, 1 ♀ ovig., Chenier au Tigre, Vermillion Parish about 25 m from shore on Gulf of Mexico just E of freshwater Bayou, Ryan and L. Rogas, 13 Sep 1980; USNM 33104, 2 ♀, Chandeleur Islands, L.R. Cary; USNM 221337, 3 larvae (*U. affinis?*), Gulf of Mexico, 10 km SW Calcasieu River,

29°39'52"N, 93°26'34"W, 1 m, B. Andryszak, 4 Jun 1984. *Texas*: USLZ 3501, 1 ♂, 1 ♀ (juvs.), off Matagorda Island, 28°14'N, 96°29'W, 4/I HEV, BLM-STOCS study, 14 Feb 1976; USLZ 3022, 1 ♂ juv. (frag.), 7<sup>1</sup>/<sub>2</sub> Fathom Reef, sediment sample, D.L. Felder, 24 Jun 1971; USLZ 3499, 1 ♂, 1 ♀, Causeway Blvd., S Padre Island and Port Isabel, landward side, D.L. Felder, Jul 1991; USNM 82076, 1 ♂, 1 ♀, Rockport, J.W. Hedgpeth, 29 Dec 1945; USNM 172304, 1 juv., SE Corpus Christi, 28°14'N, 96°29'W, 10 m, N. Rabalais, 11 Oct 1976.

**DIAGNOSIS.**—Rostrum bearing 0–8 ventral spines. Projections to either side of rostrum ending in acute spine. Postocular spine present. Abdominal sternites unarmed. Carpus of cheliped with 2 strong spines on anteromesial margin. Merus of P2 with proximal mesioventral spine and 1 subdistal dorsal spine; merus of P3 with ventrolateral cluster of spines, that of P4 usually spineless.

**DESCRIPTION.**—Rostrum triangular, slightly downturned; median ventral keel bearing 1–8 (rarely 0) variably developed spines, but almost never ending in terminal projecting point; tip usually exceeding eyestalks in normal position by  $\frac{1}{3}$ – $\frac{1}{2}$  their length, but sometimes barely so; dorsal pair of subapical spines followed on each side by 2 spines separated by slightly decreasing intervals; lateral ridge bearing crest of about 12 spines, strongest on process lateral to rostrum and decreasing almost to obsolescence posteriorly. Shoulder paralleling cervical groove bearing 1 spine, sometimes 2, below intersection with thalassinidean line, obsolescent tubercle occasionally above it. Postocular spine present.

Abdominal sternites unarmed.

T with well-developed median furrow, distal margin biarcuate; transverse proximal ridge confluent with lateral ridges unspined.

Eyestalk stout, deepest at about midlength, convex ventrally, concave dorsal side sometimes bearing 1–2 or more obsolescent tubercles in row; prominent terminal cornea narrower than diameter of stalk and directed ventrolaterally, sometimes triangular in lateral view, and occasionally with tiny mesiodistal spine on stalk above margin.

A1 peduncle reaching to about midlength of terminal article of A2 peduncle, its proximal 2 articles together slightly longer than terminal article, proximal article with small distoventral spine or angle.

A2 peduncle with about  $\frac{1}{3}$  its length extending beyond tip of rostrum; article 1 bearing variable ventral spine, obsolete to strong and acute; article 2 bearing subdistal ventral spine; scale moderate, oval.

Mxp3 with epipod.

Epistomial projection rather broad in lateral view, bearing 1 spine at distodorsal corner.

Chelipeds with ventral margin of ischium bearing 1 spine. Merus with row of 4–5 spines on ventral margin, subdistal dorsal spine reaching level of postocular spine. Carpus trigonal, shallow longitudinal groove laterally, strong spine at anterior

ventrolateral corner preceded by 1–4 spines in row; mesiodorsal crest of almost uniform small spines leading to prominent spine on anterior margin, short dorsal spine near articulation with merus partly obscured by setae; 2–3 (rarely 4) strong spines on anterodorsal margin mesial to articulation with propodus; 1 strong spine near middle of anteromesial margin, nearly equal spine dorsal to it, and very strong spine at distoventral corner. Chl about 2 times chh; spineless dorsal ridge, with erect dorsal spine near its proximal end, mesiodorsal row of spines erect proximally and variably obsolescent near distal margin of palm; distal margin bearing row of obsolescent tubercles, reinforced distal margin below mesial dactylar condyle bearing spine and 3–4 small rounded spines below this in fully adult male, less well developed in immature male; lower mesial surface bearing scattered spines; ventral keel with row of 2–5 spines proximal to base of fixed finger, low transversely arcuate beaded ridge near proximomesial corner. Fixed finger shorter than dactyl, continuing contour of lower margin of palm, though bowed ventrally, and tapering to slender tip, 3–5 teeth on proximal prehensile edge. Dactyl of male with corneous tip preceded on prehensile edge by toothless interval, tooth at  $\frac{2}{3}$  length opposing tip of fixed finger, then row of about 6 closely crowded small teeth increasing proximally to larger tooth in proximal  $\frac{1}{4}$  of length (sometimes only few large teeth in this row), and toothless section basally; arched extensor surface bearing rows of closely crowded beaded tubercles or spines separated by grooves and/or dense setae, largest tubercles erect proximally but becoming obsolescent distally, files of similar beaded granules on mesial and submesial surface; corneous tip in female preceded by slightly curved prehensile edge, strong tooth at  $\frac{1}{2}$  length opposing tip of fixed finger, proximal to this a section with obscure small teeth, then large tooth at  $\frac{1}{4}$  length, and toothless section basally; curved extensor surface bearing about 4 small tubercles proximally.

P2 reaching about to distal  $\frac{1}{4}$  of palm; carpus with distodorsal spine and tiny acute or obsolescent subdistal ventral spine; merus with slender subdistal dorsal spine and strong proximal mesioventral spine; coxa with 2 or more spines on mesial aspect, often acute, and posteromesial margin variously lobed. Merus of P3 with cluster of spines and spiniform granules ventrolaterally, and sometimes slender distodorsal spine; coxa with low spine lateral to gonopore, sometimes spine on distomesial margin, and rarely still another spine anterior to gonopore. P4 with merus usually spineless, rarely with 2 tiny lateral spines near ischium.

U not exceeding length of telson; spine on protopod above base of mesial ramus; mesial rib of lateral ramus often bearing blunt spine proximally; distal margin of rami bearing uniformly spaced small granules.

**MEASUREMENTS** (in mm).—♂, acl 12.8, cl 18.8, chl 10.8, chh 5.8; ♀ ovig., same, 10.8, 16.1, 7.7, 2.7.

**COLOR.**—Gray, blue, or yellowish gray dorsally, tinged with light blue medially on tail fan and on tergite V, interlaced with

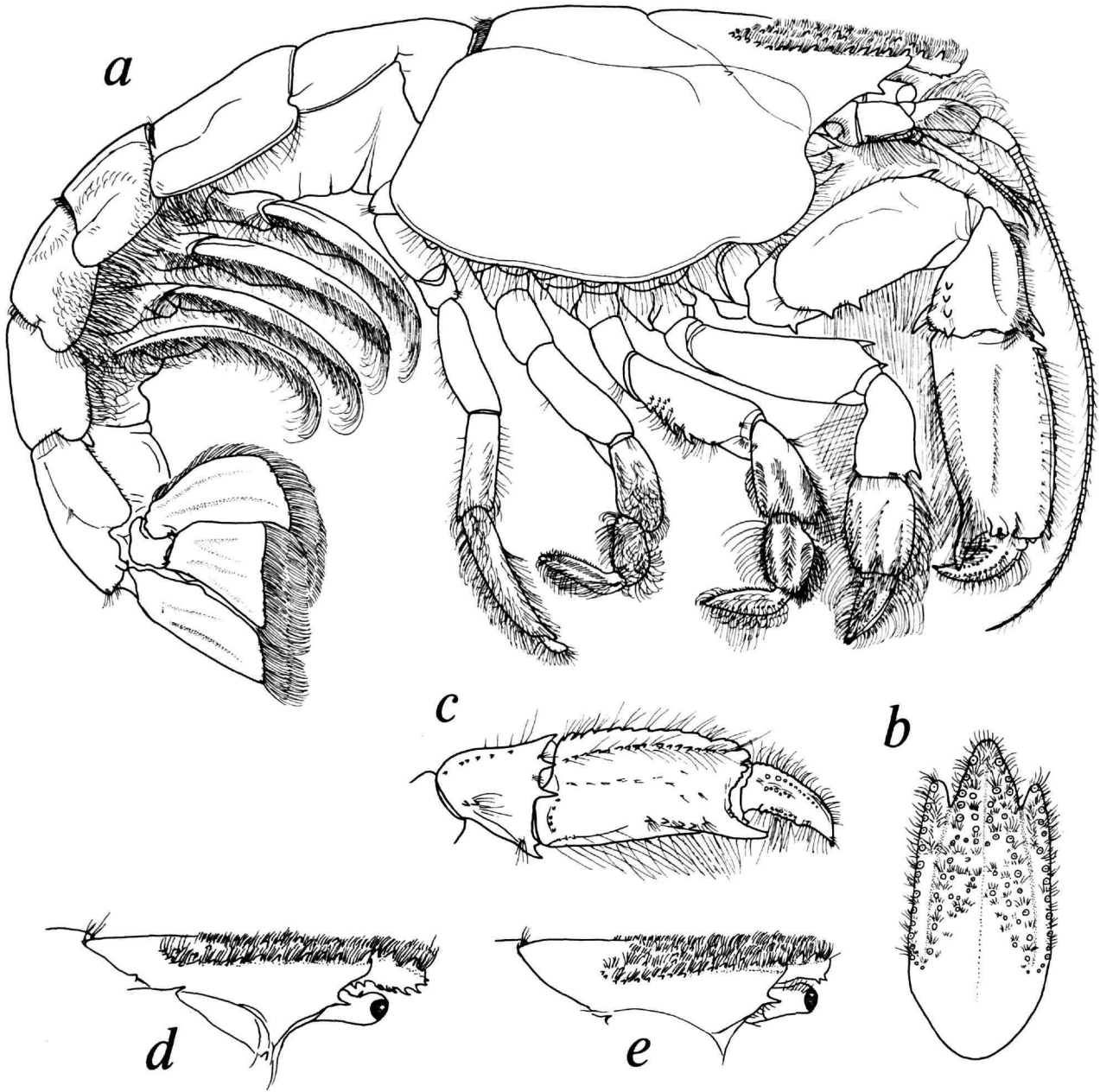


FIGURE 14.—*Upogebia affinis* (Say) (a-c, USNM 31289; d,e, USNM 251400): a, animal in lateral view; b, anterior carapace, dorsal; c, chela and carpus, left mesial; d,e, anterior carapace, lateral, ♂, ♀. (Scale = 1 mm.)

uniform light lines; an oblique blue spot on side of carapace at base of antenna extending posterodorsally; legs lighter on articles, but joints and dactyls of chelae lighter grayish white; underparts light. (From various authors as summarized in Williams 1984a, and color slide of specimen photographed on

overcast day at Ft. Pierce, Florida, by D.L. Felder, Aug 1986.)

KNOWN RANGE.—Massachusetts to southern Texas, U.S.A.

REMARKS.—Thomas Say (1818:243) noted that his specimen of *Gebia affinis* was “found on an oyster bar near the edge of the water at low tide, and appears to be rare.” Its length was

"two inches and a quarter" (= 57 mm). The holotype (White, 1847), now in the Natural History Museum (London) where it "was transferred to the spirit collection a few years ago" (R. Ingle, pers. com. 16 August 1989), is a fragmentary husk of the specimen that Say described, represented only by exoskeletal parts of the abdomen, telson, and left uropod. The specimen seems smaller than Say's measurements. Only structures that indicate generic placement of the specimen thus remain, and the sex is undeterminable. However, there can be little confusion concerning its identity as this is the only species of *Upogebia* that is known to occur in Georgia. The illustrated specimen, of size comparable to Say's type when originally described, is from South Carolina near the Georgia state line.

*Upogebia affinis* has long been thought to have a broad distribution in the western Atlantic, extending from Massachusetts, U.S.A., to south central Brazil. Several species, some undescribed until now, have been included within *U. affinis* in this broad sense. In the strict sense, the known range of this species extends only from Massachusetts to southern Texas, fitting a well-established biogeographic pattern for many species in the western North Atlantic (see Pérez Farfante, 1969; Williams, 1984a:6, 7, 1986:12; Briggs, 1987). Species formerly assigned to *U. affinis* that occur south and east of this range are herein identified otherwise.

Spination in *U. affinis*, *U. felderi*, and *U. paraffinis*, its Mexican and southern hemisphere counterparts described herein, is so similar that confusion of the three is understandable until their subtle differences become apparent. Chief among these are: (1) lack of a strong anteriorly projecting spine originating near the dorsal margin of the rostrum in *U. affinis*, but presence of such a spine, often extremely strong, in *U. paraffinis*; (2) stronger spines on the chelipeds of *U. felderi* and *U. paraffinis* than their counterparts in most individuals of *U. affinis*; (3) more strongly developed, but varied, spination on the coxa of P1-3 in *U. affinis* than in the other two species; and (4) presence of small granules or spines on the distal margin of U in *U. affinis* and *U. felderi*, but lack of these in *U. paraffinis*.

Strongly spined individuals of *U. affinis* are found throughout its range, but both *U. felderi* and *U. paraffinis* are especially strongly spined. There may be some tendency for development of stronger, more acute spination in warmer parts of the *U. affinis* range, as seems to occur in the widely distributed *Callinectes sapidus* Rathbun (Williams, 1974a:780, 781).

Fossilized burrows in limonitized oyster reef of the Late Pleistocene Biloxi Formation, Industrial Seaway Bridge, Gulfport, Mississippi, reported by Otvos (1982:21, 1985:25), have the Y shape characteristic of those constructed by *Upogebia* and are of a size that could accommodate *U. affinis*, but no fossilized mud shrimp remains have been associated with them.

Markham (1988:9, 14) revised the bopyrids, *Orthione furcata* (Richardson) and *Progebiophilus upogebiae* (Hay), that are known to infest *U. affinis* in Massachusetts and North Carolina, respectively.

### *Upogebia aquilina*, new species

FIGURE 15

MATERIAL EXAMINED.—U.S.A.: Florida: USNM 251426, ♂ (holotype), Martin Co., Seminole Shores, intertidal, Worm Reef Survey, sta RHG-162-74, L.E.S., L.J.B., M.A.K, 15 Aug 1974, HBOM 89:2601; USNM 251427, ♀ ovig. (allotype), same; USNM 251428, 3 ♂, 2 ♀ (paratypes), same; HBOM 89:324, 1 ♂ (paratype), Palm Beach Co., Jupiter Inlet, broken from jetty rock, north side, 1.2 m (4 ft), R.H. Gore, 19 Sep 1972; HBOM 89:712, 1 ♂ (paratype), Palm Beach Co., Jupiter Inlet, south side by jetties (granite), SCUBA, R.G.G., G.R.S., 8 Mar 1973; HBOM 89:2207, 1 ♂ juv. (paratype), Martin Co., Seminole Shores, Hutchinson Island, worm reef, intertidal, by hand, sta RHG-162-74, L.E.S., L.J.B., M.G.R., 15 Aug 1974; HBOM 89:2651, 1 ♂ juv. (paratype), Martin Co., Indian River, Seminole Shores seawall at point of subdivisions, intertidal, hand and rotenone sta RHG-137-74, N.B., L.E.S., R.G.G, 20 Jul 1974.

DIAGNOSIS.—Projections to either side of rostrum ending in acute spine. Postocular spine present. Abdominal sternites unarmed. T subrectangular. Carpus of chelipeds with small spine near middle of anteromesial margin, smaller or obsolescent spine dorsal to it usually present. Merus of P2 with proximal mesioventral spine, often a distodorsal spine, subdistal dorsal spine obsolescent; merus of P3 with 2-4 small ventral and ventrolateral spines; merus of P4 spineless.

DESCRIPTION.—Rostrum triangular, slightly downturned; lateral margin shorter than basal width; tip exceeding eyestalks by less than 1/2 width of cornea; dorsal pair of strong subapical spines followed on each side by 2 spines shorter in length, distance between subapical spines and second pair about twice that between second and third pair, median dorsal area spineless except for sparse spines at base; posteriorly divergent lateral ridge bearing crest of about 11-14 spines, strongest on process lateral to rostrum and decreasing posteriorly, but not to obsolescence. Shoulder lateral to cervical groove either unarmed or bearing 1-2 obsolescent tubercles below intersection with thalassinidean line. Postocular spine present.

Abdominal sternites unarmed.

T subrectangular, transverse proximal ridge confluent with inconspicuous longitudinal ridge at each side, posterior margin shallowly convex.

Eyestalk stout, inclined anterodorsally in repose, convex ventrally; prominent terminal cornea as broad as diameter of stalk in lateral view.

A1 peduncle reaching to level between base and midlength of terminal article of A2 peduncle, its proximal 2 articles together slightly longer than terminal article.

A2 peduncle with about 1/2 its length extending beyond tip of rostrum; article 2 bearing tiny subdistal ventral spine; scale moderate, oval.

Mxp3 with epipod.

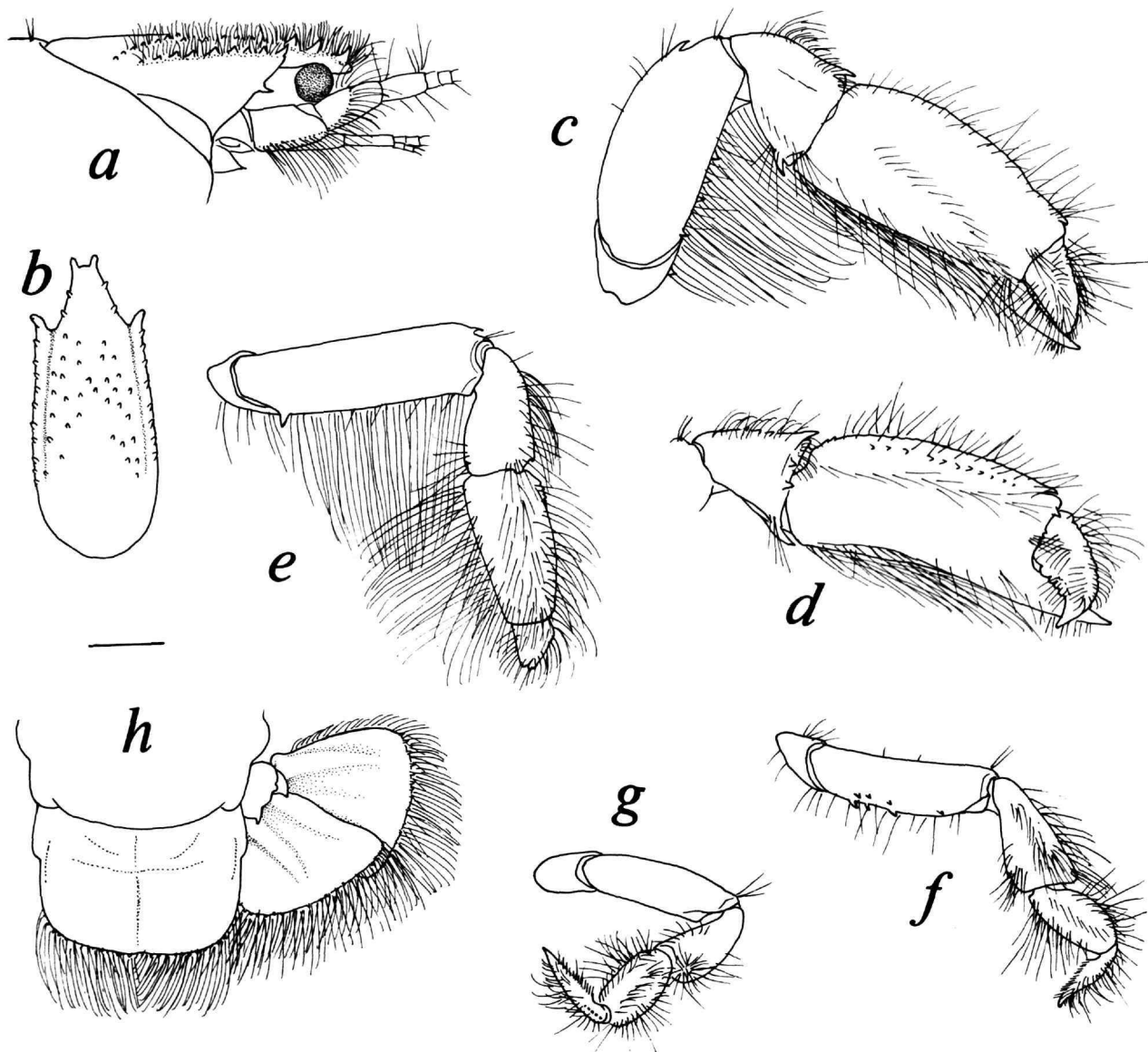


FIGURE 15.—*Upogebia aquilina*, new species, USNM 251426, ♂ holotype: *a*, cephalic region, lateral; *b*, anterior carapace, dorsal; *c*, cheliped, right lateral; *d*, chela and carpus, left mesial; *e-g*, legs 2-4; *h*, parts of abdominal segment 6, telson, and uropods, dorsal. (Scale = 1 mm.)

Epistomial projection of adult rather broad in lateral view, bearing acuminate apical spine or 2 small slender spines.

Chelipeds with coxa bearing small spine on mesiodistal margin. Ischium bearing 1 spine on ventral margin. Merus with ventral margin bearing 5-6 small to moderate spines; single subdistal dorsal spine reaching level of postocular spine. Carpus trigonal, obsolescent longitudinal groove laterally, anterior ventrolateral corner usually bearing small stout spine

preceded by remote smaller spine, but sometimes spineless; prominent dorsal spine on anterior margin preceded by mesiodorsal crest of 5-6 almost uniform small spines, partly obscured by setae in many adults; 2-4 very small spines on anterodorsal margin mesial to articulation with propodus; adults with 1 small spine near middle of anteromesial margin, and smaller or obsolescent spine dorsal to it, but this margin sometimes unarmed; small slender spine at distoventral corner.



Chl about 2–3.5 times chh (depending on wear); lateral patch of long setae near base of fixed finger; spineless dorsal ridge terminating anteriorly near distal spine mesial to it; mesiodorsal row of forward-trending spines, usually about 14, becoming more widely spaced and obsolescent near anterior margin, fewer and obsolescent in juveniles and subadults; mesial surface bearing row of variously developed sparse low spines at level of lower  $\frac{1}{3}$  (sometimes obsolete), low transverse arcuate ridge near proximomesial corner arising on sharp ventral keel, adult may have slightly rugose area mesiodorsally; lateral and mesial dactylar condyles usually bearing associated ventral spine, distomesial margin entire except for weak spine on lower  $\frac{1}{2}$ . Fixed finger slightly shorter than to as-long-as dactyl (noticeably shorter if worn) and more slender, slightly downcurved in middle and tapering to slender tip, 4–5 low teeth on proximal prehensile edge, distalmost sometimes clumped as a pair. Dactyl bearing longitudinal rows of setae; hawkbilled in lateral or mesial outline, tip strongly flexed, preceded on prehensile edge by crest of about 8–9 low rounded teeth, sometimes badly worn, ending in larger tooth proximally, toothless section at base short; tip often preceded on curved extensor surface by tiny subdistal corneous spine, and 2 rows of tiny tubercles proximally.

P2 reaching about to midlength of palm; carpus with small, occasionally obsolescent, distodorsal spine and stronger, acute, subdistal ventral spine; merus with obsolescent subdistal dorsal spine, often a distodorsal spine as well, and well-developed proximal mesioventral spine; coxa of adults with strong proximal spine mesially, but only a shoulder present in smaller individuals. P3 with 2–4 small ventral and ventrolateral spines. P4 with spineless merus and ischium.

U with acute spine on protopod above base of mesial ramus; both rami with dense fringe of setae and minute scattered spinules or granules on distal margin; lateral ramus with mesial rib bearing obsolescent spine.

MEASUREMENTS (in mm).—Holotype ♂, acl 4.5, cl 6.3, chl 4.8, chh 1.8; ♀ (allotype), same, 5.6, 7.8, 4.0 (worn), 1.9.

COLOR.—Body pale white, speckled red (field notes for HBOM 89:2601).

KNOWN RANGE.—Confined to material examined.

REMARKS.—*Upogebia aquilina* belongs to the large group of western Atlantic species in the genus that have a proximoventral spine developed on the merus of P2. The structure of the cheliped dactyl in *U. aquilina* resembles that of *U. corallifora* and *U. annae*, possessing a tiny subdistal corneous spine on the extensor surface that is subordinate to the overgrown noncorneous dactylar tip; the overgrowth is magnified in *U. aquilina*. Both *U. corallifora* and *U. aquilina* have a proximoventral spine on the merus of P2, whereas this spine is absent or obsolescent in *U. annae*. For other remarks, see accounts for the comparative species.

ETYMOLOGY.—From the Latin *aquilinus* -a -um (of or pertaining to an eagle), for the fancied resemblance of the hooked dactyl of the cheliped to the beak of an eagle.

### *Upogebia careospina*, new species

FIGURE 16

MATERIAL EXAMINED.—BRAZIL: USNM 138899, ♀ (holotype), Ceará, N of Camocim, 02°31'S, 40°51'W, 27.5 m, Oregon sta 4247, 40-ft shrimp trawl, 12 Mar 1963; USNM 251244, ♀ ovig. (paratype), same.

DIAGNOSIS.—Projections to either side of rostrum ending in acute spine. Postocular spine present. Abdominal sternites unarmed. T subrectangular. Carpus of cheliped with 2 spines on mesiodistal margin, palm without row of spines on mesioventral surface. Merus of P2 with proximal mesioventral spine and subdistal dorsal spine; merus of P4 spineless.

DESCRIPTION.—Rostrum triangular, lateral margin shorter than basal width; slightly downcurved in lateral view, tip exceeding eyestalks; dorsal pair of strong subapical spines followed on each side by 2–3 spines separated by nearly equally wide intervals, central dorsal area spineless and densely setose; posteriorly divergent lateral ridge bearing crest of about 13–15 moderate to small spines, strongest on process lateral to rostrum and decreasing almost to obsolescence posteriorly. Shoulder lateral to cervical groove unarmed below intersection with thalassinidean line, latter continuing strongly to posterior margin. Postocular spine present.

Abdominal sternites unarmed.

T bearing low transverse proximal ridge confluent with low longitudinal ridge to either side.

Eyestalk stout, deepest at about midlength, concave dorsally, convex ventrally, almost horizontal in repose; cornea prominent, oval, obliquely terminal, narrower than diameter of stalk.

A1 peduncle reaching about to base of terminal article of A2 peduncle, its proximal 2 articles together slightly longer than terminal article.

A2 peduncle with almost  $\frac{1}{3}$  its length extending beyond tip of rostrum; article 2 with dorsal margin raised into densely setose slight lobe at midlength and less setose submesial lobe; scale moderate, oval.

Mxp3 bearing epipod.

Epistomial projection rather broad in lateral view, bearing small apical projection.

Chelipeds with coxa bearing small spine on mesiodistal margin. Ventral margin of ischium bearing 1 spine. Merus with row of 4–7 relatively strong spines on ventral margin, number differing on right and left sides of both females examined; single subdistal dorsal spine reaching level of postocular spine. Carpus trigonal, shallow longitudinal groove laterally, anterior ventrolateral corner with or without obsolescent spine preceded by 0–2 obsolescent spines; mesiodorsal crest of 8 small spines behind prominent spine on anterior margin, and 1 or 2 obsolescent spines near articulation with merus, partly obscured by setae in proximal part of row; 4 variable spines obscured by dense setae on anterodorsal margin mesial to articulation with propodus; strong spine near middle of anteromesial margin, smaller similar spine dorsal to it, and very

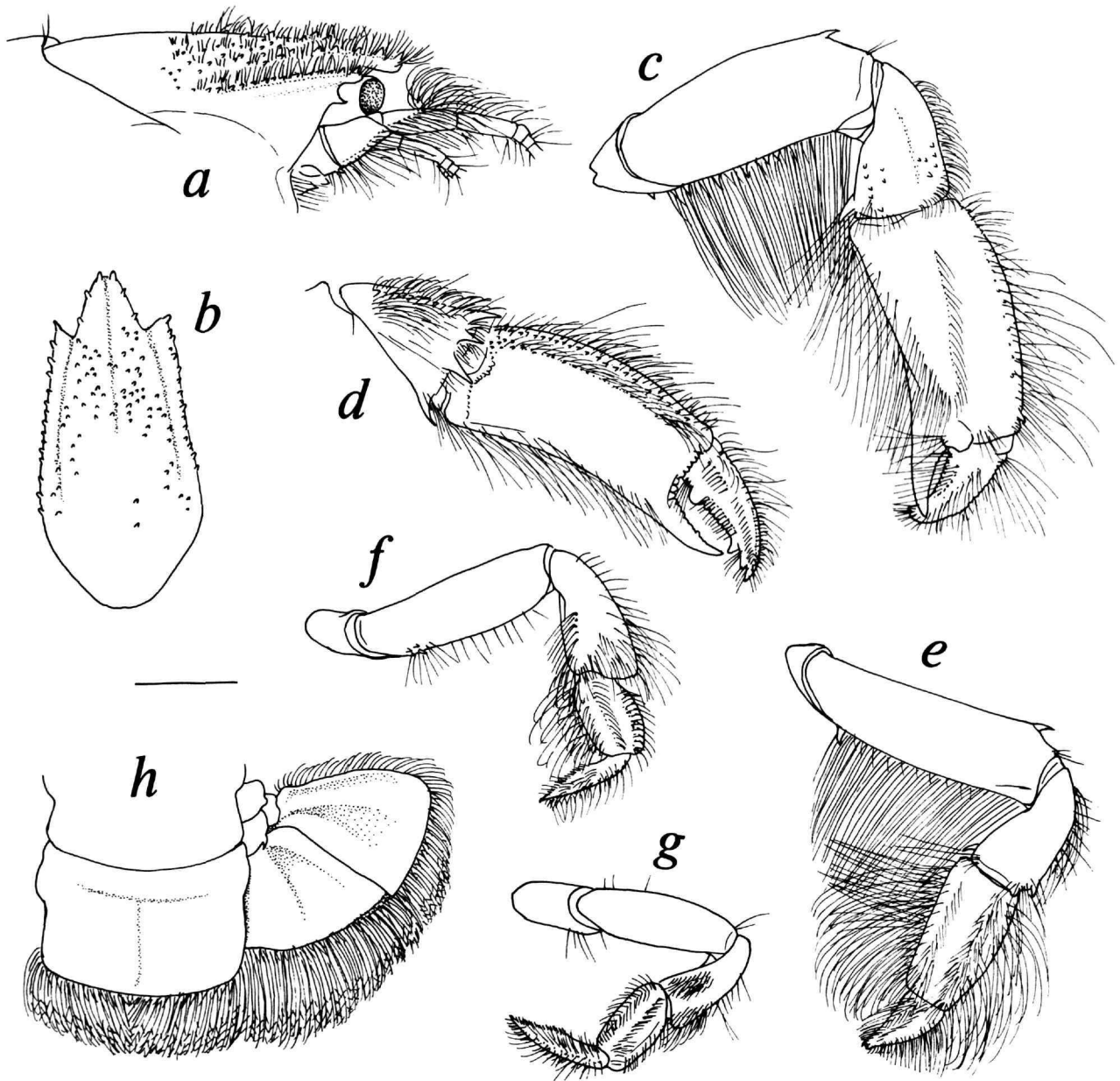


FIGURE 16.—*Upogebia careospina*, new species, USNM 138899, ♀ holotype: *a*, cephalic region, lateral; *b*, anterior carapace, dorsal; *c*, cheliped, right lateral; *d*, chela and carpus, left mesial; *e-g*, legs 2-4; *h*, parts of abdominal segment 6, telson, and uropods, dorsal. (Scale = 1 mm.)

strong spine behind distoventral corner. Chl about 2.6-2.9 times chh; spineless dorsal ridge rather inconspicuous, partly obscured by setae, with stout spine mesial to it subdistally; mesiodorsal row of about 13-20 irregularly distributed small spines or spiniform tubercles, becoming obsolescent near distal

$\frac{2}{3}$  of palmar length and with tendency for development of scattered spines around proximal end of row; moderate spine and row of about 4 smaller rounded teeth below mesial dactylar condyle, single spine on margin below lateral condyle; mesial surface bearing longitudinal row of obsolescent ciliated

tubercles on upper  $\frac{1}{2}$ , lower  $\frac{1}{2}$  unornamented; sinuous transverse granulatuberculate ridge surface near proximomesial margin intersecting rather sharp ventral keel. Fixed finger shorter than dactyl and more slender, continuing curve of lower margin of palm and tapering to slender tip, 5 irregular strong teeth on proximal prehensile edge. Dactyl with corneous tip preceded on prehensile edge by subdistal tooth, small tooth at base of much larger tooth opposing tip of fixed finger, and crowded row of 6–8 small teeth increasing proximad to much larger tooth near base, toothless section basally; mesial more or less concave surface bearing 2 rows of closely crowded periform tubercles, upper row running nearly length of finger, lower row only  $\frac{1}{2}$  as long; curved extensor surface bearing 2 rows of small tubercles, strongest at base and diminishing to obsolescence distally, few scattered granules between rows at base.

P2 reaching about to midlength of palm; carpus with small acute distodorsal spine and similar subdistal ventral spine; merus with subdistal dorsal spine and strong proximal mesioventral spine; coxa with proximal spine, obsolescent in holotype but strong and doubled on right side in paratype. Merus of P3 with 2–3 ventral spines proximally; coxa with broad low spine lateral to gonopore. P4 with spineless merus.

U with acute short spine on protopod above base of mesial ramus; mesial rib of lateral ramus bearing tubercle proximally, distal margin of both rami bearing row of weak granules well-spaced apart.

MEASUREMENTS (in mm).—Holotype ♀, acl 8.6, cl 14.5, chl 5.7, chh 2.0; paratype ♀, same, 5.1, 7.3, 5.2, 2.0.

KNOWN RANGE.—Confined to the material examined.

REMARKS.—*Upogebia careospina* seems to resemble most closely *U. vasquezi*, but it differs in that the palms of the chelae have weaker dorsal spines and lack mesioventral spines. The carpus of the chelipeds is nearly featureless laterally. It is possible that this species could be interpreted as an extreme variant of *U. vasquezi*, but the dense setation and differences in spination clearly set it apart.

ETYMOLOGY.—From the Latin “careo,” to be without, want, be deprived of, and “spinata,” spines, for lack of a diagonal row of spines on the lower mesial surface of the chela.

### *Upogebia corallifora* Williams and Scott, 1989

FIGURES 17, 18

*Upogebia corallifora* Williams and Scott, 1989:405, figs. 1, 2.

MATERIAL EXAMINED.—JAMAICA: USNM 230075, ♀ ovig. (holotype), Drunkenmans Cay, Port Royal, 3–4 m, area of dead *Siderastrea siderea* (Ellis and Solander, 1786), P.J.B. Scott, Oct 1986; USNM 230076, 2 ♂, 2 ♀ (1 ovig.) (paratypes), Drunkenmans Cay, Port Royal, ~2–4 m, P.J.B. Scott, 10 Oct 1986 (1 ♂ and 1 ♀ from this lot of specimens have been deposited in the National Museum of Canada); *Upogebia corallifora*? USNM 230077, 2 ♀ juvs., 2 juvs., Discovery Bay,

boring in Pleistocene CaCO<sub>3</sub> of an artificial reef, about 5 m depth, P.J.B. Scott, Oct 1986.

PUERTO RICO: USNM 251243, 1 ♂, 1 km E Cabo Rojo Light, in fine sand, 0.5 m, H. Austin, 15 Apr 1967.

VIRGIN ISLANDS OF THE UNITED STATES: *St. Croix* (all collected by M.L. Reaka project; in following list, excr. = experimental coral rubble sun dried and placed on reef): Teague Bay: USNM 251372, 1 juv., natural dead coral rubble on live patch reef in midlagoon, 3 m, PR-2, 19 Jun 1980; USNM 251373, 1 juv., natural dead coral rubble, base of live fore reef, 12 m, FR-6, 26 Feb 1981; 2 juvs., same habitat, PR-3, 4 Mar 1981; 3 ♂ juvs., same habitat, PR-4, 4 Mar 1981; 1 juv., same habitat, FR-10, 8 Mar 1981; USNM 251374, 1 ♀, natural dead coral rubble, live patch reef behind barrier reef, 3 m, PR-2, 17 Jun 1981; 2 ♀, same habitat, PR-7, 17 Jun 1981; 2 ♂, same habitat, PR-8, 17 Jun 1981; 2 ♀, same habitat, PR-10, 17 Jun 1981; 1 ♂ juv., natural dead coral rubble on live patch reef, midlagoon, 3 m, PR-1, 4 Mar 1981; USNM 251375, 1 ♂, 6 juvs., frags., excr. patch reef midlagoon, 3 m, PRcol3, wk3, 7 Jul 1981; USNM 251376, 4 juvs., excr. on patch reef in lagoon, ~3 m, PR-2, 11 Sep 1981; 1 juv., excr. back of bank barrier reef, 3 m, BR-3, 12 Sep 1981; 1 juv., excr. sea grass beds in lagoon, 4 m, SG4, 13 Sep 1981; 1 juv., excr. fore reef, 12 m, CST FR  $\frac{1}{2}$ -5, 15 Sep 1981; 2 juvs., same habitat, FR FC 1, 15 Sep 1981; 3 juvs. frags., same habitat, FR-1, 16 Sep 1981; USNM 251377, 1 cephalothorax, excr. back of bank barrier reef, 3 m, AgSt Full 3A, 24 Jul 1982; USNM 251378, 1 juv., frags., same habitat, FR-9, 8 Mar 1981. Boiler Bay: USNM 251379, 1 ♂, 1 juv., natural dead coral rubble on live fringing reef with scattered seagrass, BBS-6, 7 Jun 1980; 6 juvs., same habitat, BBS-2, 20 Oct 1980; USNM 251380, 2 ♂, 4 ♀, frags., same habitat, BBS-1, 11 Feb 1981; USNM 251381, 1 ♂, 4+ juvs., excr. fringing reef, 3 m, BBST  $\frac{1}{2}$  C2, 30 Apr 1981; USNM 251382, 2 ♂, 1 ♀, fringing reef, natural dead coral rubble and seagrass, 3 m, BBS-6, 18 Jun 1981; USNM 251383, 3 juvs., excr. fringing reef, 3 m, BBS col. 4, wk. 5, 19 Jul 1981; 2 ♀, 2 juvs., natural dead coral rubble, 2 m, AF-8, 30 Jul 1981; USNM 251384, 2 ♂, 4 juvs., same habitat, BBST  $\frac{1}{2}$  C4, 9 Sep 1981; several juvs., natural dead coral rubble/sea grass on fringing reef, 3 m, BBS-4, 19 Aug 1980; USNM 251385, 1 juv., same habitat, BBST-1, 10 Sep 1981; 1 ♂ frag., excr. fringing reef, 3 m, BBST  $\frac{1}{2}$  C5, 19 Sep 1981. Salt River Canyon: USNM 251386, 6 juvs., frags., excr. base of cinder block reef on sandy canyon floor, 20 m, MAV3, 12 Jan 1981; 1 juv., same habitat, MCIII-3, 12 Jan 1981; 2 cephalothoraxes (1 a ♀), same habitat, DC-1, 21 Jan 1981; USNM 251387, 1 ♀, 1 juv., natural dead coral rubble, back side bank barrier reef, 3 m, SCon-10, 30 Jun 1981; 2 ♂, 1 ♀, frags., natural dead coral rubble on live reef slope, 30–35 m, DCon-9, 27 Jun 1981; 3 ♂, 2 ♀ (1 ovig.), juvs., same habitat, SIV-2, 29 Jun 1981; 2 ♂, excr. on sand/sea grass floor, 3 m, SIII-4, 29 Jun 1981; 2 ♂, 5 ♀, frags., natural dead coral rubble, back side barrier reef, 3 m, SCon-1, 30 Jun 1981; 2 ♀, same habitat, SCon-4, 30 Jun 1981; 5 ♂, 4 ♀, 2 cephalothoraxes, same habitat, SCon-9, 30 Jun 1981; USNM

251388, 3 ♂, same habitat, DR-2c, 16 Jan 1982; USNM 251389, 3 ♂, 2 ♀, 1 juv., natural dead coral rubble back of barrier reef, 3 m, SCon-4, 18 Jan 1982; 1 ♂, 1 ♀, same habitat, SCon-3, 18 Jan 1982; 1 ♂, 1 ♀, same habitat, SCon-2, 18 Jan 1982; USNM 251392, 2 ♂, 1 ♀, natural coral rubble on reef slope, 20 m, SCon-4, 16 May 1982; USNM 251390, 1 ♀ ovig., 2 ♂ juvs., excr. sand/sea grass floor, 3–4 m, SAIV-1, 17 May 1982; 1 ♂, same habitat, SAV-3, 17 May 1982; USNM 251393, juv., excr. around cinder block experimental reef on sandy canyon floor, 20 m, MAIII-1, 20 May 1982; 1 juv., same habitat, MAIV-3, 20 May 1982; 1 ♀, same habitat, MAV-3, 20 May 1982; 4 ♂, 1 ♀ ovig., same habitat, MAII-6, 21 May 1982; USNM 251391, 3 juvs., excr. same habitat, 30–35 m, DAII-1, 22 May 1982; 1 ♂ juv., 1 ♀ juv., same habitat, DAIV-1, 22 May 1982; 1 ♂ juv., frags., same habitat, DAV-1, 22 May 1982; 1 ♂, 1 ♀, same habitat, DAV-6, 22 May 1982; 1 ♂, 1 ♀ ovig., excr. same habitat, DAII-6, 20 Aug 1982; USNM 251394, 1 juv., excr. placed on sandy canyon floor, 20 m, MCII-1, 23 May 1982; 1 ♂, 3 juvs. frags., same habitat, MCII-3, 23 May 1982; 1 juv., same habitat, MCIV-1, 23 May 1982; 1 postlarva, same habitat, MCIV-6, 23 May 1982; 1 ♀, same habitat, MCV-6, 23 May 1982; 1 ♂, 1 ♀ ovig., same habitat, MCV-1, 23 May 1982; USNM 251395, 1 juv., natural coral rubble, live reef slope, 20 m, MC-5, 25 May 1982.

MEXICO: *Quintana Roo*: USNM 251178, 1 ♂, Ascension Bay, along shore near Suliman Pt., rocks above high tide to tide pools below low tide level, Smithsonian-Bredin Caribbean Exped. IV, sta 85-60, Schmitt, Daiber, Bousfield, Rehder, 17 Apr 1960; USNM 251180, 1 ♂, N of Ascension Bay, 200–300 yds SW Suliman Pt., sand shallows, 0.6–1.5 m (2–5 ft), Smithsonian-Bredin Caribbean Exped. IV, sta 85-60, Bousfield, Daiber, Rehder, 17 Apr 1960.

DIAGNOSIS.—Projections to either side of rostrum ending in acute spine. Postocular spine present. Abdominal sternites unarmed. T subrectangular. Carpus of cheliped in juveniles with no spines on anteromesial margin, adults with 0–1 or 2 small spines and rarely a row of obsolescent spines in this position. Merus of P2 bearing proximal mesioventral spine in adults, but no such spine in juveniles, and poorly developed subdistal dorsal spine; merus of P3 varying from spineless to bearing as many as 4 obsolescent ventral and ventrolateral spines; merus of P4 spineless.

DESCRIPTION.—Rostrum triangular, slightly downturned; lateral margin shorter than basal width in adults, but longer than this in juveniles; tip exceeding eyestalks by about  $\frac{1}{2}$  width of cornea; dorsal pair of strong subapical spines followed on each side by 2 spines successively shorter in length, distance between subapical spines and second pair about twice that between second and third pair, median dorsal area spineless except for sparse spines at base; posteriorly divergent lateral ridge bearing crest of about 11–14 spines, strongest on process lateral to rostrum and decreasing to obsolescence posteriorly. Shoulder lateral to cervical groove usually unarmed but sometimes bearing obsolescent tubercle below intersection

with thalassinidean line. Postocular spine present.

Abdominal sternites unarmed.

T subrectangular, transverse proximal ridge confluent with inconspicuous longitudinal ridge at each side, shallow median concavity on distal margin.

Eyestalk stout, deepest at about midlength, straight to convex ventrally; prominent obliquely terminal cornea narrower than diameter of stalk in lateral view.

A1 peduncle reaching to about proximal  $\frac{1}{4}$  of terminal article of A2 peduncle, its proximal 2 articles together slightly longer than terminal article.

A2 peduncle with about  $\frac{1}{2}$  its length extending beyond tip of rostrum; article 2 bearing tiny subdistal ventral spine; scale moderate, oval, sometimes with minute terminal spine.

Mxp3 bearing epipod.

Epistomial projection of adult rather broad in lateral view, bearing small apical spine; that of juvenile rather narrowly rounded in lateral view, unspined at tip.

Chelipeds with coxa usually unarmed, occasionally 1 slender spine on mesiodistal margin. Ventral margin of ischium unarmed or bearing 1 small or obsolescent spine. Merus with ventral margin often unarmed, but may bear 2–5 small to moderate spines; single subdistal dorsal spine reaching level of postocular spine. Carpus trigonal, shallow longitudinal groove laterally, anterior ventrolateral corner sometimes with slender spine, but often spineless; prominent dorsal spine on anterior margin preceded by mesiodorsal crest of almost uniform small spines partly obscured by setae in many adults, but these small spines often missing; 2–4 very small spines on anterodorsal margin mesial to articulation with propodus; adults with 1 small spine near middle of anteromesial margin, and obsolescent spine dorsal to it, sometimes both of these spines minutely doubled, but this margin usually unarmed in juveniles and subadults; small slender spine at distoventral corner. Acl about 3 times chh; lateral patch of long setae near base of fixed finger; spineless obsolescent dorsal ridge terminating anteriorly near distal spine mesial to it; mesiodorsal row of forward trending spines, usually about 8–11, becoming obsolescent near anterior margin, fewer and sometimes completely obsolescent in juveniles and subadults; mesial surface usually unarmed, row of variously developed setal tufts below mesiodorsal row of spines, low transverse arcuate ridge near proximomesial corner arising on sharp and occasionally granular ventral keel, large adult may have slightly rugose area mesiodorsally; lateral and mesial dactylar condyles usually without associated spines, distomesial margin entire except for weak spine or tubercles on lower  $\frac{1}{2}$ . Fixed finger slightly shorter than dactyl and more slender, slightly downcurved in middle and tapering to slender tip, 3–4 small teeth on proximal prehensile edge. Dactyl bearing longitudinal rows of setae, its curved extensor surface sometimes bearing about 3 small, proximal tubercles; elongate acute tip often preceded on extensor surface by tiny subdistal corneous spine; crest on prehensile edge bearing row of often irregular and poorly defined small teeth, ending in larger tooth

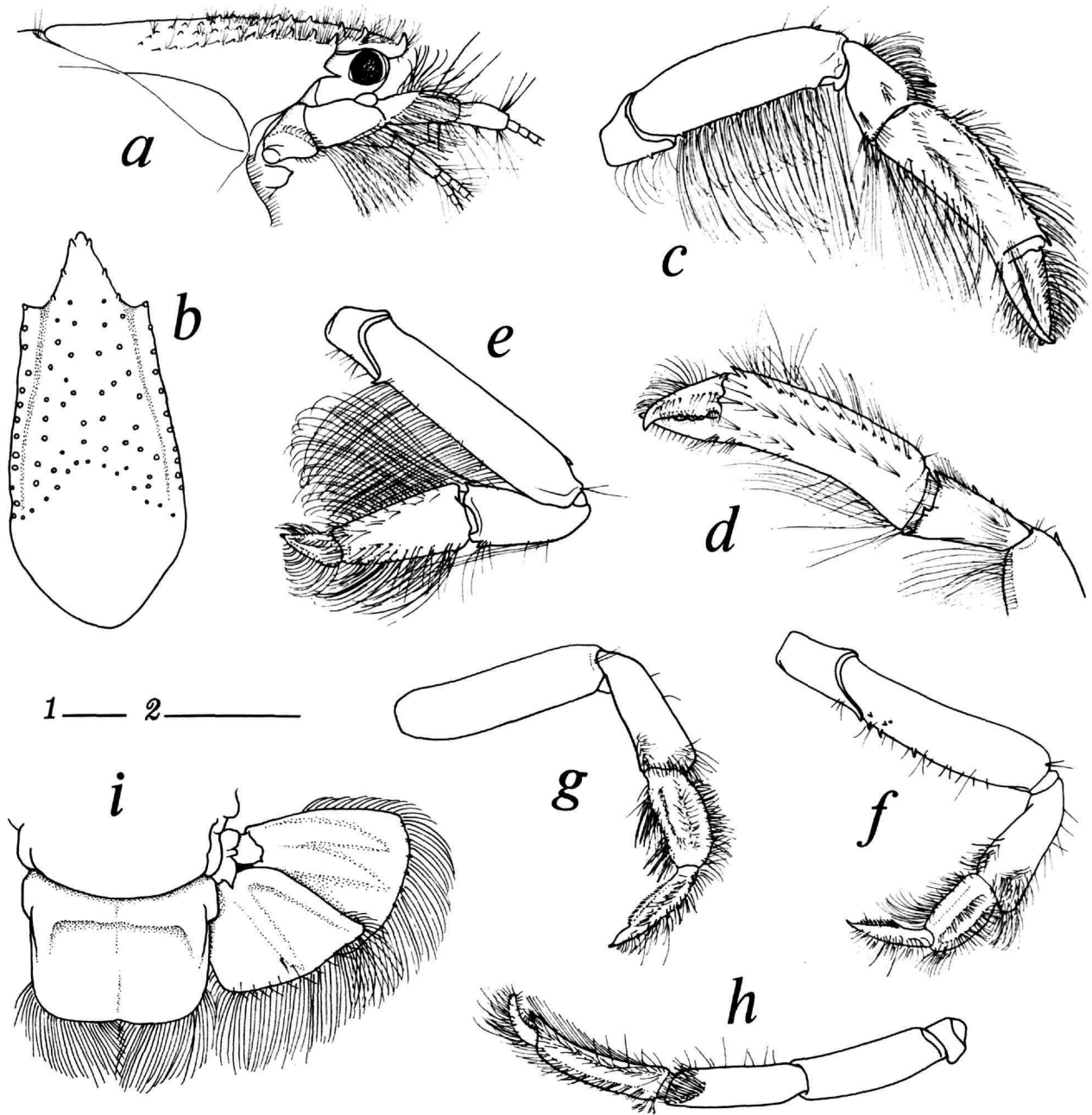


FIGURE 17.—*Upogebia corallifora* Williams and Scott (*a-d, h, i*, USNM 230075, ♀ holotype; *f, g* USNM 230076, paratypes (from Williams and Scott, 1989)): *a*, cephalic region, lateral; *b*, anterior carapace, dorsal; *c*, cheliped, right lateral; *d*, chela and carpus, right mesial; *e-h*, legs 2-5; *i*, parts of abdominal segment 6, telson, and uropods, dorsal. (Scales = 1 mm: 1 = *a-h*; 2 = *i*.)

proximally, toothless section at base short.

P2 reaching about to distal 1/4 of palm; carpus with obsolescent distodorsal spine and tiny, acute, subdistal ventral

spine; merus with obsolescent subdistal dorsal spine, moderate proximal mesioventral spine in adults, but none in juveniles; coxa often with strong proximal and smaller distal spine

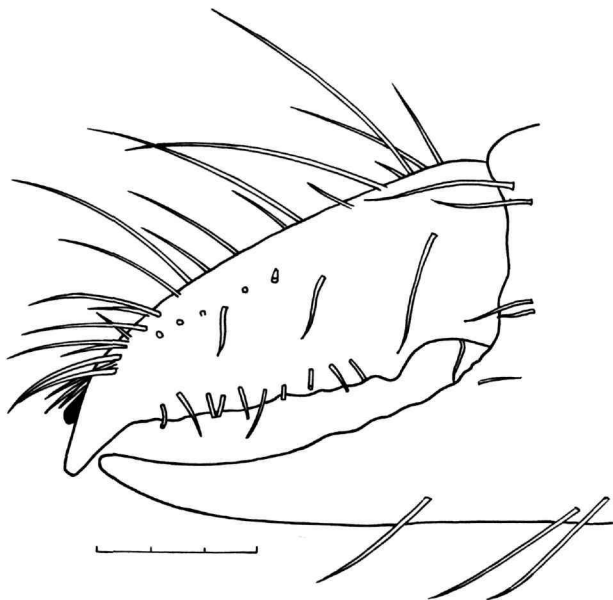


FIGURE 18.—*Upogebia corallifora* Williams and Scott, USNM 292393: Fingers of chela showing subterminal corneous (darkened) spine on extensor surface of dactyl. (Scale = 0.3 mm.)

mesially, but unarmed in smaller individuals. P3 with 1–5 obsolescent ventral and ventrolateral spines. P4 with spineless merus and ischium.

U with obsolescent spine on protopod above base of mesial ramus; both rami with dense fringe of setae and minute scattered spines or granules on distal margin; lateral ramus with mesial rib bearing obsolescent spine.

MEASUREMENTS (in mm).—Holotype ♀, acl 4.6, cl 7.3, chl 4.5, chh 1.2; ovigerous ♀, same, 3.3, 4.8, 3.2, 0.74; ♂, same, 3.8, 5.2, 3.3, 1.2.

COLOR.—Field notes describe the Puerto Rico specimen, USNM 251243, as white.

KNOWN RANGE AND HABITAT.—Known distribution of *U. corallifora* is limited to localities listed above, although Williams and Scott (1989) noted a specimen of what appeared to be this species that was collected from dead coral on the reef of Bellairs Research Institute, Barbados, in 1981. This specimen was lost and cannot now be verified. It is possible that the species is widely distributed in coral reef habitats of the Caribbean region (see Williams and Scott, 1989).

Williams and Scott (1989) noted that the Jamaican habitat of *U. corallifora* partly overlaps that of *P. operculata*. Both species inhabit dead coral skeletons there, but occurrence of the former is much restricted. It has not been found with boreholes opening from living corals, which are a common habitat for *P. operculata* (Scott et al., 1988). The abundant samples from St. Croix provided by M.L. Reaka amply demonstrate the

association of these two species with coral and coral rubble there, although actual presence in boreholes was not demonstrated in this sampling program.

REMARKS.—The dactyl of the cheliped in *Upogebia corallifora* has a calcareous tip that is often preceded on its extensor surface by a tiny subdistal corneous spine. Presence of this spine was not noticed when the species was first described (Williams and Scott, 1989) and only became apparent when the large series from St. Croix was studied, for the spine is often more evident in juveniles than in adults. The tip of this finger is analogous to that on other species in the genus (*U. brasiliensis*, for example) that have the dactyl ending in a prominent acute corneous tip preceded on the prehensile surface by an adjacent calcareous tooth, but in *U. corallifora* the corneous spine has overgrown the corneous dactylar tip to become the functional tip of the dactyl (Figure 18), thereby relegating the corneous tip to a subordinate reduced spine on the subdistal extensor surface of the finger. This secondarily reduced corneous spine is not always evident because it may be worn, obscured by a dense setal tuft, or lost by breakage of the dactyl tip.

#### *Upogebia felderi*, new species

FIGURE 19

MATERIAL EXAMINED.—U.S.A.: *Texas*: USLZ 3515, 1 ♂ (paratype), Calhoun Co., Port O'Connor, shoreline of bay, yabby pump, D. Felder and J. Staton, 3 Aug 1990.

Mexico: *Tamaulipas*: USLZ 3017, 2 ♂ (paratypes, 1 with ♀ bopyrid, *Progebiophilus upogebiae* (Hay) and attached ♂), Barra del Tordo, mouth of Río Carrizal, oyster covered beaches near grass beds, shallow water and intertidal, D.L. Felder, R. Tinin, N. Rabalais et al., USL 7FF III-B, 14 Jun 1978; USLZ 3018, 1 ♂ (paratype), same, on edges and just inshore of *Thalassia* bed, 0–0.5 m in estuary about 500 m from mouth, between village and dune line, yabby pump, photo voucher, 14 Jun 1978; USLZ 3019, 11 ♂, 7 ♀ (2 ovig., 1 bearing bopyrid, USNM 251431 and USNM 251433 taken from original number of specimens in lot, remainder are paratypes), same, inshore of grass beds, yabby pump, D.L. Felder and R. Tinnin, sta 6, 24 May 1982; USLZ 3020, 1 ♀ juv. (paratype), same, 12–15 m deep on rocky ledges among muddy dead bryozoans, D.L. Felder and N. Rabalais, 17 Aug 1979; USLZ 3021, 3 ♂, 2 ♀ (1 ovig.) (paratypes), same, D.L. Felder and N. Rabalais, 25 May 1982; USLZ 3498, 1 ♂, 4 ♀ ovig. (USNM 251430 and USNM 251432 taken from original number of specimens in lot, remainder are paratypes), Barra del Tordo, mangrove mud flat and beach shore near seagrass flats, yabby pump, 32 ppt, D.L. Felder and party, USL TFE 91-1, 31 Mar 1991; USNM 251430, 1 ♂ with oviducal openings (holotype), from USLZ 3498; USNM 251431, 1 ♀ ovig. (allotype), from USLZ 3019; USNM 251432, 1 ♂, 3 ♀ ovig. (paratypes), from USLZ 3498; USNM 251433, 3 ♂, 2 ♀ (paratypes), from USLZ 3019.

**DIAGNOSIS.**—Rostrum often with anteriorly projecting spine terminating ventral row of spines. Projections to either side of rostrum ending in moderate spine. Postocular spine present. Abdominal sternites unarmed. T subrectangular. Carpus of cheliped with 2 very strong spines below mesiodorsal spine on anteromesial margin. Merus of P2 with proximal mesioventral spine and 1 subdistal dorsal spine; merus of P3 with ventrolateral cluster of spines; merus of P4 spineless.

**DESCRIPTION.**—Rostrum triangular, slightly broader at base than long, slightly downturned; median ventral keel often bearing variably developed spines, anteriormost usually projecting forward, usually exceeding eyestalks in normal position by  $1/3$ – $1/2$  their length; dorsal pair of subapical spines followed on each side by 2–4 often asymmetrically arranged spines; middorsal area spineless; posteriorly divergent lateral ridge bearing crest of about 12 spines, strongest in middle of row and decreasing in size posteriorly, anterior spines lateral to rostrum hidden in dense setae. Shoulder paralleling cervical groove bearing 1 or 2 spines below intersection with thalassinidean line. Postocular spine present.

Abdominal sternites unarmed.

T with distal margin slightly biarcuate and sometimes bearing obsolescent median spine; transverse proximal ridge confluent with lateral ridges unspined.

Eyestalk stout, deepest at about midlength, convex ventrally, almost straight dorsal side sometimes bearing 1 or 2 small spines, 1 or 2 spines on mesial basal flange; prominent terminal cornea narrower than diameter of stalk and directed ventrolaterally.

A1 peduncle reaching to beyond midlength of terminal article of A2 peduncle, its proximal 2 articles together about equal in length to terminal article, proximal article without small distoventral angle mesially.

A2 peduncle with about  $1/3$  its length extending beyond tip of rostrum; article 1 either spineless ventrally, or bearing a spine; article 2 bearing strong subdistal ventral spine; scale moderate, oval.

Mxp3 bearing epipod.

Epistomial projection rather broad in lateral view, bearing 1 strong spine at distodorsal corner.

Chelipeds with coxa in male bearing small spine on mesiodistal margin. Ventral margin of ischium usually bearing 1 strong spine, occasionally 2, and sometimes asymmetrically 1 and 2 on either side. Merus with row of 4–6 strong spines on ventral margin, distal ones sometimes diminishing in length, subdistal dorsal spine reaching level of postocular spine. Carpus trigonal, shallow longitudinal groove laterally, strong spine at anterior ventrolateral corner preceded by 1–4 spines (sometimes worn or suppressed); mesiodorsal crest of 4–6 nearly uniform moderate spines leading to prominent spine on anterior margin, short strong dorsal spine or pair of unequal spines near articulation with merus partly obscured by setae; 2–3 (rarely 0) strong spines on anterodorsal margin mesial to articulation with propodus; strong spine near middle of

anteromesial margin, nearly equal or stronger spine dorsal to it, and very strong spine near distoventral corner. Chl about 1.9 times chh in male, about 2.5 times in female; spineless dorsal ridge, with erect dorsal spine or pair of spines near its proximal end; mesiodorsal row of strong spines, more erect proximally than distally and sometimes irregular in size and position, those on female variable in size and becoming diminished distally; strong spine below lateral dactylar condyle, reinforced distal margin below mesial dactylar condyle bearing spine and 3–4 rounded spines below it in fully adult male, less well developed in female and immature male; mesial palmar surface bearing arched upper row of obsolescent spines and well-developed setae, ventral keel bearing row of 3–4 spines proximal to base of fixed finger, low transversely arcuate beaded ridge near proximomesial corner. Fixed finger shorter than dactyl and more slender, continuing contour of lower margin of palm, though slightly bowed ventrally, and tapering to strong rounded tip in male, with slender acute tip in female, about 5 variable small teeth on proximal prehensile edge. Dactyl tip in male corneous, preceded on prehensile edge by tooth at  $2/3$  length opposing tip of fixed finger, then crest of about 5 closely crowded rounded teeth ending proximally in larger tooth at proximal  $1/4$  of length (sometimes only few large teeth in this row), and toothless section basally; arched extensor surface bearing central row of closely crowded beaded granules or spines, largest proximally and becoming obsolete distally, flanked on each side by longitudinal ridge, groove, and row of dense setae; files of beaded granules on mesial and submesial surfaces; corneous tip in female preceded by slightly curved

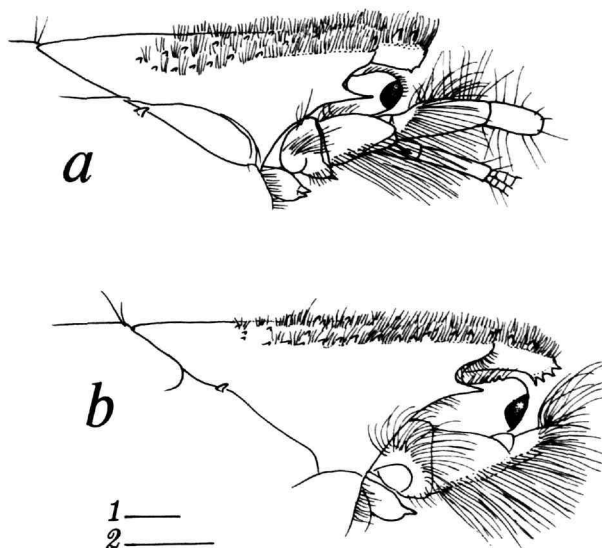


FIGURE 19.—*Upogebia felderi*, new species (a, USNM 251430, ♂ holotype; b, USNM 251431, ♀ allotype): a, b, cephalic region, lateral. (Scales = 2 mm: 1 = a; 2 = b.)