

ANOMURAN, MACRURAN CRUSTACEA
FROM PANAMA AND CANAL ZONE

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Article II.—A COLLECTION OF ANOMURAN AND MACRURAN
CRUSTACEA FROM THE BAY OF PANAMA AND THE
FRESH WATERS OF THE CANAL ZONE

BY LEE BOONE¹

TEXT FIGURES 1 TO 23

The present report discusses the second part of the collection of decapod Crustacea obtained by Dr. Williard G. Van Name during a trip to the Isthmus of Panama and Pearl Islands in the spring of 1926. The brachyuran Crustacea of this collection were reported by the writer in the Bulletin of The American Museum of Natural History, 1929, LVIII, Art. 11, pp. 561-583, Figs. 1-18.² The collection is deposited in The American Museum of Natural History. The specimens are to be credited in part to the work of other members of the party which included Mrs. Samuel D. Sturgis, Mr. and Mrs. Sherman P. Haight, and the late Mrs. Sydney E. Brewster.

The collection of Anomura and Macrura, though numerically smaller than the Brachyura, has proven even more interesting in the number of rare and new species represented. Of the twenty-one species collected, four are new to science, three of these four represent little-known groups of Macrura: namely, *Axianassa mineri*, *Upogebia sturgisæ*, *Peneus vannamei*, and *Automate haightæ*. Seven are very rare species, three of which are from the type locality and are especially valuable because the types are believed to be no longer extant. Two members of the West Indian fauna are recorded for the first time from the Bay of Panama. The known fauna of the Bay of Panama is increased by ten species, which is a goodly percentage in view of the many scientific investigations of these waters by the United States government and private expeditions.

Among the Anomura are two remarkably armored hermits, *Aniculus elegans* Stimpson, hitherto known only from the unillustrated type which is no longer extant. This is the only American species of this small genus of marine hermits, which is widely distributed in the Indo-Pacific.

Another rare hermit, *Pagurus benedicti* (Bouvier), collected in the Pearl Islands, establishes the first Panaman record for the species, hitherto known only from three records in the Gulf of California and Peru.

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²The specimens of *Pseudothelphusa richmondi* Rathbun (p. 568), collected by Mr. C. M. Breder of the New York Aquarium, were collected in the Rio Sucubti, a tributary of the Rio Chucunaque, Darien Peninsula, Panama, and not in Rio Chagres, Panama, as first stated. The error was due to a mixed label.

The extensive series of the flat-eyed land hermit, *Cænobita compressus* Guérin, enables the writer to present data on and an adequate figure of this species.

Among the Porcellanidæ collected are two species of unusual interest, *Petrolisthes galathinus* (Bosc) and *Megalobrachium poeyi* (Guérin), both well-known members of the West Indian fauna, here established for the first time as members of the West Coast fauna.

Conspicuously interesting among the Macrura is the finding of one specimen of the curious burrowing shrimp, *Axiassassa mineri*, new species, the first member of the little-known family *Laomediidæ* to be described from the American Pacific coast and the second species known from the western hemisphere.

Of scarcely less interest is the second burrowing shrimp, a new species, *Upogebia sturgisæ*, from the Bay of Panama, which is very distinct from *U. pugettensis* Dana, the more northern form.

The spiny lobsters, or Palinuridæ, are represented by two specimens of the rare *Panulirus inflatus* Bouvier, which established the first record of the species from the Bay of Panama. Accurate color notes made on living specimens brought from the Galápagos Islands to the New York Aquarium by Mr. Vincent Astor's expedition to Galápagos, 1929, are also presented. Curiously, the only other published records of this American species are founded on specimens deposited in European museums.

Three species of *Peneus* are represented in the collection: *P. brevirostris* Kingsley, the more abundant, kelp-dwelling, edible shrimp; *P. stylirostris* Stimpson, another large, but apparently rare, species which is here fully figured for the first time. Stimpson's type, which came from Panama, is no longer extant. The third is a new species, *P. vannamei*, also a large edible shrimp, which was rescued for science from the native fish market in Panama City. This species is the West Coast analogue of the West Indian *Peneus setiferus* Latreille. *Penæopsis kishinouyei* is recorded from the Bay of Panama for the first time.

The queer, little-known *Pontonia margarita* Smith, which lives commensal in the gills of the pearl oyster, is represented by two specimens which establish the second record for the species from the type locality, the Bay of Panama.

The snapping shrimps are represented by two specimens of *Automate haightæ*, new species, establishing this comparatively rare genus for the second time on the west coast of America.

The fresh-water fauna of the Canal Zone is represented by the large "thorny-clawl" shrimp, *Macrobrachium jamaicense* (Herbst); the little-

known habits of which species are amplified by Dr. Van Name's careful observations.

Atya occidentalis Newport, another fresh-water shrimp whose claws are curiously modified for sieving mud and silt, is added to the fauna of the Canal Zone.

I am indebted to Dr. R. W. Miner and Dr. W. G. Van Name for the privilege of preparing these two reports, also for the hospitality of Dr. Miner's department during the prosecution of the work. The line drawings of six species were prepared by Mrs. Helen Ziska of the American Museum, under my direction; the remaining line drawings were also made by Mrs. Ziska for my report on the Crustacea of the 'Eagle' and the 'Ara' and are here copied through the courtesy of Mr. William K. Vanderbilt of the Vanderbilt Marine Museum. The photographs were prepared by Mr. Hugh Rice of the American Museum photographic laboratory.

LIST OF ANOMURA AND MACRURA

Order ANOMURA

Family Paguridæ

Aniculus elegans Stimpson

Pagurus benedicti (Bouvier)

Family Cænobitidæ

Cænobita compressus Guérin

Family Hippidæ

Emerita analoga (Stimpson)

Family Porcellanidæ

Megalobrachium poeyi (Guérin)

Petrolisthes armatus (Gibbes)

Petrolisthes edwardsii (de Saussure)

Petrolisthes eriomerus Stimpson

Petrolisthes galathinus (Bosc)

Order MACRURA

Family Laomediidæ

Axianassa mineri, new species

Family Upogebidæ

Upogebia sturgisæ, new species

Family Palinuridæ

Panulirus inflatus Bouvier

Family Penæidæ

Peneus brevirostris Kingsley

Peneus stylirostris Stimpson

Peneus vannamei, new species

Penæopsis kishinouyei Rathbun

Family Palæmonidæ

Macrobrachium jamaicense (Herbst)

Family Pontonidæ

Pontonia margarita Smith

Family Alpheidæ

Alpheus heterochælis Say*Automate harghtæ*, new species

Family Atyidæ

Atya occidentalis Newport**Paguridæ****ANICULUS Dana**

Aniculus DANA, 1852, 'U. S. Explor. Exped.,' XIII, Crust., part 1, p. 460. STIMPSON, 1859, Proc. Acad. Nat. Sci. Phila., (1858), p. 234. MIERS, 1876, 'Cat. Crust. New Zealand,' p. 64. STEBBING, 1893, 'Hist. Crust.,' p. 60. THOMSON, 1898, Trans. New Zealand Inst., p. 184. ALCOCK, 1905, 'Cat. Indian Decapod. Crust. Calcutta,' Anomura, part 2, p. 94.

This small genus of hermits is represented by four species, three of which are rather widely distributed in the Indo-Pacific, the fourth species, which is quite rare, is known only from west Panama, and apparently the present material constitutes the second record of the species, the type of which is believed to be no longer extant.

As stated by Dr. Alcock, the genus *Aniculus* differs from *Pagurus* in the following particulars:

The chelipeds and next two pairs of legs are very regularly scutulated transversely like a sort of ringmail, the free edge of the scutes being elegantly ciliated.

The chelipeds are equal and similar, or very nearly so, and the fingers of both hands are short, blunt, and deeply spooned.

In the female the abdominal appendages are biramous, not triramous (and in the typical species, *A. aniculus*, in addition to the large foliaceous brood-flap, each of the first three appendages carries a large leaf-like bract which aids in forming the brood-pouch).

***Aniculus elegans* Stimpson**

Figure 1

Aniculus elegans STIMPSON, 1858 (issued March, 1859), Ann. Lyc. Nat. Hist., N. Y., VII, p. 83.

Aniculus longitarsis STREETS, 1871, Proc. Acad. Nat. Sci. Phila., p. 240.

TYPE.—Stimpson's type was found at Panama by the Rev. J. Rowell; it is believed to be no longer extant. Street's type of *A. longitarsis* was described in his 'Catalogue of Crustacea from the Isthmus of Panama,' with no other locality data than that cited in the title; it is deposited in the collections of the Philadelphia Academy of Natural Sciences, and is synonymous with Stimpson's *elegans*.

DISTRIBUTION.—Known only from the above records and the two specimens herein described from the Pearl Islands.

MATERIAL EXAMINED.—Two adults, one inhabiting a heavy *Strombus* shell, from Saboga Island Harbor, Pearl Islands, on a sandy beach with scattered rocks, at

extreme low tide, new moon, March 13, 1926, collected by Dr. W. G. Van Name and Mrs. S. D. Sturgis.

TECHNICAL DESCRIPTION.—Precervical region of carapace shield-shaped, 1.2 times as long as wide, frontal margin straight, except for a small median triangulate rostral point, anterior portion of lateral margins subparallel; median areolet out-



Fig. 1. *Aniculus elegans* Stimpson, natural size.

lining an incomplete trapezium which does not extend to the hinder margin of the precervical region. The postcervical region of the carapace widens posteriorly and is encased in a tough leathery membrane, its median region defined by an elongate, tonguelike, calcareous plate. Abundant tufts of stiff coarse setæ occur on the lateral walls of the carapace, and more scattered, well developed, coarse tufts are found on the dorsal surface.

The abdomen has the soft portion no longer than the carapace, rather stout, encased in a tough membrane; the telson and pretelsonic segment covered by squarish calcareous plate, which on the telsonic portion has a deep longitudinal sulcus. The distal portion of the telson is unequal, the left-hand side being much the longer and produced into a rounded tongue-like process fringed with stiff setæ; the left lateral telsonic margin is incised, as is also the right margin; the right distal lobe is aborted. The uropodal peduncle is stout, heavily calcareous, the blades unequal in size, each with a prominent elliptical patch of squamose scales; the margin of each blade fringed with stiff crimson setæ. The right uropod is much smaller than the left. Four biramous pleopoda occur on the left side of the abdomen, decreasing in size from the anterior end backward; each has peduncle small, but larger than the aborted posterior blade; the anterior blade is oval about twice as long as wide with ciliated margins.

The ocular scales are triangular with margins entire, apex acute, and directed inward toward each other. Eystalks slender, cylindrical, exceeding the width of the frontal margin by about the length of the cornea, which is terminal, convex, and slightly more dilated than the stalk. The antennules have the distal two peduncular articles very slender, cylindrical, the distal the longer. The peduncle, when extended, equals the eystalk in length; the flagella are short, the smaller branch consisting of about fifteen tapering rings; the stouter branch is only about one half as long as the eystalk and is rather thick for the proximal half of its length with a heavy brush of setæ on the underside of this portion. The peduncular article of the antenna has its outer distal angle produced into a triangulate tooth which reaches less than one-fourth the length of the acicule; the acicule is a narrow, acute triangle, its apex reaching only the length of the short second peduncular article; the third peduncular article is cylindrical, elongate, but only reaches two-thirds the length of the eystalk; the whip is stocky and long enough to reach to the tip of the chelipeds.

The chelipeds are approximately equal, about one and one-third times the length of the carapace, merus short, trigonal; carpus similar but shorter, both as stout distally as the palm; propodus stout, with the palm approximately as wide as long, fingers not quite so long as the palm, short and broad, with black, nail-like tips, cutting edges armed with several teeth. The entire merus, carpus, and propodus are ringed transversely by scutæ, each of which is margined anteriorly by a fine regular band of cilia. On the distal scutum of the carpus, the inner dorsal scutæ of the propodus and the scutæ of both fingers, there are numerous black spines on the distal margin of each scutum. The inner dorsal portion of the merus, carpus, and propodus, and both fingers, bear numerous tufts of long bristly red setæ. The scutæ stand out more sharply on the under side like cords, but are not tuberculated. The second pair of legs are scarcely one half the dactylus length longer than the chelipeds, while the third pair of legs is only a trifle shorter than the second, about one or two millimeters or the width of one scutum shorter. In this character, the American species differs from *A. aniculus* Fabricius as described by Alcock, who states of *A. aniculus*: "The second pair of legs is about a dactylus length, the third pair about half a dactylus length, longer than the chelipeds; in both pairs the dactylus is almost as long as the propodite." In *A. elegans*, the dactylus of both pairs is fully one-third longer than the related propodus. On the meral joint of the second and third legs, the transverse scutes are interrupted on the dorsal surface; the carpus and propodus are completely ringed by the scutæ; the dactyl has none, but is very hirsute and has a

curved, sharp nail. The lateral margins of the meral, carpal, and propodal joints of both legs are fringed with coarse setæ. The fourth and fifth pairs of legs afford no specific characters.

PAGURUS Fabricius

Pagurus benedicti (Bouvier)

Figure 2

Eupagurus minutus BENEDICT, 1892, Proc. U. S. Nat. Mus., XV, p. 14.

Eupagurus benedicti BOUVIER, 1898, Bull. Mus. Hist. Nat., Paris, IV, p. 381 (notes that *E. minutus* Hess, a different species, has priority to the name). RATHBUN, 1910, Proc. U. S. Nat. Mus., XXXVIII, p. 557, Pl. XLVIII, fig. 1.

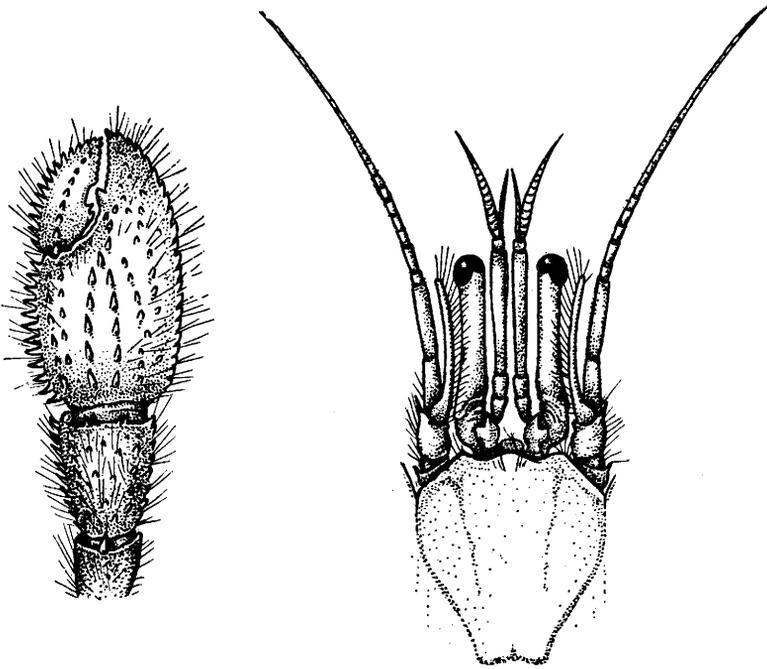


Fig. 2. *Pagurus benedicti* (Bouvier), $\times 3$.

DIAGNOSTIC CHARACTERS.—Carpus and propodus of great cheliped armed with sharp spines on each lateral margin, also with approximately three additional longitudinal rows of spines on the outer face, these rows being continuous on the fingers; a few scattered spines occur between the rows.

TYPE.—Dr. Benedict's type, a very young adult, was collected in the Gulf of California and is deposited in the U. S. National Museum; Dr. Bouvier's specimens were collected in La Paz Bay, and are deposited in the Paris Museum; Dr. Coker's material from Peru, referred "with some doubt" to this species by Dr. Rathbun, is also in the U. S. National Museum.

DISTRIBUTION.—Gulf of California, Bay of Panama, Peru, and Galápagos Islands ('Arcturus' Expedition).

MATERIAL EXAMINED.—One specimen on sandy beach with scattered rocks, at extreme low tide, new moon, Saboga Island Harbor, Pearl Islands, Bay of Panama, March 13, 1926, collected by Dr. W. G. Van Name.

TECHNICAL DESCRIPTION.—Carapace with anterior margin blunt, slightly sinuate. Anterior region of carapace with soft semicalcareous plate which has the lateral margins decidedly convex, anteriorly, but narrowing and converging posteriorly; the posterior region of the carapace is membranous and forms two large convex lobes.

The ocular peduncles are not quite so long as the width of the anterior margin of the carapace and are cylindrical; the corneas are subspherical, terminal, not at all dilated, composed of rather large hexagonal facets. The ocular scale is small, separated by a distance equal to its basal width from the other scale, with the lateral margins convex, the inner distal area produced to a triangulate apex and the outer distal area excavate and not produced. The internal antennæ have the peduncular joints slender, cylindrical, the distal one being gradually dilated distally and extending slightly beyond the cornea; the flagellum is typically small, biramose, extending almost to the distal margin of the carpus of the cheliped. The external antennæ have the basal joint about two-thirds as wide as the eystalk and produced to a rather broad triangular tooth on its outer distal border; the inner distal margin is truncated and supports the long slender sickle-shaped acicule which has the apex outward-directed, finely serrate, and reaching to the base of the cornea; the inner lateral margin and distal end are fringed with long, stiff setæ; the second and third joints are stocky, the fourth is long, slender, cylindrical, reaching to the base of the cornea, the flagellum is composed of about forty-five annulations and is slightly longer than the first ambulatory leg.

The external maxillipeds are well separated. The chelipeds are unequal, the right is much the larger. It has the proximal joints small, the ischium is produced to a long acuminate point which reaches almost half the length of the merus; the merus is of moderate length, trigonal, narrow basally and widening distally; the carpus is almost as long as the merus, narrow basally, widening distally, its distal width being four-fifths of its length; the upper carpal surface is broad, slightly convex and armed with several longitudinal rows of sharp spinelike teeth which are continuous with similar rows of spines on the propodus. The propodus is about twice as long as the carpus, the palm and fingers each being about as long as the carpus; the contour of the propodus is a long oval, the maximum width being equal to almost half the length of the propodus; the dorsal surface of the propodus is but little convex and is armed with long, spinelike teeth which are arranged in approximately five longitudinal rows, two of which are marginal, two submarginal, and one median; there are also a few irregularly scattered spines present between these rows. The propodal finger is slightly wider basally than the fixed finger but they are otherwise similar, slightly gaping, with the cutting edges each furnished with a few large teeth, the distal parts curved and meeting. The rows of spines on the palm are continuous on the fingers, the hinged finger having a marginal and a submarginal row, while the propodal finger has a marginal and two inner rows of spines; both the carpus and propodus are furnished with numerous long setæ, those near the margins being heavier. The first and second pairs of ambulatory legs are subequal, and those of the right and left sides are equal to each other. Each has the ischium compressed, three-fourths as

long as the merus; the merus is long, convex on its upper surfaces; the carpus is similar but only two-thirds as long as the merus; the propodus is compressed, cylindrical, tapering distally, about twice as long as the carpus; the dactyl is very slender, decidedly compressed, a trifle longer than the propodus, curved and tapering distally to a sharp horn-colored tip; the ventral margin is armed with a series of seven acicular but smaller horn-colored spines, and the anterior lateral face is armed with a similar row of spines. Both the dorsal and ventral margins of the merus, carpus, propodus, and especially the dactyl are fringed with conspicuous, long setæ. The fourth pair of legs is subchelate, the propodus being squarish with the distal margin slightly rounded, the distal third of the dorsal surface covered with squamæ, the dactyl arises from the anterior laterodistal angle and is slightly longer, but less than half the width of the propodus; the dactyl terminates distally in a distinct curved spine and is armed along its convex lateral border with a large brush of setæ. The fifth legs are typically small, bent, and chelate.

The abdomen is small, asymmetrical, coiled, membranous, with four biramose appendages on one side only (one each on the second, third, fourth, and fifth segments); the last segment is squarish, calcareous; the telson is transversely segmented, the proximal portion being but little more than half the length of the distal portion and having its distal margin produced to a rounded median process, on either side of which the margin is recurvate; the distal portion of the telson is cut midway on its lateral margin by an incision on each side; there is a similar median incision on the distal border which is asymmetrical produced, each lobe being armed with distinct spines along the margin. The rhipidura offer no specific features.

Cænobitidæ

CÆNOBITA Latreille

Cænobita compressus Guérin

Figure 3

Cænobita compressus GUÉRIN, 1831, 'Voy. autour du Monde sur la Coquille par Duperry,' Zool., II, part 2, p. 29. FAXON, 1895, Mem. Mus. Comp. Zoöl., XVIII, p. 52. RATHBUN, 1910, Proc. U. S. Nat. Mus., XXXVIII, p. 596. SCHMITT, 1924, Zoologica, N. Y. Zool. Soc., V, No. 16, p. 170.

NAMES.—Land hermit. Flat-eyed hermit.

DIAGNOSTIC CHARACTERS.—Eystalks decidedly compressed laterally. Inner face of propodal joint with a subrescentic band of silky setæ on the upper proximal part, the distal setæ bordering the upper propodal margin. This is the only land hermit recorded from the tropical American Pacific faunal region.

TYPE.—M. Guérin's type material came from Payta, Peru, and is probably deposited in the Paris Musum.

DISTRIBUTION.—Acapulco, Mexico; Panama; Peru; the Galápagos Archipelago; westward in the tropic Indo-Pacific to the shores of East Africa.

MATERIAL EXAMINED.—Fifteen specimens from San Jose Island, Pearl Islands; one very large specimen, Bay of Panama; two, taken between Patillo Point and old Panama; thirty-nine specimens from Pacheca Island, Pearl Island, Bay of Panama on sandy beach, flood tide, March 9, 1926; three from Patillo Point, Panama, on sandy beach, March 22, 1926; and four in a mangrove marsh and sandy beach near Santo Tomas Hospital, Panama City, March 30, 1926.

TECHNICAL DESCRIPTION.—In size, the present species may attain proportions similar to its better-known West Indian relative, *P. clypeatus*.

Carapace with the frontal margin about straight, rostral point absent; lateral projections small, pointed. Anterior region of the carapace subrectangular, slightly wider posteriorly, dorsal surface slightly convex and covered with scalelike imbrica-



Fig. 3. *Cænobita compressus* Guérin, natural size.

tions which are smaller anteriorly, nearly absent in the outer and much larger on the posterior half, which region also bears numerous fine setæ. The posterior region of the carapace is decidedly convex, with a hard, hourglass-shaped median calcareous plate, to which are closely fused the paired, suboval, calcareous plates which cover the greater part of the dorsal surface. These plates are harder on the anterior and inner regions but pass almost imperceptibly into a tough, semicalcareous, reticulated membrane on the outer and posterior parts.

The abdomen is asymmetrical, coiled and tapering, encased in a very tough, leathery membrane; the first four segments are clearly indicated; there is a harder, central suboval median patch between the second and third segments—also another between the third and fourth segments; the penultimate segment bears a sub-quadrated calcareous plate on its dorsal surface. The telson is small, transversely bent; the basal joint of the rhipidura is nearly as strong as the larger blade, the latter of which bears a large ovate patch of brown scales and is fringed on the margins with long silky setæ; the inner blade is quite small, scarcely reaching to the distal end of the basal joint, and bearing a patch of scales on its own distal region. The female bears three biramous appendages which arise from the anterior lateral margin of the left side of the second, third, and fourth abdominal segments respectively. The most anterior appendage is the smallest, the median appendage is the longest, and the posterior one is slightly shorter. Each appendage has both blades fringed with long, silky setæ. There are rudimentary indications of the second and third appendages on the right side. In the male there are rudimentary indications of appendages on both sides of the third and fourth segments.

The ocular peduncles are about as long as the anterior margin of the carapace and are strongly compressed and excavated on the proximal part of the inner faces for the reception of the inner antennæ when retracted; the outer surfaces are similarly excavated on the lower half to afford space for the peduncular joints of the external antennæ, while on the upper half they are exceedingly thin but convex, and covered with rough, scalelike granulations; the upper distal margin is slenderly produced above the cornea and is also covered with scales. The cornea is terminal, exceedingly compressed, shielded on the upper and inner faces by the produced eyestalk, with the distal surface very narrow and the outer surface triangulate and but little convex. The ocular scale is triangular, the two are set close together and extend about one-third of the length of the ocular peduncle. The external antennæ have the peduncular articles laterally compressed, the first article is subcrescentic, produced on its upper surface into an acute process which reaches to the base of the third joint; the second joint is very small and is ventral in position; the third joint is small, compressed, about as broad on its outer side as long; the fourth joint is also compressed and is about as long as the eyestalk; the flagellum is composed of sixty-five short, stout rings, each of which bears a series of short, stiff setæ on the distal margin. The inner antennæ have the basal articles enlarged and produced into a crest on the upper proximal surface, the distal portion slender, subequal, compressed rods; the flagellum is biarticulate, the proximal half of the longer branch consists of ten rings; the distal half of the flagellum is one long articulation which is constricted on its upper surface, simulating granulations; its lower third is defined from the upper two-thirds by a longitudinal groove; the distal end is furnished with short, soft, silky setæ on its lower edge. The inner antennæ are four-fifths as long as the outer antennæ. When retracted, the former pair fold upon themselves and fit between the eyestalks.

The chelipeds are similar, the left one being substantially larger than the right. Each has the proximal joints small but strong; the meral joint is extremely compressed laterally with distal part trigonal, the anterior distal face triangulate and imbricated, the upper inner margin terminating distally in an acute tooth, while the outer lateral margin, especially of the larger chela, is produced into a rough, imbricated process. The carpus is short and stout, trigonal, with the outer surface convex

and imbricated, especially along the inner margin. The hand is as broad proximally as its greatest length, from the propodal base to the tip of the propodal finger; the outer surface is convex, the lower proximal part is produced into a rounded, laminar lobe; the outer surface is covered with scalelike imbrications. The propodal finger is short, stubby, and blunt, set with one large, subdistal tooth. The hinged finger is only two-thirds as wide basally as the propodal, is stout, set obtusely and slightly gaping, blunt distally and armed on the inner surface with two teeth; the outer surface is covered with scalelike tubercles. The second ambulatory legs are longer than the first pair by one-third the length of the dactyl. Both the first and second pairs have the meral joints decidedly compressed, that of the first leg being flattened on both sides, while that of the second leg is a little thicker and is convex on the outer surface and covered with squamosities; the carpal joint of the first leg is slightly shorter than that of the second, its inner face is flattened, the upper face is slightly convex, the outer lateral face is much narrower than the others and is flat and thickly set with squamosities which become very coarse and sharp along the inferior lateral margin; the carpal joint of the second leg is slightly longer than that of the first and less pronouncedly trigonal, the outer and under faces merging without a ridge; the dactyli are the longest joints of the respective appendages, that of the second being almost a third longer than that of the first. Both are stout, curved, covered with small squamosities and set with small tufts of short bristles. The third pair of ambulatory legs is typically modified, being closely appressed to the side of posterior region of the carapace; the meral joint is the largest, being broad, almost subovate; the carpal joint is somewhat smaller, squamose on its outer surface and fringed with long, silky setæ along its anterior margin; the propodus is subchelate, suboval, covered on the outer surface, except for a small basal area, with squamose, brown scales; the margin is fringed with long, silky setæ; the finger is very small, squamose, and setigerous, situated on the proximal anterior part of the palm. The fifth pair of ambulatory legs is slender, short and subcylindrical, with the distal third folding back upon the proximal part; the large, curved, paired male appendages arise from the coxal joints and are nearly as large as the remainder of the leg. The appendages are strong, lie close together, and are strongly arched; they are pointed at the tip, which is covered with silky brown setæ. The ischium of the fifth leg is short, the merus is long, subcylindrical, the carpus is about two-thirds as long as the merus; the "palm" of the propodus is as long as the carpus; the finger is three-fourths as long as the palm and is spatulate. The outer face of the palm bears an ovate patch of brown scales and the remaining faces of the palm and both fingers are covered with silky brown setæ.

Hippidæ

EMERITA Gronovius

Emerita analoga (Stimpson)

Figure 4

Hippa emerita MILNE EDWARDS AND LUCAS, Crust. in d'Orbigny's 'Voy. dans l'Amér. Merid.,' 1843, VI, p. 32. NICOLET, Crust. in Gay, 'Hist. Chile,' 1849, III, p. 185. DE SAUSSURE, 1853 (not Edwards), Rev. et Mag. de Zool., V, p. 367.

Hippa talpoides DANA, 1852, 'U. S. Explor. Exped.,' XIII, Crust., part 1, p. 409, Pl. xxv, fig. 10; 1854 (not Say), Proc. Acad. Nat. Sci. Phila., VII, p. 175.

Hippa analoga STIMPSON, 1857, Proc. Boston Soc. Nat. Hist., VI, p. 486. MIERS, 1897, Journ. Linn. Soc. London, Zool., XIV, p. 324, Pl. v, fig. 10. ORTMANN, 1892,

Zool. Jahrb. f. Syst., VI, p. 537, Pl. xxvi, fig. 1. HOLMES, 1900, Occas. Papers Calif. Acad. Sci., VII, p. 103.

Emerita analoga RATHBUN, 1904, 'Harriman Alaska Exped.,' X, Crust., p. 168. WEYMOUTH AND RICHARDSON, 1912, Smithsonian Misc. Coll., LIX, No. 7. MEAD, 1917, Univ. Calif. Publ. in Zool., XVI, p. 431. SCHMITT, 1921, idem, XXIII, p. 173, Fig. 19. BOONE, 1930, Bull. Vanderbilt Marine Museum, III, p. 67, Pl. xvii, *E.* and *F.*

DIAGNOSTIC CHARACTERS.—Carapace oval, shuttle-shaped, but wider in proportion to its length and not so high as is *E. emerita*. The median frontal lobe is broader, less acute and not separated so widely from the lateral lobes, which are acute but far



Fig. 4. *Emerita analoga* (Stimpson), natural size.

less prominent than are those of *E. emerita*, the East Coast species. The median spine of the second peduncular article of the antennæ is proportionately shorter and is directed inward, while that of *E. emerita* is longer and directed outward.

TYPE.—Professor Stimpson's type material apparently consisted of a large series taken by a Mr. Samuels, at Tomales Bay; near San Francisco, by Trowbridge; Monterey (Taylor), and Mazatlan (Verreaux), and deposited in the museums of the Boston Society of Natural History, the Philadelphia Academy of Natural Sciences, the Smithsonian Institution, the Paris Museum, and the Museum at Petrograd.

DISTRIBUTION.—West coast of the Americas from California to Chile.

MATERIAL EXAMINED.—One dry specimen from Sandy Beach, San Jose, Pearl Islands, Bay of Panama, collected by Dr. W. G. Van Name.

Porcellanidæ

MEGALOBRACHIUM Stimpson**Megalobrachium poeyi** (Guérin)

Figure 5

Porcellana poeyi GUÉRIN, "1855," La Sagra's 'Nat. Hist. Cuba,' VII, text, VIII, Atlas, Pl. II, fig. 4.

Megalobrachium granuliferum STIMPSON, 1858, Proc. Acad. Nat. Sci. Phila., X, p. 228; 1859, Ann. Lyc. Nat. Hist. N. Y., VII, p. 76.

Megalobrachium poeyi BENEDICT, 1901, Bull. U. S. Bur. Fish., XX, part 2, p. 136, Pl. III, fig. 8.

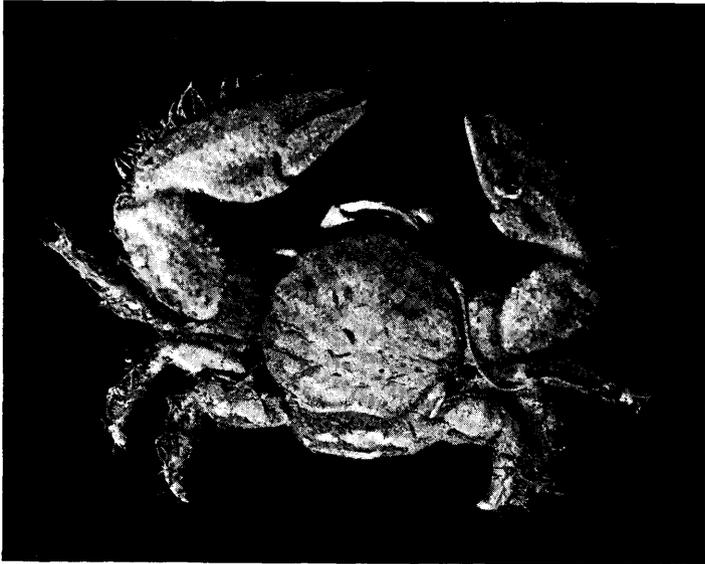


Fig. 5. *Megalobrachium poeyi* (Guérin), $\times 3$.

TYPE.—From Cuba, depository not cited; probably the Havana Museum.

DISTRIBUTION.—Cuba; the Bahamas at St. Thomas; Savanilla, Porto Rico. Recorded for the first time, so far as I am aware, from the Pacific coast of Panama.

MATERIAL EXAMINED.—One adult collected on the north shore of Tabogilla Island, Bay of Panama, at flood tide, under stones on sandy, gravelly beach, March 4, 1926.

TECHNICAL DESCRIPTION.—Carapace approximately subcircular; frontal margin trisinate with the median lobe rounded, no larger, but slightly in advance of the submedian lobes which are somewhat angulated. The frontal region of the dorsal surface of carapace is deflected; convex from front to back; scarcely at all so from side to side; there is a paired depression behind the eye on the gastric region; the antero-

lateral margin is slightly excavate at the outer terminus of the cervical groove which is clearly delineated; the cardiac areolation is distinct. The dorsal surface is moderately setose; along the front, on the postorbital and hepatic regions, and along the anterolateral margin, the surface is decidedly granular, the individual granules are coarse, squamose. Along the outer branchial region these squamæ form regular lines; this is the only item in which the Bay of Panama specimen differs from the series of West Indian specimens before me. The lateral walls and abdominal parts of the body are clothed in dense, coarse, shaggy setæ, as are also the outer lateral margins of the chelipeds and both lateral margins of the three pairs of ambulatories. The eye is small.

The chelipeds are about equal, each has the merus shorter than the carpus; the carpus is about as long as the palm, subrectangular dorsally, about one and two-thirds as long as its own median width. The propodus is triangular, widest at the base of the dactyl; the lower finger is continuous with the lower margin of the palm and is only a little more than half as long as the latter, with the apex pointed and up-curved; the hinged finger is a little longer than the lower one and has its tip down-curved, acute. The entire dorsal surface of the merus, carpus, propodus, and dactyl is paved with coarse, low, squamose granules, those along the margins showing distinctly uneven; on the carpus, there are two longitudinal depressions between three cordlike ridges, one of which is median, the other two each marginal; on the propodus there are three such longitudinal depressions and four ridges. Young specimens and females sometimes show only two such depressions, the third depression, or the one nearest the lower lateral margin in large male specimens, being the one absent or very faintly indicated in young specimens. The three pairs of ambulatories are short and of moderate thickness, each with the dactyl scarcely one half as long as the related propodus and tipped with a curved, horny nail.

PETROLISTHES Stimpson

Petrolisthes armatus (Gibbes)

Figure 6

Porcellana armata GIBBES, 1850, Proc. Amer. Assoc. Adv. Sci., III, p. 190. BOONE, 1930, Bull. Vanderbilt Marine Museum, III, p. 73, Pl. xix (full analysis).

DIAGNOSTIC CHARACTERS.—Carpus of cheliped armed with three teeth on anterior margin; merus of first and second ambulatory legs with one subdistal spine on posterior lateral margin; no such spine on merus of third ambulatory leg. Lateral margins of carapace terminating anteriorly in a sharp distal (or hepatic) spine.

TYPE.—Gibbes's type material was collected in Florida and originally deposited in the Boston Society of Natural History and the Charleston Museum, South Carolina.

DISTRIBUTION.—From the Bermudas and southern Florida southward through the West Indies to Brazil; from Lower California southward, including the Galápagos Islands, to Peru; the Indo-Pacific region.

MATERIAL EXAMINED.—One young specimen, Taboga Island, Pearl Islands, Panama; five specimens, Patillo Point, Panama; fifty-five specimens, north shore of Tabogilla Island, Bay of Panama, at flood tide, under stones on beach, March 4 and 5, 1926; two specimens, Pacheca Island, Pearl Islands, Bay of Panama, at flood tide on sandy beach under stones, March 9, 1926; thirty-one specimens, Pacheca Island,

Pearl Islands, Bay of Panama, at low tide under stones on rocky and gravelly beach, March 8, 1926; thirteen specimens, Patillo Point, Panama, at low tide on sandy beach with scattered rocks and stones, March 26, 1926; two specimens, Saboga Island, March 12, 1926, under stones; one specimen, Fortified Island, Panama, March 25, 1926; six very large specimens, Patillo Point, very low water.

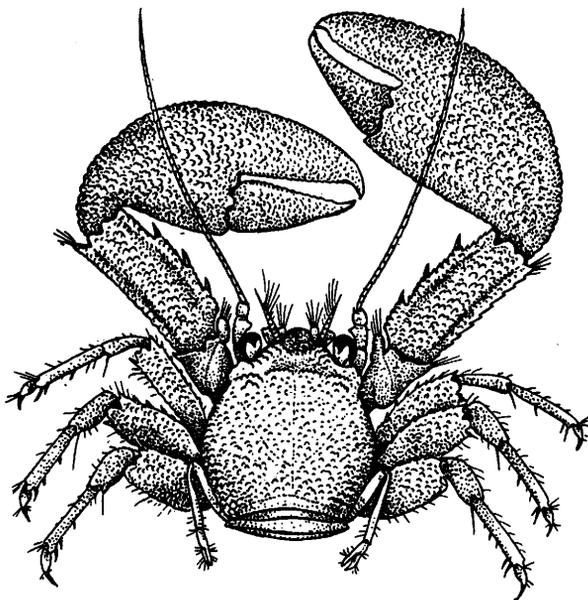


Fig. 6. *Petrolisthes armatus* (Gibbes), $\times 2$.

***Petrolisthes edwardsii* (de Saussure)**

Figure 7

Porcellana edwardsii DE SAUSSURE, 1853, Rev. et Mag. de Zool., (2) V, p. 355, Pl. XII.

Petrolisthes edwardsii NOBILI, 1901, Boll. Mus. Torino, XVI, No. 415, p. 11. RATHBUN, 1910, Proc., U. S. Nat. Mus., XXXVIII, p. 500. SCHMITT, 1924, Zoologica, N. Y. Zool. Soc., V, No. 15, p. 170. BOONE, 1931, Zoologica, N. Y. Zool. Soc., IX (in press). (Full description.)

DIAGNOSTIC CHARACTERS.—Vivid scarlet; carapace and chelæ covered with transverse scalelike rugæ which are fringed anteriorly with setæ; three lines on carapace forming an equilateral triangle with apex directed backward.

The chelipeds are subequal but both are well developed, rather thick and strong, but decidedly flattened; the proximal joints are short; the merus is short, trigonal, covered with squamose rugæ on its outer and upper surfaces, its inner distal angle produced to a prominent tooth and with a longitudinal series of three raised dentiform squamæ accentuating the posterior lateral border; the carpus is long and

narrow, covered with irregular rows of squamæ and with the anterior border armed with three large serrated teeth and several small ones; the posterior lateral margin bears a row of about ten raised dentiform squamæ in addition to the distal tooth; the propodus is twice as long as the carpus and has its lower border decidedly convex, its upper border forming the two sides of a broad triangle; the fingers comprise five-twelfths of the length of the entire propodus. The fingers are of equal length but the upper finger is approximately one-third wider at the base than the lower; each finger has the cutting edge straight, the proximal half smooth, the distal half is marked into low, close-set obtuse teeth, the apices of the fingers are distinctly curved; the upper margin of the hinged finger is carina-like; both fingers are covered with squamæ like those on the palm.

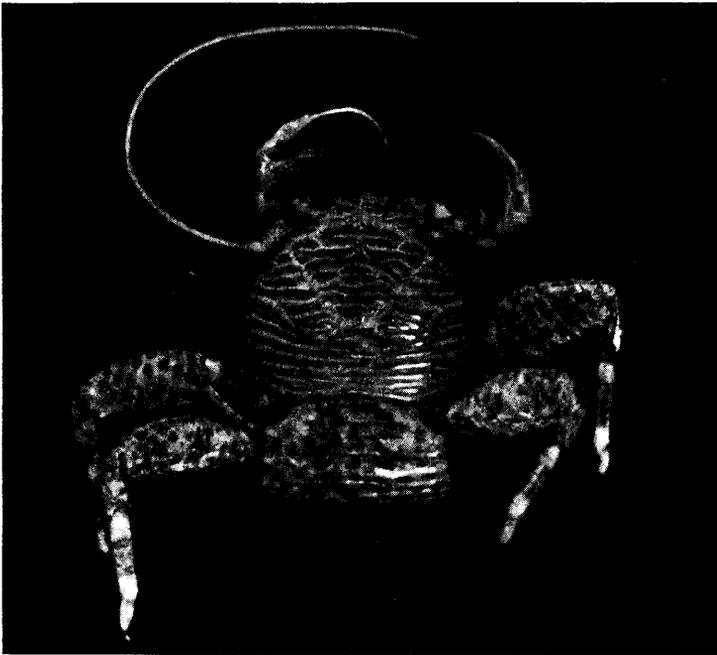


Fig. 7. *Petrolisthes edwardsii* (de Saussure), $\times 3$.

TYPE.—The type of this species came from Mazatlan, Mexico, and is probably deposited in the Natural History Museum at Geneva.

DISTRIBUTION.—Known from the Gulf of California, southward to Ecuador; at the Galápagos Islands.

MATERIAL EXAMINED.—One specimen taken at extreme low tide on sandy beach with scattered rocks, Saboga Island, Pearl Islands, by Mrs. S. D. Sturgis and Dr. Van Name, March 13, 1926.

***Petrolisthes eriomerus* Stimpson**

Figure 8

Petrolisthes eriomerus STIMPSON, 1871, Ann. Lyc. Nat. Hist., N. Y., X, p. 119. HOLMES, 1900, Occas. Papers Calif. Acad. Sci., VII, p. 108, Pl. 1, fig. 15. SCHMITT, 1921, Univ. Calif. Publ. in Zool., XXIII, pp. 181, 182, Fig. 144. BOONE, 1931, in press, Zoologica, N. Y. Zool. Soc., IX (complete analysis).

DIAGNOSTIC CHARACTERS.—Carpus of chelipeds one and three-fourths to twice as long as wide, lateral margins parallel, inner proximal angle rounded but not pro-



Fig. 8. *Petrolisthes eriomerus* Stimpson, $\times 1$.

duced; dorsal surface finely, irregularly granulose, and minutely punctate. The carapace has the areolations distinct, branchial regions lightly striated transversely. The distal pair of sutures of the telson is transverse. The external maxilliped has the inner lateral margin of the merus produced to a broad, rounded lobe; the distal extremity of the ischium is rather truncated and rounded.

TYPE.—Professor Stimpson's type material came from Mendocino, California. It was originally deposited in the Smithsonian Institution.

DISTRIBUTION.—Known from the southern part of British Columbia to Lower California; also the Galápagos Islands.

MATERIAL EXAMINED.—Seven specimens from the north shore of Tabogilla Island, Bay of Panama, tide about one half flood, crab under stones on beach, March 5, 1926.

***Petrolisthes galathinus* (Bosc)**

Figure 9

Porcellana galathinus Bosc (not Say), 1802, 'Hist. Nat. Crust.,' I, p. 233, Pl. vi, fig. 2.

Petrolisthes galathinus BOONE, 1930 (full diagnosis), Bull. Vanderbilt Marine Museum, III, p. 76, Pl. xx.

DIAGNOSTIC CHARACTERS.—Carpus of chelipeds two-thirds as wide, including the marginal teeth, as it is long; a series of about six prominent rounded squamæ form a median ridge on the dorsal surface; smaller granules are scattered on the remaining dorsal area; the posterior lateral margin is accentuated by a series of about six

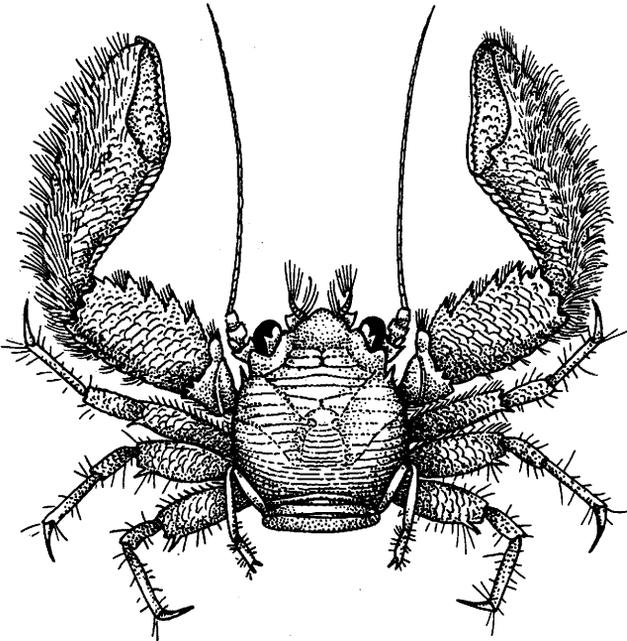


Fig. 9. *Petrolisthes galathinus* (Bosc), $\times 3$.

rugæ, which are produced into upward- and forward-pointing spines, the distal one of which projects beyond the margin; the anterior lateral margin is cut into five acute jagged triangular teeth, which have their margin finely serrate.

Carapace convex in both directions; lateral margins delineated by a line which terminates anteriorly in a single, sharp hepatic spine. Dorsal surface of carapace devoid of rugæ except for a pair of wide, transverse rugæ on the anterior part of the gastric region, minutely, sparsely granulate and finely hirsute. Distal pair of sutures on the telson oblique.

TYPE.—The locality of Bosc's type is unknown.

DISTRIBUTION.—West Indian region; littoral.

MATERIAL EXAMINED.—Two specimens, collected at El Rey Island, Pearl Islands, Panama, hauled up on algæ caught on fishline, by Dr. Van Name.

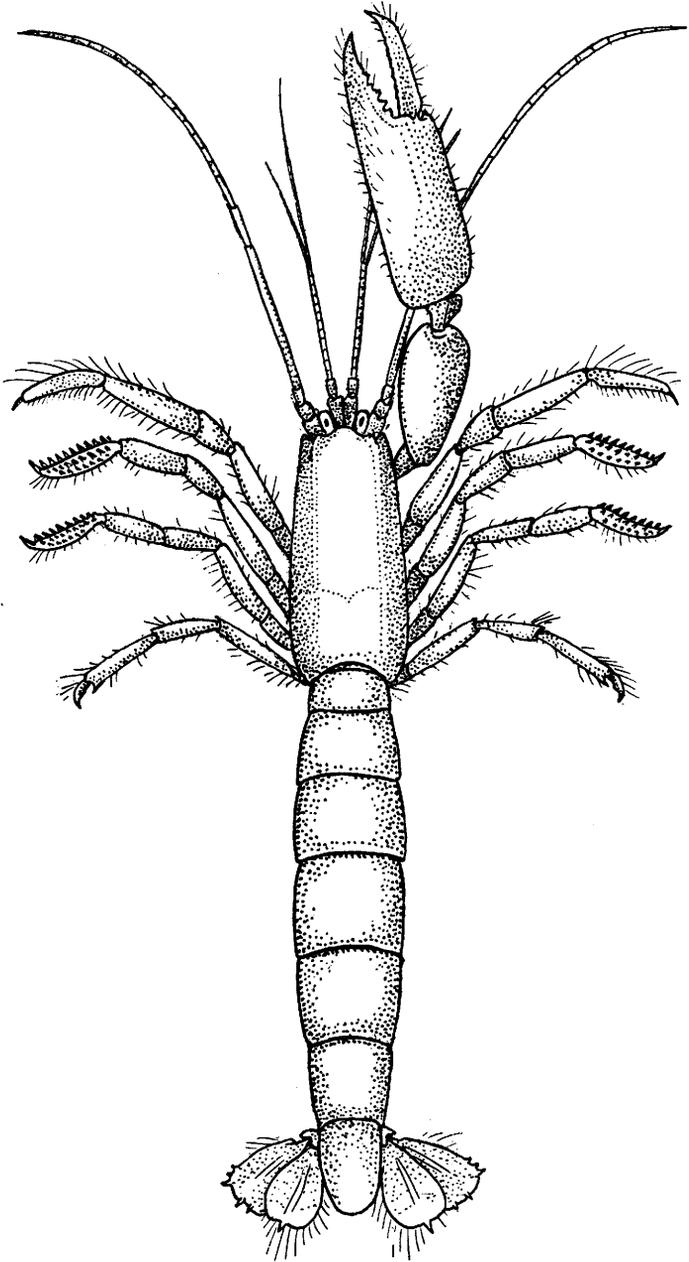


Fig. 10. *Azianassa mineri*, new species, type, $\times 3$.

ORDER MACRURA

Laomediidæ

AXIANASSA Schmitt

Axianassa mineri, new species

Figure 10

TYPE.—One specimen, collected at low tide under stones on rocky and gravelly beach, Pacheca Island, Pearl Islands, Bay of Panama, March 8, 1926. Deposited in The American Museum of Natural History, Cat. No. 6403. Named for Dr. R. W. Miner.

DISTRIBUTION.—Known only from the holotype. The genotype, *A. intermedia* Schmitt, is from Curaçao, West Indies, and is deposited in the Leyden Museum.

COLOR.—Opaque creamy.

HABITS.—Unrecorded.

TECHNICAL DESCRIPTION.—Body soft, membranaceous. The carapace, which is narrow dorsally but convex between the sharply defined *linea thalassinica*, has the rostral margin in the form of a broad, shallow, blunt triangle; the frontal margin curves downward from either side of the base of the rostral triangle and forms a small, slightly rounded lobe above the antennal peduncle. A sinus just below this lobe separates the median and lateral plates of the body for a short distance and is contiguous posteriorly with the *linea thalassinica* which is very distinct the entire length of the carapace. Just below this line, the lateral wall of the carapace has its frontal margin convex, forming a rounded lobe which is more conspicuous than the upper lobe and a little below this large lobe there is another short suture, the hepatic suture, below which is a smaller lobe which is continuous with the postlateral margin. The dorsal surface of the carapace consists of the above-described anterior, or precervical plate, which is elongate, narrowed, 1.6 times as long as the posterior dorsal plate and separated therefrom by a distinct transverse suture which extends down on each side to the *linea thalassinica*. This cervical groove does not curve forward on either side, as is usual, but meets the *linea thalassinica* almost at right angles. The postcervical dorsal plate has its hinder margin slightly rounded. The dorsal surface of both plates is furnished with numerous isolated setæ and scattered coarse punctæ. The lateral walls of the carapace are closely appressed and have the postlateral margins evenly rounded, but scarcely at all produced.

The first abdominal segment is convex on its anterior margin, fitting into the concave hinder margin of the median region of the carapace, and with the lateral region of the first segment tapered to a narrow epimera; the hinder margin of the first segment is straight; the second segment is about twice as long as the first; the third segment is slightly longer than the second; the fourth is a little longer than the third, or one and one-third times as long as the second segment; the fifth segment is about as long as the third segment; the sixth segment is as long as the fifth but more tapered; the telson is as long as the preceding segment and moderately tapered with its posterior margin evenly rounded and ciliated, but without spines. The epimera of the abdominal segments are very small. On the second to sixth segments, they are slightly rounded and produced to a moderate lobe posteriorly, behind which lobe the margin of the related segment is excavate. There are five pairs of biramous pleopoda present; each consists of a very narrow, elongated peduncle, which is about as long, and slightly

thicker than, the blade; the blades are approximately subequal, very narrow, almost linear, tapered distally, each composed of several articulations, of which the proximal one is about three times as long as any of the succeeding subequal rings; the lateral margins of both blades are fringed with long, single setæ.

The uropoda have a small peduncle and two broad, oval blades, the inner of which is a little the narrower and has a longitudinal ridge which terminates about midway the blade in a spinule; another on the convex distal margin; the outer blade is much wider, keeled proximally on the outer surface, and with two separated spines on the distal margin, also three or four spinules in series on the outer distal margin; margins of both blades ciliated.

The eyestalks are short, not reaching more than half the length of the first peduncular article of the antennulæ, above which the eyes lie, projecting beyond the rostral border; they are cylindrical with the cornea small, black, circular, situated on the dorsal surface and visible just beyond the rostral border; the distal, rounded end of the eyestalk bears no pigment spot. The antennulæ are submedian, lie beneath the eyestalks, and have the first peduncular article actually about twice as long as the second article if viewed ventrally, but only half its length is dorsally visible; the second article is short, cylindrical; the third article is cylindrical, very long and slender, 3 mm. long or about six times as long as the preceding article, or two-thirds as long as the second peduncular article of the antennæ. The antennular flagellum is biarticulate. The outer whip is composed of many articles and is about as long as the preceding peduncular article. It is thicker than the shorter inner branch, which is barely two-thirds as long as the outer branch, and consists of about fifteen rings, each of which is a trifle longer than those of the other branch. The antennæ have the first article very short dorsally, wider than long on its outer lateral margin, and produced on the lower outer lateral surface into a short conical tooth; the second article is short, cylindrical, and supports a minute acicule which is not so long as the third joint, lanceolate, with an acuminate tip; the third article is shorter than the second, scarcely visible dorsally; the fourth article is greatly elongated, very narrow, cylindrical, 4.3 mm. long; the fifth article is similarly slender, but very short, only .6 mm. long; the flagellum is very slender, reaching about as far forward as the extended great claw and composed of numerous small rings, each with a few isolated long setæ on its distal margin.

The external maxilliped is reniform; the ischial and meral joints subequal, elongated, both with the inferior outer lateral margin with a weblike brush of long cilia, also with three strong, sharp spines on the distal part of this convex margin; the palp has the first article trigonal, three-fifths as long as the merus, narrowed proximally, widening distally, and with a spine at the outer inferior distal angle; the second article is almost as long as the merus and half as wide, medially as long, with the lower lateral margin quite convex; the third article is two-thirds as long as the preceding one but very much narrower with the distal margin rounded, both margins with long cilia which also occur on the preceding article conspicuously.

The first legs are chelate, the left cheliped is broken off at the base of the prodopus, but the remaining ischial, meral, and carpal joints, also proximal part of

propodus, are identical in shape and size, indicating that the claws are probably of equal size, or nearly equal. The right great cheliped has the basis well developed, the ischium slender, slightly wider distally, with a distinct longitudinal suture line on the outer face just below and subparallel to the upper margin; the merus is slightly longer than the carpus and is greatly dilated, of oval contour, and convex on the outer face, the lower lateral margin with one or more spinules, the carpus is about half as long as the propodus, very constricted proximally, distally nearly as wide as the propodus; the lower outer lateral margin of the carpus terminates distally in a small tooth. The propodus, including the pollex, is 1.4 times as long as the carapace, the palm being four-sevenths of this total, with its outer surface regularly convex, the proximal lower lateral margin rounded below the carpus and roughened along its anterior part by coarse granules; the pollex is three-fourths as long as the palm, triangular with the tip curved upward and acuminate; the cutting edge is set with eighteen teeth, the proximal five of which are large, coarse, triangulate. The hinged finger is more slender and a little longer than the pollex with the tip very curved, acuminate; when closed, projecting below and beyond the tip of the pollex; the cutting edge is crenulated. Palm and fingers are furnished with isolated bristles which are more numerous on the dactyl. The second leg, when extended, reaches almost to midway the carpus of the first leg and has the ischium short, the merus 3.9 mm. long, its greatest width 1 mm., the upper lateral margin nearly straight, the lower lateral margin convex; the carpus is clavate, one half as long as the merus; the propodus is three-fourths as long as the merus, very slightly wider proximally; the dactyl is three-fifths as long as the propodus, curved, with an acute, horny tip, below which, on the anterior three-fourths of the lower lateral margin, are a series of small, horny spinules. The lower lateral margins of the merus, carpus, and propodus and upper margin of the dactyl are fringed with very long, weblike setæ. The third and fourth legs are similar, but the fourth pair is distinctly shorter than the third by approximately the length of its dactyl. The third leg has its merus elongated, its outer face flattened with the lower lateral margin much more convex than the upper; the carpus one half as long as the propodus, clavate; the propodus, very little longer than the carpus but with its outer face flattened, the lateral margins a little convex; the dactyl is about as long as the propodus and is curiously three-faced; the dorsal surface being the widest, flattish, tapered to a tooth distally, and armed with three rows of horny spines; the two lower faces converge to a convex lower margin. The fifth legs only reach to about two-thirds the length of the propodus of the fourth legs and have the basis heavy, the ischium shorter and lighter; the merus elongate, sub-cylindrical, arched, the carpus clavate, 0.7 as long as the merus; the propodus 0.8 as long as the merus and terminating distally on the lower part in a truncated node which together with the anterior half of the lower propodal margin is furnished with five short setæ; the dactyl is about one half as long as the propodus and is somewhat of the shape of a spoon, convex on the upper and outer surface, of subovate contour, with the inner or lower surface, which closes upon the propodal node, concave, the projecting half of the closed dactyl not concave and furnished with corneous squamæ, the lateral margins of the fingers finely setose; the upper surface with long, isolated hairs.

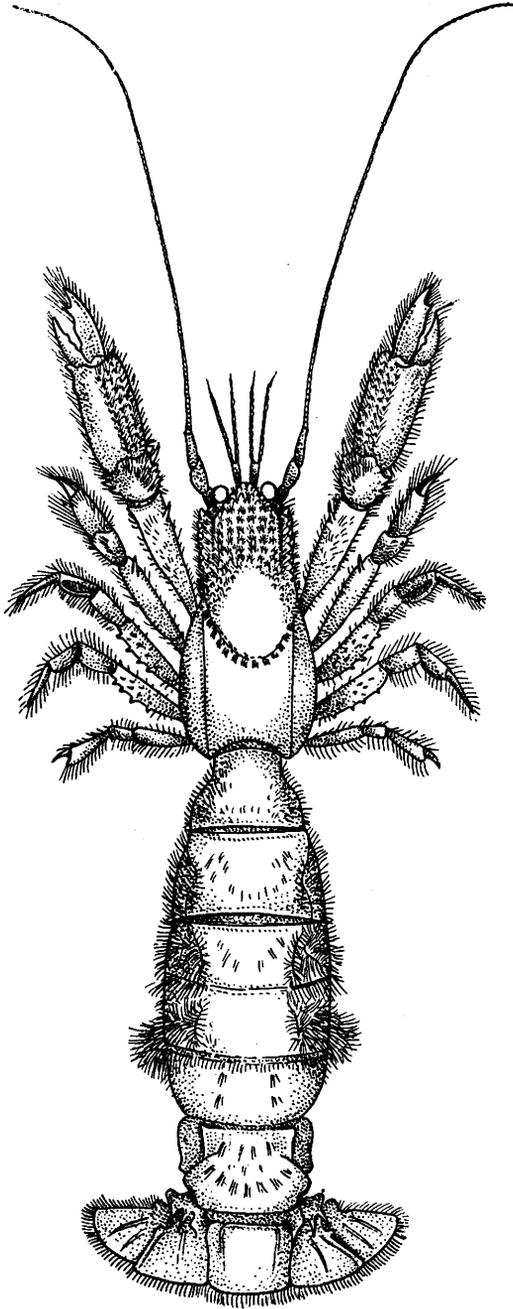


Fig. 11. *Upogebia sturgisæ*, new species, type, $\times 2.5$

Upogebidæ

UPOGEBIA Leach

Upogebia (Upogebia) sturgisæ, new species

Figure 11

TYPE.—An adult male, taken together with eight additional specimens at extreme low tide, on sandy beach with scattered rocks and stones, Patillo Point, Panama, collected by Dr. W. G. Van Name. Cat. No. 6325, A. M. N. H. Named for Mrs. S. D. Sturgis.

COLOR.—Approximately dirt-color.

HABITS.—Unrecorded.

TECHNICAL DESCRIPTION.—This species, which is most intimately related to *U. pugettensis* (Dana), from the more northern region of the American Pacific coast, is unquestionably distinct therefrom. The rostrum in *sturgisæ* is not quite so long as the eye and the tip is not downward bent, but points directly forward, its frontal margin forming a broad, shallow triangle with the apex armed with a pair of upward-directed spines or tubercles and with two additional similar tubercles on each side of the rostral margin, besides the anterior tooth of the lateral ridges of the cephalic region. This tooth is acute, directed obliquely upward and slightly outward and being scarcely larger than the other teeth of the frontal margin. The length of the rostral triangle from apex to base is exactly one half of its width, measured from tip to tip of the outer lateral teeth; this width of the rostrum is equal to two-fifths of the total length of the precervical region, or approximately five-sixths of the length of the anterior scabrous portion of the carapace, as measured in the median line. The dorsal surface of the precervical part of the carapace is flattish, very slightly convex from side to side; there is a deep groove separating the anterior tooth of the lateral ridges of the cephalic region, extending back subparallel to the lateral margin for the anterior five-sixths of its length; this lateral margin is armed with eleven or twelve spines, which series decreases slightly in size posteriorly. The anterior half of the cephalic portion is covered with a dense brush of short, stiff setæ set in definite tufts; hidden among the setæ are eight longitudinal series of upward-directed subacute tubercles; occasionally a few scattered tubercles occur in addition to the longitudinal series; these tubercles of the longitudinal series decrease in size posteriorly; those of the lateral margin being a trifle stronger than the others; the setose-scabrous area terminates posteriorly in graduated series, the margin between this area and the smooth surface forming a V, with the apex directed forward. The cervical groove is sharply defined and on the lateral wall is ornamented with a series of six to eight similar tubercles. There is one strong tooth on the fronto-lateral border at the outer side of the eyestalk. In all the series of *sturgisæ*, this spine is substantially stronger and more out-directed than in the series of *pugettensis*, in which the spine is nearly obsolete. The postcervical region of the carapace is glabrous, moderately convex transversely with scattered, solitary seta; the linea anomurica sharply delineated. The first five abdominal segments afford no specific characters. The telson is subrectangular, its median length being equal to its distal margin; the lateral margins are slightly sinuate, being a trifle wider proximally than distally, the distal margin truncated, slightly rounded, but nearly right-angled. There is an elevated transverse ridge on the proximal dorsal surface of the telson; each end of this transverse ridge runs backward, diminishing subparallel to the lateral margin. There is a decided

median longitudinal depression on the telson. The uropoda have the peduncle armed with two acute spines, one at each distal angle, above each blade and pointing obliquely upward and outward. The inner blade has its distal margin nearly as wide as that of the telson, both latero-distal angles subacute; there are two oblique ridges on the dorsal surface; the outer blade is about as wide distally, but has the distal margin more convex and the lateral margins less convergent proximally; there are the usual two thickened ridges on this blade also, in addition to the somewhat thickened lateral margin. The telson of *pugettensis* is fully one-fourth wider on its distal margin than its length in the median line.

The eyestalks in *sturgisæ* are stocky, the calcareous border of the stalk reaching to the second rostral tooth, while the convex cornea extends fully as far as the median pair of rostral teeth; in *pugettensis* the rostrum reaches twice as far forward as the cornea. The antennulæ of *sturgisæ* are slender with the first and second joints semiconcealed and the first nearly twice as long as the second and thicker proximally; the distal part of the first joint is as abruptly narrow as the second; the entire elongated distal peduncular joint reaching beyond the rostrum or extending as far forward as third peduncular article of the antennæ; the antennular flagellum is about as long as its last peduncular article, consisting of twelve or thirteen tapered rings, with one or two setæ at the extreme tip. The antennæ measured on the outer lateral margin show the first peduncular joint to be 1.9 mm. long, or three-fifths as wide proximally as long, extending as far as the calcareous eyestalk; the second joint is a little more slender than the first and about 0.2 mm. shorter; the third joint is about 0.5 mm. shorter than the second; the flagellum is rather fleshy, 15. mm. long, or exceeding the length of the extended great chela by the length of the dactyl, each short ring set with several isolated setæ which give the whip a very bristly appearance.

The chelipeds are equal in both sexes, but are stouter and a little longer in *sturgisæ* than in *pugettensis*. They also differ in *sturgisæ* in having the dorsal and upper outer face covered with a series of scabrous tubercles, which in both sexes are continued down on to the dorsal surface of the basal three-fifths of the propodal finger, and back along the lower margin of the palm. The upper and outer faces of the palm are much more hirsute than those of *pugettensis*; the hinged finger is the longer, curved and downbent, with a subdistal large tooth, also three or four lesser teeth proximally; the outer lateral face of this finger is grooved and it bears a heavy brush of setæ on either side of its flat dorsal surface. The propodal finger is straight, in unbroken or unworn specimens, its tip is barely long enough to reach the big subdistal tooth of the hinged finger; in *pugettensis* the propodal tooth is quite as long as the more curved, hinged finger. Mr. Schmitt's drawing of this finger was evidently from a worn chela. The ischium of *sturgisæ* has a strong subdistal spine on the inferior lateral margin; the merus is nearly 2 mm. shorter than the palm and has three to five spines on the proximal half of the inferior lateral margin, and one very large spine on the superior lateral margin where the dorsal surface of the merus widens; the carpus has three acute spines, one at each distal angle of the respective lateral margins; the upper lateral margin bears in addition a series of tubercles, and its inner dorsal surface is densely pubescent; the palm is a little longer than the merus and is three-fifths as high as long and plump or thick with about three longitudinal ridges on the dorsal inner surface, each ridge composed of a row of coarse tubercles and with a deep groove between each ridge; a fourth ridge of tubercles occurs on the inner face of the palm terminating at the upper basal angle of the fixed finger; a fifth line of tubercles

extends from the lower base along the inferior margin. The second leg has the merus about two and one-third times as long as wide, with a strong outward-pointing spine at the proximal end of the lower lateral margin; on the upper lateral margin there is a sharp forward-pointing subdistal spine; the carpus is one half as long as the merus, dilated distally; the propodus is three-fourths as wide proximally as long, a little narrowed distally, moderately convex on the lateral faces, but not quite so broad in ratio to its length as is that of *pugettensis*; the dactyl of *sturgisæ* is short, pointed, with the grooved, flattish upper lateral margin and dense brush of cilia surrounding it on either side, characteristic of *Upogebias*. There is also a long brush of cilia along both lateral margins of this uropodus. The third, fourth, and fifth pairs of legs are of the form usual in the genus; the somewhat dilated uropodus of the third leg bears three longitudinal series of setæ. There are also setæ in dense formation on the carpus and dactyl of this leg. The inferior margins of the merus are set with three or four out-pointing spines. The fourth leg is similarly spined and ciliated, but weaker. The fifth leg is subchelate and densely ciliated distally.

Palinuridæ

PANULIRUS Latreille

Panulirus inflatus Bouvier

Figure 12

Panulirus inflatus BOUVIER, 1895, Bull. Mus. Hist. Nat. Paris, No. 1, p. 43; 1912, Ann. L'Inst. Oceanog., III, p. 4, Fig. 1.

Panulirus penicillatus NOBILI, 1906, Mem. Acad. Sci. Torino, (2) LVII, p. 366.

Panulirus ornatus RATHBUN, 1910, Proc. U. S. Nat. Mus., XXXVIII, p. 603, Pl. LII, fig. 1.

TYPE.—Collected in the Gulf of Lower California and deposited in the Paris Museum.

DISTRIBUTION.—Lower California; Bay of Panama; Peru; also Galápagos Islands. According to Dr. Bouvier, specimens of this species from the Sandwich Isles are in the Paris Museum; Nobili records it from the Pacific coast of Darien. I am inclined to question the validity of the Sandwich Isles record for this species, if it is intended to refer to the Hawaiian Islands.

MATERIAL EXAMINED.—Two specimens, purchased in the market, Panama City, by Dr. W. G. Van Name, March 27, 1928.

COLOR.—Thirty-odd living specimens of this species, obtained in the Galápagos Islands in 1930 by the Vincent Astor Expedition, under the direction of Dr. C. H. Townsend, and exhibited in the New York Aquarium of the New York Zoölogical Society, are the basis of the following color notes. Mr. W. S. Bronson, scientific artist of the Astor Expedition, has assured me that the specimens have not changed or suffered loss of color during their long transportation and captivity.

The carapace has oliveaceous green tones over reddish bronzy brown; the spines are creamy to bright orange; the base of antennæ has markings of peacock-blue. The legs are dark reddish-brown dorsally with a thin creamy longitudinal stripe; ventrally, the legs are marked with irregular creamy spots. The dominant color of the abdomen is dark reddish bronzy brown dorsally, with small flecks of yellow; also a narrow transverse creamy line on each segment near its posterior margin, and on either side a single fairly large subcircular spot of creamy color on the lateral region of each segment.

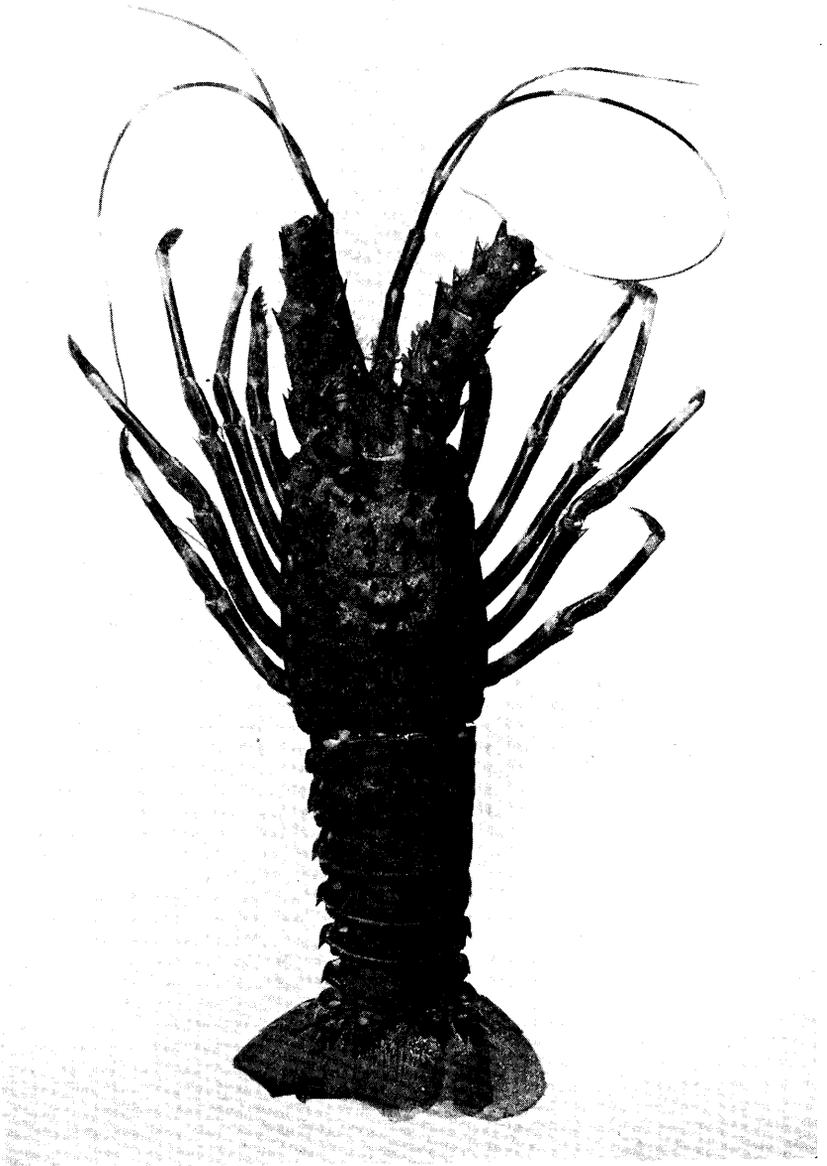


Fig. 12. *Panulirus inflatus* Bouvier, reduced to about one half of natural size.

TECHNICAL DESCRIPTION.—*Panulirus inflatus* is readily distinguished from the other west-coast species found on the Pacific coast of North America by the distinctive coloration of the respective species and by the fact that *interruptus* possesses on the abdominal segments a transverse setose sulcus which does not meet in the median dorsal area, except indistinctly on the sixth segment.

A specimen of *P. inflatus*, with a body length of about six inches, has the carapace about four-fifths as wide as long, very convex, with the cervical groove deep, the urogastric groove deep. There is the usual submedian pair of large forward-curved spines, one above each eye, and with the acute apex scarcely reaching beyond the eye. There are also much smaller acute upper and lower antennal spines on or near the frontal margin. There are roughly approximate longitudinal series of spines behind the submedian pair of great ocular spines and both the antennal spines extending the entire length of the carapace; there are many lesser spines between these larger ones; all are acute, forward-pointing; the smaller spines are each ringed basally with exquisite, radiating, feather-like setæ which form a rather thick pilosity on the hinder region of the carapace of young adults; in older adults the lesser spines of the carapace are less abundant. There is a deep, transverse sulcus on the carapace near the posterior margin; anteriorly the margin of the sulcus is banded by a series of rather coarse, acute, forward-pointing spines; posterior to the sulcus there is a smooth arclike band, about three times as wide as the sulcus and with its dorsal surface coarsely punctate, and both its anterior and posterior margins setose. The six abdominal segments are smooth except for coarse punctæ; all of the epimera are very narrow, each having the hinder half of the epimeral margin crenulated; terminating distally in a posteriorly directed acute tooth. On all the epimera except the sixth, there is a short, oblique, setose sulcus which does not extend dorsally beyond the lower border of the subcircular creamy spot which occurs on each segment. The proximal third of the telson and uropoda is calcareous, smooth, and colored like the preceding segment; this calcareous segment of the telson forms a subtriangulate area on either side of the base and has its margin distally spinose; on each of the uropod blades, the calcareous region forms a lanceolate design and also has its hinder margin setose; the remaining and greater portion of the caudal fan is flexible, leather-like, and has its dorsal surface longitudinally striated with fine radiating ribs, each of which, under the microscope, shows itself to be regularly set with series of acute, horny, backward-directed spinules. The sternum has on its posterior part an embossed and denticulated trapezoid surface, behind which there is a pointed median projection; two or three depressions in the median region.

The first maxillipeds usually have the flagellum of the exopodite very much widened and flattened, composed of about ten articles and extending to the end of the merus of the third maxilliped. The second maxillipeds have the flagellum of the exopodite flattened but not dilated, composed of about ten articles and reaching to midway the merus of the third maxilliped. The third maxillipeds have no exopodite.

The eyestalks are short; the cornea, placed distally, is short, reniform. The antennal segment is ornamented with two pairs of acute, forward-directed spines, one pair behind the other, forming an approximate square; the area between these spinules is set with four, or sometimes more, finer spinules, each of which is ringed basally with radiating, feather-like setæ. The epistome has three epistomial teeth, the median of which is in advance of and a little longer than the others; there is no epistomial ridge present. The antennular peduncle is slender and exceeds the antennal

peduncle in length by about two-thirds of the distal article of the antennular peduncle. The flagellum is biarticulate, both branches cordlike, composed of many short rings and alternately banded every half to two-thirds of an inch with creamy color between maroon-bronzy markings; the longer inner branch is one and one-third times as long as the entire body of the animal; the shorter outer whip is only half as long as the inner branch. The first joint of the antennal peduncle is scarcely half as long on the outer side as the second and is armed on the dorsal surface with an acute spine at each inner and outer margin; the lower part of the first joint is obliquely produced to an acute tooth which does not reach quite to the distal margin of the second joint; the second and third joints are subequal, each about as long as the distance between the lower antennal and orbital spines and have all surfaces, but especially the upper, set with numerous acute spines. The whips are coarse and are somewhat longer than the entire body of the lobster.

The legs decrease in length in the following order: 3, 2-4, 1, 5; all are monodactyl, with the finger short, curved acute. Dorsally the legs each bear a longitudinal cream stripe, between the maroon-bronze ground color; the ventral surface is almost entirely cream, with blotches of cream extending on the lateral surfaces.

Penæidæ

PENEUS Latreille

Peneus brevirostris Kingsley

Figures 13 and 14

Peneus brevirostris KINGSLEY, 1878, Proc. Acad. Nat. Sci. Phila., XXX, p. 98. RATHBUN, 1902, Proc. Wash. Acad. Sci., IV, p. 287; 1904, Harriman, 'Alaska Exped., Crust.,' X, p. 146; 1910, Proc. U. S. Nat. Mus., XXXVIII, p. 564, Pl. LIV, fig. 2. SCHMITT, 1921, Univ. Calif. Publ. in Zool., XXIII, p. 21, Fig. 9a-e. Boone, 1930, Bull. Vanderbilt Marine Museum, III, p. 106, Pl. xxxii, text fig. 2, A, B.

Peneus californiensis HOLMES, 1900, Occas. Papers Calif. Acad. Sci., VII, p. 218, Pl. IV, figs. 64-69.

TYPE.—Kingsley's type was taken at Realego, Nicaragua, and is deposited in the Academy of Natural Sciences of Philadelphia.

DISTRIBUTION.—From San Francisco Bay, southward to the Pearl Islands; Panama; Peru; and also at the Galápagos Islands.

MATERIAL EXAMINED.—Fifteen specimens purchased from fishermen, Panama City, March 30, 1926; one purchased in the market, Panama City, March 25, 1926.

COLOR.—This shrimp is a deep orange-pink both on the body and appendages, the deeper tone being accentuated along the suture lines of the abdomen. There is a decided patch of seaweed-brown in the median dorsal region of the carapace just behind the rostrum. The eyes are deep brown.

TECHNICAL DESCRIPTION.—Animal large, four to six inches long, being an average size. Carapace robust with the rostral carina prominent, continued posteriorly not quite to the hinder margin of the carapace. Rostrum strong, thick, short, reaching only as far forward as the scaphocerite, directed straight forward, armed on the inferior margin with two teeth and on the superior margin with about eight teeth, and one postrostral tooth. Adjacent to the rostrum on either side there is a carina extending from about midway the length of the carapace forward on to the upper surface of

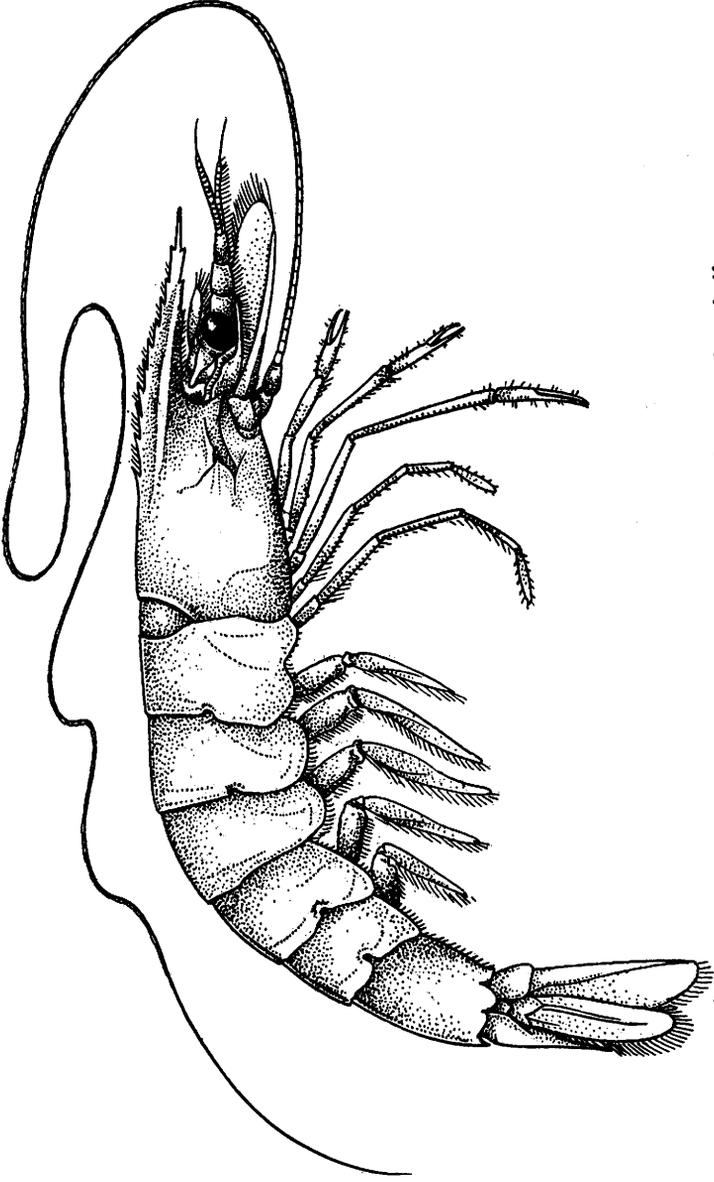


Fig. 13. *Peneus brevirostris* Kingsley. Adult, reduced one half.

the rostrum. There is a short antennal spine, also a small hepatic spine. There is a deep sulcus running forward from the hepatic spine to the base of the eyestalk, and margined above by a short carina which begins near the base of the hepatic spine but does not extend quite to the frontal margin, and on the lower by a more prominent carina which runs obliquely backward from the antennal spines; a short, oblique carina lies below the hinder end of this larger carina.

The abdomen is stout, laterally compressed, a distinct median longitudinal carina on the fifth and sixth segments, terminating on the sixth segment in a slight spine. The first abdominal segment has the anterior half of the epimeral margin produced to a prominent triangle, the posterior portion convex; the epimera of the second, third, and fourth segments are rounded, that of the fifth segment produced to a triangle at the postlateral angle; the sixth segment is about one and one-half times as long as the fifth; the telson is about as long as the sixth segment, tapering, triangular, with a very acuminate apex, and a decided median longitudinal sulcus. The rhipidura

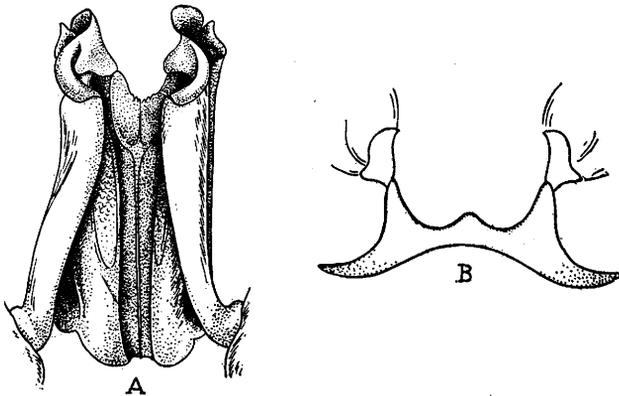


Fig. 14. Petasma and thelycum of *Peneus brevirostris*, $\times 2$.

is very well developed with a strong, short base, the inner blade extending beyond the telson for nearly half its length with the distal margin unequally rounded, a median longitudinal ridge; the outer blade is of similar shape to the inner, but longer and slightly wider with an oblique ridge on the upper surface and the outer lateral margin nearly straight.

The eyestalk is of moderate size, the cornea reniform, set obliquely terminal, very convex, nearly spherical, black. The antennulæ have the basal article long, excavate beneath the cornea, and giving rise on the inner upper proximal region to an elongate, flexible, tongue-like process which widens slightly distally and has the free end rounded; the entire margin ciliated, and the process extends to midway the second joint, which is thickened, two-thirds as wide basally as long, with a longitudinal line of cilia on the upper surface; the third joint is very small, short. The flagellum is biramous, both branches very short, composed of short rings. The antennæ have all the peduncular articles very short, the scaphocerite lobate, with the outer margins thickened, nearly straight except near the tip, the inner lateral margin convex, narrowing near the tip, which lacks but little of being triangular.

The first, second, and third legs are chelate; the fourth and fifth pairs are mono-dactyl; all five pairs increase slightly in length from the first to fifth pairs.

The male petasma is figured (see Fig. 14A).

***Peneus stylirostris* Stimpson**

Figure 15

Peneus stylirostris STIMPSON, 1874, Ann. Lyc. Nat. Hist., N. Y., X, p. 134. RATHBUN, 1910, Proc. U. S. Nat. Mus., XXXVIII, p. 564, Pl. LIII, fig. 2.

TYPE.—Stimpson's type material was collected at Panama, and is believed to be extant no longer.

DISTRIBUTION.—Panama; Peru.

MATERIAL EXAMINED.—Twenty-three specimens, ranging in size from about three to five inches body length, purchased in the market, Panama City, Panama, March 25, 1926, by Dr. Van Name.

TECHNICAL DESCRIPTION.—Shrimp three to six inches long, body strongly compressed laterally. Carapace with a decided median carina throughout its entire length, continuous anteriorly with the rostrum which is about as long from the pre-orbital angle to apex, as is the carapace and crested or arched on its proximal portion, above the orbit, and armed above with spines; the distal two-thirds of the rostrum is very acuminate and devoid of spines, directed forward and with the apex curved upward. There is a strong sulcus on either side of the rostrum, extending from the posterior tooth on the carapace forward beyond the most distal rostral tooth. The antennal spine is sharp, and running obliquely backward from it there is a decided carina which abruptly terminates just in advance of the deep sulcus which occurs just in advance of the well-developed acute hepatic spine; a sulcus runs forward from this point, above the antennal carina, to the frontal margin. Below the hepatic spine there is a long oblique carina, paralleled on its upper border by a sulcus, terminating anteriorly below and in advance of the hepatic spine and posteriorly running obliquely upward on the carapace not quite to its posterior margin. All the abdominal segments are strongly compressed laterally; the fourth, fifth, and sixth segments are sharply carinated, the carina terminating on the posterior margin of each segment in a small acute tooth. The epimeral region is but very little developed, the lateral margins rounded and ciliated. The telson is much shorter than the uropoda, being only about a millimeter longer than the preceding, and is very acuminate, with a distinct median longitudinal groove on its proximal three-fifths, margined on either side by a carina. Lateral telsonic margins are fringed with cilia. The peduncle of the uropoda has the outer angle rounded; the inner blade has its greatest width proximally, tapering distally, with an unequally convex ciliated margin and with a strong median longitudinal keel for the proximal three-fourths of its length; the outer blade exceeds the inner in length in about the proportion that the latter exceeds the telson; the outer blade is more regularly elongate oval, with its distal margin evenly rounded; an oblique ridge extends from the base to the outer distal angle of the proximal part of the blade; there is a transverse ridge accentuating the fused line of articulation between the proximal and distal portions of this blade; both blades have their margins ciliated.

The eyestalk projects on the dorsal surface of the cornea for the greater part of its length; the cornea is large, black, reniform, and lies within the concavity of the anten-

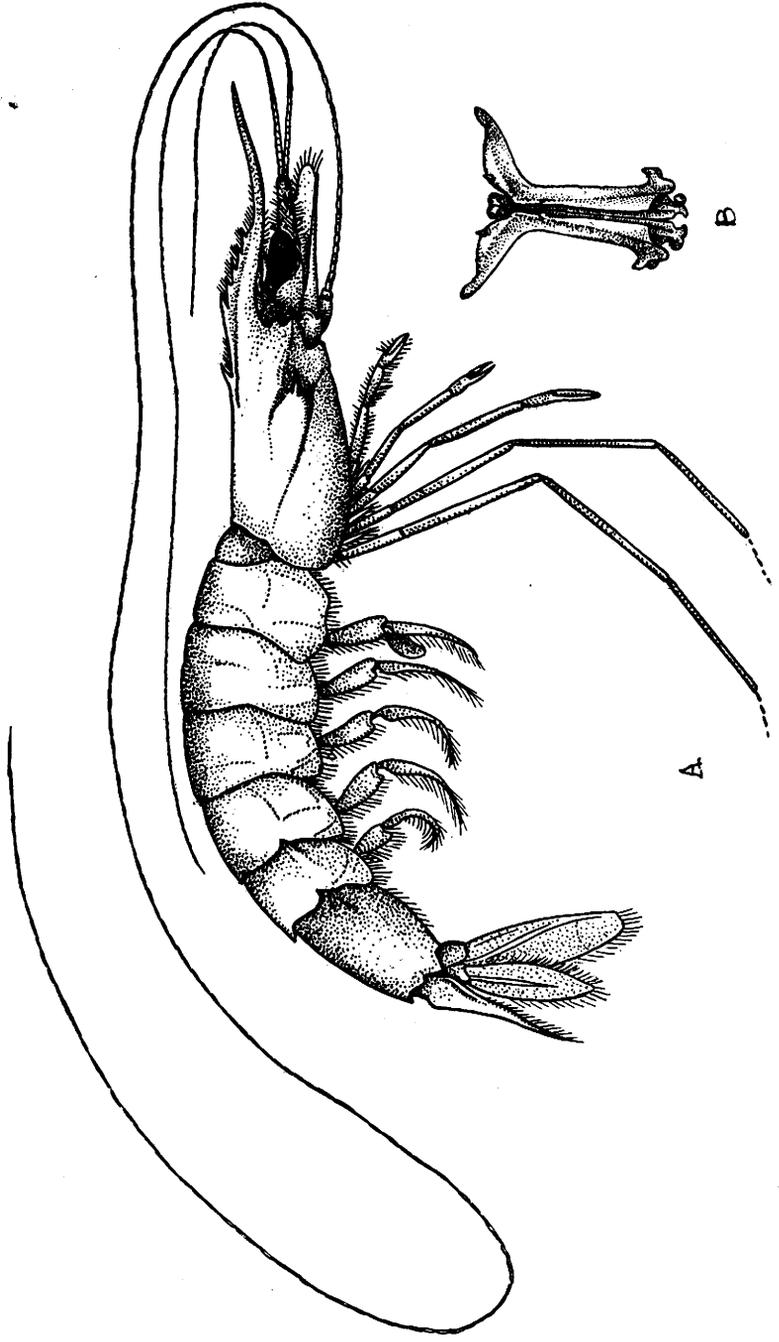


Fig. 15. *Peneus styirostris* Stimpson. a. Adult, natural size. b. Petasma, enlarged.

nular peduncle and is protected on all sides by a very dense fringe of cilia. The antennulæ have the first article much elongated and excavate beneath the eye; there is on the outer proximal lateral margin of this article a small, fixed, acuminate-lanceolate process; the extensive outer lateral margin of this article terminates in a spinule; the second and third articles are subcylindrical, dorsally compressed, successively shorter, and do not extend to the distal margin of the scaphocerite; the flagella are unequal, the shorter inner blade is the slenderer, and is only one-third as long as the outer blade; the latter, which is thickened for the first half inch of its length, is composed of fleshy rings and is less than a third of the length of the long antennular flagellum. The antennæ have a short peduncular article which has its upper distal margin rounded but terminates on its inferior distal angle in a small spine; the second article is short; the third article about twice as long as the second, but reaches only to midway the length of the scaphocerite; the flagellum is remarkably long, about two to two and one-half times the body length and very slender. The scaphocerite is about 3 mm. longer than the antennular peduncle, and has the outer lateral margin straight, thickened, terminating in a short subdistal spine; the inner lateral margin is somewhat convex on its proximal portion, narrowing distally and with the distal margin unevenly convex, the inner portion fuller, the outer sloping toward the subdistal spine.

The first three pairs of legs are typical *Peneus*; chelate, successively increasing in length posteriorly; the first and second pairs of legs each have an acute spine at the inferior distal angle of the basal joint. Rudimentary epipodytes are present on fourth and fifth pairs of legs. These legs are remarkably long and slender; the dactyli are acuminate. The male orifices are paired, circular apertures situated between the bases of the fifth legs and having a prominent calcareous ridge which is continuous in the median region with a distinctive nodular process that elongates anteriorly into a more thickened node. The male pleopoda are very well developed; with the elongated, ciliated, distal blades multiarticulate.

The male petasma is of a shape so distinctive that the species is at once set apart from all other American members of the genus by this organ. (See Fig. 15b.) The petasma is attached on each side to the distal angle of the peduncular article of the first pair of pleopoda and projects forward, branching on each side into a not quite right-angle "arm" which has its outer tip flared and rounded, constricted below this round process on the distal margin. The ventral face of the petasma consists of two separate margins, closely applied, each bearing a small node, the margins enclose a funnel-like cavity, posteriorly there are two larger prominent rounded nodes on the inner ventral margin of the petasma, from each of which a ridge extends into the funnel. Each of the second male pleopoda bears a short, stout, rounded stylambes.

The female thelycum is also distinctive of the species. It consists of a flat lozenge-shaped plate between the bases of the fifth legs and a small blunt tubercle anterior to this plate, between the bases of the fourth legs.

Each of the first female pleopoda has only one distal article; the second to third, inclusive, are biramose, but none has the stylambes.

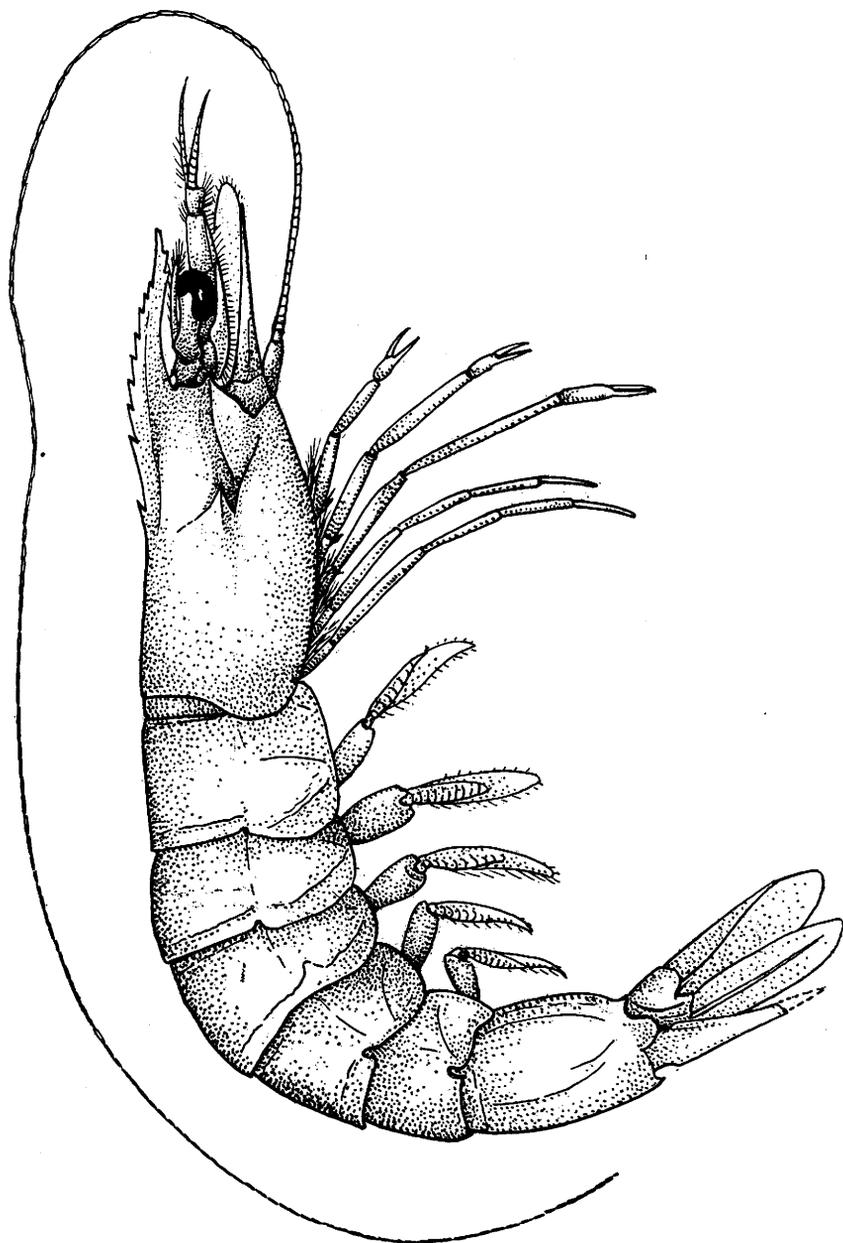


Fig. 16. *Peneus vannamei*, new species, type, about natural size.

***Peneus vannamei*, new species**

Figure 16

TYPE.—One male, purchased in the market, Panama City, Panama, March 25, 1926, by Dr. W. G. Van Name, to whom I take pleasure in dedicating the species. Cat. No. 6281.

DISTRIBUTION.—Bay of Panama and Sinaloa, Mexico.

MATERIAL EXAMINED.—Holotype. Three additional specimens are in the collections of the American Museum. They were collected in Estero de Caleguez Escumapa Sinaloa, Mexico, by Señor Gallegos who donated them to the American Museum.

TECHNICAL DESCRIPTION.—The type, which is about four inches long, superficially reminds one of the above-described *P. stylirostris* Stimpson, in the general appearance of the crested, carinate, and dentated rostrum. However, *P. vannamei* is readily distinguished from *stylirostris* by the following characters: (a) The animal is more robust and less compressed laterally than a *stylirostris* of the same length; (b) the median carina of the carapace does not extend quite to the posterior margin of carapace; from midway the length of carapace it rises in a decided crest which attains its greatest height behind the orbital angle and is continuous anteriorly with the rostrum, which reaches only to the distal margin of the second peduncular antennular article, and has its distal third acuminate and curved downward; there are nine teeth on the upper margin of the crest; four of them occur between the middle of carapace and orbital angle, while the remaining five are placed between this angle and the distal margin of the cornea; the inferior rostral margin bears two teeth, the hinder of which is slightly in advance of the foremost tooth of the upper rostral margin, the apex is subacute. On either side of the rostral crest there is a sulcus which extends from a little in advance of the most posterior tooth to the most anterior tooth of the upper rostral series. The antennal spine of *vannamei* is acute, as in *stylirostris*, and a carina runs obliquely back and downward from it, terminating in the sulcus that is just anterior to the acute hepatic spines. The hepatic sulcus is much wider and more prominent in *vannamei*; the little carina which forms its upper margin vanishes about halfway to the frontal margin. There is an equally brief carina running upward from the apex of the hepatic spine in the place occupied by the cervical suture but reaching scarcely a third of the way toward the median carina. Below the hepatic spine a short carina runs obliquely down and forward toward, but not reaching, the frontal margin. In *vannamei*, there is no oblique carina running backward and upward toward the hinder margin, as is the case in *stylirostris*.

The first three abdominal segments are more robust and have the epimera more developed and more convex than *stylirostris*; the fourth, fifth, and sixth segments are laterally compressed, and each has a median carina which terminates in a small tooth posteriorly. On the fifth segment there is one short, oblique ridge in the median lateral region, one on each side, and in line with this, on the sixth segment, there are three similar, subequally spaced ridges. Such markings also occur on the same segments in the two West Indian species, *P. brasiliensis* and *P. setiferus*. The telson is tapered triangulate, acuminate, not so long as the preceding segment and with a deep median sulcus throughout its length; the uropoda have the outer lobe of the peduncular article more broadly rounded than does *stylirostris*, the inner lobe forms a broad triangle, the inner blade is the shorter, but is longer than the telson and attains its greatest breadth not far from the distal end, which is unequally convex, the inner half

sloping toward the fuller outer half; there is an approximately submedian groove extending almost the entire length of the blade; the outer blade is distinctly longer than the inner with its lateral margins subequal, convergent distally, the distal margin evenly rounded and ciliated; there is an oblique longitudinal carina running out to the lateral margin, but not quite reaching the margin; there is no spine at the terminus of this carina and no vestige of transverse articulation of the distal part of the blade, such as occurs in *stylirostris*; the blade is entire in *vannamei*.

The eystalk is quite as long as the cornea; a calcareous plate covers the greater part of the dorsal surface of the cornea; the cornea is shortened reniform, very convex on its distal and lower faces and lies within the concave peduncular article of the antennulæ. The antennulæ have the first joint elongated, excavate beneath the eye, with a lanceolate process at the proximal outer lateral border. On the inner lateral side is a free, long, narrow, tongue-like process with its distal margin rounded, all margins ciliated; this process lies above the inner lateral margin of the eye and extends as far forward as the distal spine of the inferior rostral border. The peduncular article is short, dorsally flattish, nearly as wide proximally as long, narrowing distally; the third article is very short, only half as long as the preceding article, cylindrical; the flagellum is biramose, the inner branch stout, about as long as the second and third peduncular articles; the slenderer branch is only eight to ten annulations longer, but is distinctly more slender. The antennæ have a short peduncular article which has its distal margin rounded, no spinule present; the second to third articles very short, their combined length less than a third of that of the scaphocerite; the flagellum is 125 mm. long, or nearly as long as the body. The scaphocerite is large, 19 mm. long, or slightly more than two-thirds as long as the carapace, exceeding the length of the antennular peduncle by about one-fourth of its own length; it has the outer lateral margin thickened, terminating subdistally in a spine, the inner lateral portion of the blade widest proximally, convex, tapering distally; the distal margin is tapered on both sides to a much narrowed, slightly rounded apex, the outer lateral distal margin being more oblique than the inner.

The first, second, and third legs are chelate; the first leg has a sharp spine at the distal angle of the basis and ischium; the second leg has a similar spine at the distal angle of the ischium. The fourth and fifth pairs of legs are slender, nearly equal, each with the dactyl four-fifths as long as the related propodus, very narrow and acuminate distally.

Peneus vannamei is the Pacific Coast analogue of *P. setiferus* from which *vannamei* may be readily distinguished by its shorter carapace; in *vannamei*, the carapace, measured from orbital angle to posterior margin, is equal to the length of only two and one-half anterior abdominal segments, while in *setiferus* the carapace is equal to three or more anterior abdominal segments. The hepatic sulcus of *vannamei* is coarser and wider than in specimens of *setiferus* of the same size. The rostrum of *vannamei* is more cristate proximally and has its apex directed downward. The rostral formula in *vannamei* is $\frac{8+1}{2}$; in *setiferus* it is the same.

The male has epipodites present on all five legs; each epipodite is a little more than one half as long as the related ischial joint, the most anterior epipodite is a trifle longer than those posterior.

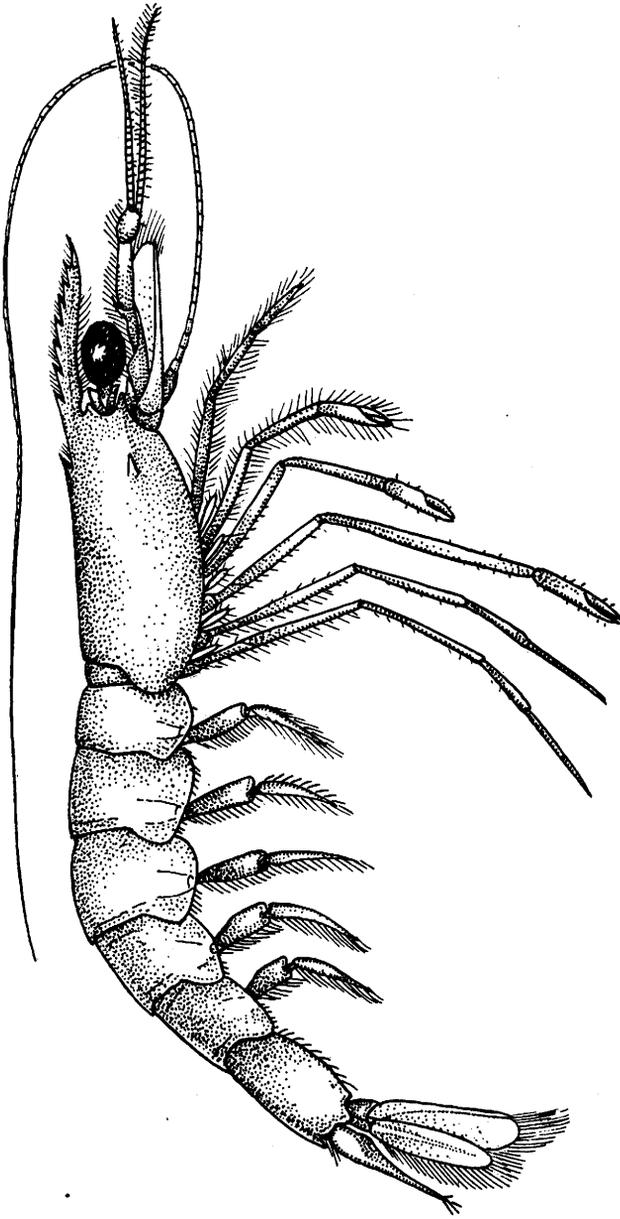


Fig. 17. *Penaeopsis kishinouyei* Rathbun.

The male petasma of the present species, while immature in a well-developed specimen about five inches long, differs in shape from the undeveloped petasma of various specimens of *P. setiferus* which I have examined.

The incompletely matured sternal plates which are sexually modified also indicate differences between the two species, but these characters must await the capture of additional material. The petasma of the present species has a broadly rounded distal margin on each half. The related sternal region bears a different development. It is in the form of a subrectangular plate at the bases of the fifth legs and continued forward between these in the form of a ridge which is wider anteriorly; there is between the bases of the fourth legs a similar ridge that terminates in a forward-directed spine.

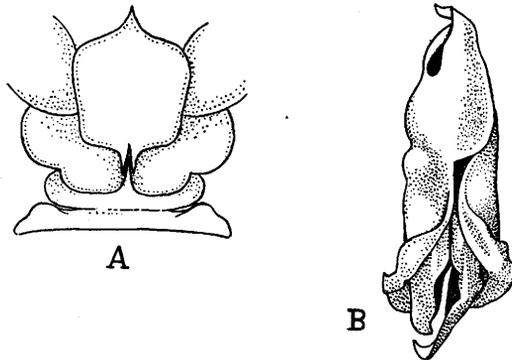


Fig. 18. *a.* Petasma. *b.* Thelycum of *Penaeopsis kishinouyei* Rathbun. (Both much enlarged. After Rathbun.)

PENÆOPSIS Spence Bate

Penaeopsis kishinouyei (Rathbun)

Figures 17 and 18

Parapeneus kishinouyei RATHBUN, 1902, Proc. Wash. Acad. Sci., IV, p. 288, Pl. XII, figs. 13-15; 1910, Proc. U. S. Nat. Mus., XXXVIII, p. 607.

Penaeopsis kishinouyei DE MAN, 1911, 'Siboga Expedition,' Monog. 39a, Decapoda, part 1, Penaeidae, pp. 8, 55. SCHMITZ, 1925, Zoologica, N. Y. Zool. Soc., V, p. 161. BOONE, 1930, Bull. Vanderbilt Marine Museum, III, p. 108, Pl. XXXIII, and text fig. 3A, B.

TYPE.—The type and additional specimens were taken at Tagus Cove, on the reef north of Tagus Hill, Albemarle Island, Galápagos, March 16, 1898 or 1899, by the Hopkins Stanford Expedition, and others in a depth of two fathoms, in the same locality. The majority of the type series is deposited in the United States National Museum.

Named for the Japanese carcinologist, Dr. Kishinouye.

DISTRIBUTION.—Galápagos Islands; Costa Rica; Bay of Panama.

MATERIAL EXAMINED.—One adult male taken in the Bay of Panama by Dr. W. G. Van Name.

TECHNICAL DESCRIPTION.—Animal about 55 mm. long, from tip of the rostrum to the tip of telson. Carapace 11 mm. long from orbital angle to posterior margin, rostrum 65 mm. long from tip to orbital angle, slender, arched above the eye, with the tip on a lower plane and directed forward; armed on the upper margin with seven acute forward-directed teeth, in addition to the apical tooth and with a slight fringe of cilia between the teeth; the teeth are continuous to the tip of the rostrum. The lower margin is entire; the lateral carina curved, extending practically the entire length of the rostrum. The rostral carina is continued upon the carina for a very short distance, practically terminating at the median gastric spine, which is acute. The entire carapace is covered with a fine pubescence. There is a sharp hepatic spine. The superior orbital spine is weak; the postorbital spine is well developed with a carina behind it.

The eye is large, reniform, with a flattish calcareous scale dorsally and very convex on the outer side. The antennulæ have the basal article long, concave beneath the eye, with an incised lateral process; the second article is narrowed elongate, with a lateral carina along the lower outer margin. The third article is small, bulbous; the flagellum is biarticulate, about as long as the entire peduncle; the branches of approximately equal length, the lower branch being the thicker and quite setose; the annulations of both whips are short. The antennæ have a short peduncle, the second article very small, the third article elongate cylindrical, scarcely one-third the length of the scaphocerite; the flagellum is multiarticulate.

The abdomen is somewhat compressed laterally, the fourth, fifth, and sixth joints each having a median longitudinal carina which terminates on the sixth segment in a minute tooth. The epimeral plates are not much produced. The telson is triangulate, about as long as the sixth segment. The rhipidura has a small peduncle, the inner blade long and narrow, with a tapered convex distal margin and a strong median longitudinal rib. The outer blade is wider, with the outer lateral margin thickened, the distal margin broadly rounded; both blades are fringed with a web-like brush of cilia on the distal and inner lateral margins.

The first, second, and third legs are chelate, increasing in length in the order named. The basis and ischium of the first legs are each armed with a spine; two spines occur on the sternum between the bases of the second legs. The fourth and fifth legs are long, slender, monodactyl.

The petasma is asymmetrical, the left side the longer, with its distal portion ovate and quite narrowed at the anterior end. The thelycum has the lateral plates broad and fused, the central plate about semicircular.



Fig. 19. *Macrobrachium jamaicense* (Herbst), reduced to about one half of natural size.

Palæmonidæ

MACROBRACHIUM Spence Bate

Macrobrachium jamaicense (Herbst)

Figure 19

Cancer (Astacus) jamaicensis HERBST, Naturg. Krabben u. Krebse, 1792, II, p. 57, Pl. XXVII, fig. 2. BOONE, 1930, Bull. Vanderbilt Marine Museum, III, p. 146, Pl. LI (detailed description and synonymy).

TYPE.—Collected in the fresh-water streams of Jamaica, and deposited in the Berlin Museum.

DISTRIBUTION.—This species is well known in the fresh-water fauna of the American tropics on both sides of the continents and has been recorded from Texas, southward to Brazil on the East Coast, and also from several of the islands of the West Indies, as well as from Lower California to Peru on the West Coast.

MATERIAL EXAMINED.—Six large specimens taken in pool of a nearly dry brook, seventy-five feet above the lake, buried in leaves in pool, which has a maximum depth of ten inches, Barro Colorado Island, Panama.

TECHNICAL DESCRIPTION.—Carapace robust, smooth, slightly more than one-third the total of body-length; rostrum short, only reaching as far forward as the second peduncular article of the inner antennæ, acute-tipped, slightly crested, with eleven acute forward-directed teeth on the upper margin besides the apical tooth; four of these teeth are postorbital on the carapace, a row of cilia anterior to each tooth; the rostrum extends back on the carapace for two-fifths of the length of the carapace; the under margin of the rostrum has three teeth in addition to the apical tooth; there is an approximately median longitudinal carina on each side of the rostrum which is continuous posteriorly on the margin bounding the ocular cavity. The antennal spine is short, acute, the lateral margin carinate and bent under the body. The abdominal segments, including the telson, uropoda, and pleopoda, are practically identical in shape and proportion to those of *M. olfersi*.

The second legs are decidedly unequal, the right being the larger. One specimen, from Panama, now in the American Museum, has the second legs about equal. The ischium is elongated, the merus a third longer than the ischium; the carpus five-sixths as long as the merus; the propodus, including the finger, three times as long as the merus, the palm being cylindrical, slightly compressed laterally, the fingers about as long as the palm, slender, cylindrical, each with one or two large triangulate teeth, the tips curved upon each other. The distal part of the merus and the entire carpus and propodus, including the fingers, are covered with numerous fine rugosities set with setæ.

M. jamaicense is readily distinguished from young *M. olfersii* by the fact that *jamaicense* has the carpus uniformly elongated, nearly half as long as its propodus. Adult *M. olfersii* is of course readily distinguished by its great purplish-blue chela, which bears a dense brush of furlike setæ on the dorsal of palm.

Pontonidæ**PONTONIA** Latreille**Pontonia margarita** S. I. Smith

Figure 20

Pontonia margarita SMITH, as footnote in A. E. Verrill's, 'Parasitic Habits of Crustacea,' 1870, American Naturalist, III, p. 247. BOONE, 1930, Bull. Vanderbilt Marine Museum, III, p. 148, Pl. LII.

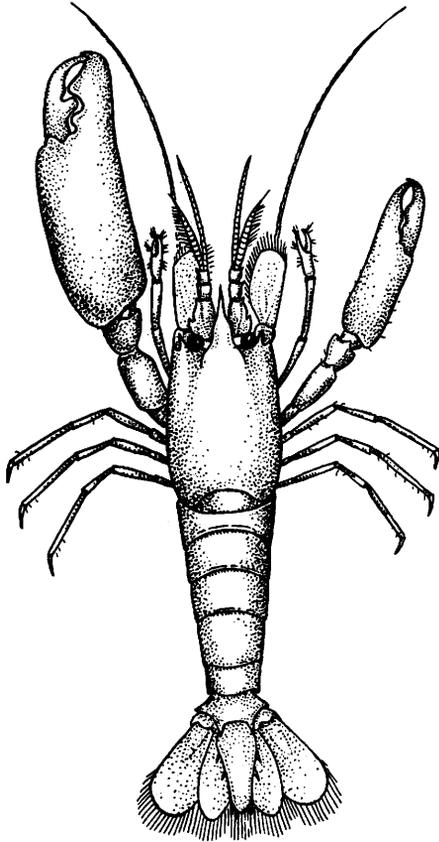


Fig. 20. *Pontonia margarita* Smith, $\times 1.5$.

TYPE.—From the Bay of Panama, in pearl oysters; depository not cited.

DISTRIBUTION.—Costa Rica to Panama, in *Margaritiphora fimbriata* and *Pinna* species. Rare in collections.

MATERIAL EXAMINED.—One specimen, Pearl Islands, Panama; one large ovigerous female from Saboga Island, Pearl Islands; both collected by Dr. W. G. Van Name.

TECHNICAL DESCRIPTION.—The carapace is 15 mm. long, including the rostrum, which is 3.6 mm. from tip to orbital angle, a slender acuminate triangle, with the dorsal surface flat, glabrous. The rostrum extends as far forward as the distal end of the second peduncular articles of the antennulæ. The carapace is four-fifths as wide as long, glabrous, with a slender, acute, branchiostegal spine which is about as long as the basal antennal article. The abdominal segments in the female are broad, with well-developed rounded epimeral plates, except the sixth segment, which is produced into a narrow, triangulate projection, on each side at the base of the telson, which is about one and one-half times as long as the sixth segment, narrow, tapered, the apex truncated and armed distally with four pairs of articulated spines, the outer pair of which is the thicker; there are two pairs of articulated, short, blunt spines, the proximal pair placed midway the length of and near the lateral margin, the second pair about halfway between that and the distal margin. The caudal fan has both blades of the uropoda longer and wider than the telson, the inner blade being a very little longer and about one-fourth narrower than the outer blade; both are broadly oval, with only a brief fringe of cilia distally.

The antennulæ have the first article elongate and flattened, slightly concave dorsally, with a leaf-like process on the outer lateral margin and not quite so long as the rostrum; the second article is short, cylindrical, nearly as wide as long, reaching to, or half a millimeter beyond, the rostral tip; the third article is subequal to the second article; the flagellum is biramous, the thicker branch consisting of about ten stocky rings, which are heavily setose on the lower surface. The slender branch consists of twelve to fifteen rings and is not much longer than the thicker branch. The antennæ have a short peduncular article; the scaphocerite is oval, exceeding the length of the peduncular article by about the length of the third article, and its median width is equal to half its length, the distal margin evenly rounded and only slightly ciliated. The carapocerite is very slender and cylindrical, extending only two-thirds the length of the scaphocerite and being of only slightly greater diameter than the flagellum, which is tapering, two and one-half times as long as the scaphocerite. The eyestalk is stocky, cylindrical, two-thirds as long as the rostrum, beneath which it lies, the cornea small, terminal, of slightly less diameter than the stalk.

The first legs are very slender, chelate, the merus elongated, flattened; the carpus slightly longer than the merus, cylindrical, but much narrower basally than distally; the propodus, including the dactyl, is only three-fourths as long as the carpus, the palm is cylindrical, of about the same diameter as the distal half of the carpus; the fingers are about as long as the palm, the cutting edges meeting. The entire length of both fingers is set with bristly clusters of setæ. The second legs are markedly unequal, the left claw being much the larger; both claws lying in the bent position characteristic of members of the genus. The female has the merus short, less than one-third the length of the palm, as wide as long, with the lower distal margin obliquely excavate for the articulation with the carpus, which is short, bulbous, encupping the base of the propodus; the latter in the larger chela is 17 mm. long, of which the lower finger is 5 mm.; the palm is moderately swollen, the hinder end slightly dilated posteriorly; both lateral faces of the palm moderately convex; the lower finger is the larger, armed with two coarse teeth fitting between the one coarse tooth of the slenderer, curved, hinged finger tips; the apex of the lower finger is much down-curved. The smaller second chela is of similar contour to the larger one, but the hinged finger has one tooth, and the lower finger none. The three pairs of ambula-

tories are slender, each with the propodus twice the length of the carpus; the dactyl very rudimentary, with a small curved apex, which has a smaller tooth subdistally.

The published description, with figure, of Miss Rathbun's *Pontonia californiensis*, based on one imperfect female from off Santa Cruz Island, California, 'Albatross' Station 2945, thirty fathoms, does not state a single character differentiating *P. californiensis* from Dr. Smith's careful description of the type of his *Pontonia margarita*, which Miss Rathbun (1904) briefly states is a *Conchodytes*. I have had the pleasure of examining the largest single series of *Pontonia margarita* Smith recorded; these were obtained by Mr. William K. Vanderbilt at Punta Arenas, Costa Rica, February, 1928. I have also examined the series obtained by Mr. Harry Payne Bingham, from pearl oysters and *Pinna* species in the Gulf of California, and a single specimen deposited in the American Museum from the Gulf of California. I am convinced that *Pontonia californiensis* is merely a synonym of *P. margarita*.

Alpheidæ

ALPHEUS Fabricius

Alpheus heterochælis Say

Figure 21

Alpheus heterochælis SAY, 1818, Journ. Acad. Nat. Sci. Phila., I, p. 243. BOONE, 1930, Bull. Vanderbilt Marine Museum, III, p. 171, Pl. LXI (and synonymy).

TYPE.—Say founded the species on material from South Carolina and a specimen from Amelia Island, Florida; deposited in the Philadelphia Academy of Natural Sciences.

DISTRIBUTION.—Known from Beaufort, North Carolina; southward throughout the West Indian region to Maceio, Brazil. Taken at the Bermudas, in Porto Rico, Curaçao, and Barbados.

MATERIAL EXAMINED.—Five, Tabogilla Island, Panama; five, three of which are very large, Patillo Point, Panama; three, Saboga Island, Panama; seven, from the Bay of Panama; all collected by Dr. W. G. Van Name.

COLOR.—See the color plate of Brooks and Herrick.

TECHNICAL DESCRIPTION.—Animal robust, superficially resembling *A. armillatus*, from which it may at once be separated by the different rostrum, and differently placed grooves on the cheliped. The rostrum is simple, a linear ridge, projecting the distal third of its length beyond the frontal margin as an acute spine and continuous posteriorly as far as the base of the orbital lobes, from which it is separated by a deep sulcus; the ocular lobe is convex, rounded on the frontal margin. The carapace and abdominal segments are very similar to those of *A. armillatus* except that the telson of *A. heterochælis* is substantially wider in proportion to its length than is that of an *armillatus* of the same size and sex.

The antennulæ have the first article two-thirds as long as the second, and the second article twice as long as the third article. The antennæ have the scaphocerite with a shorter, acuminate tooth at the distal margin and the scale slightly wider, and

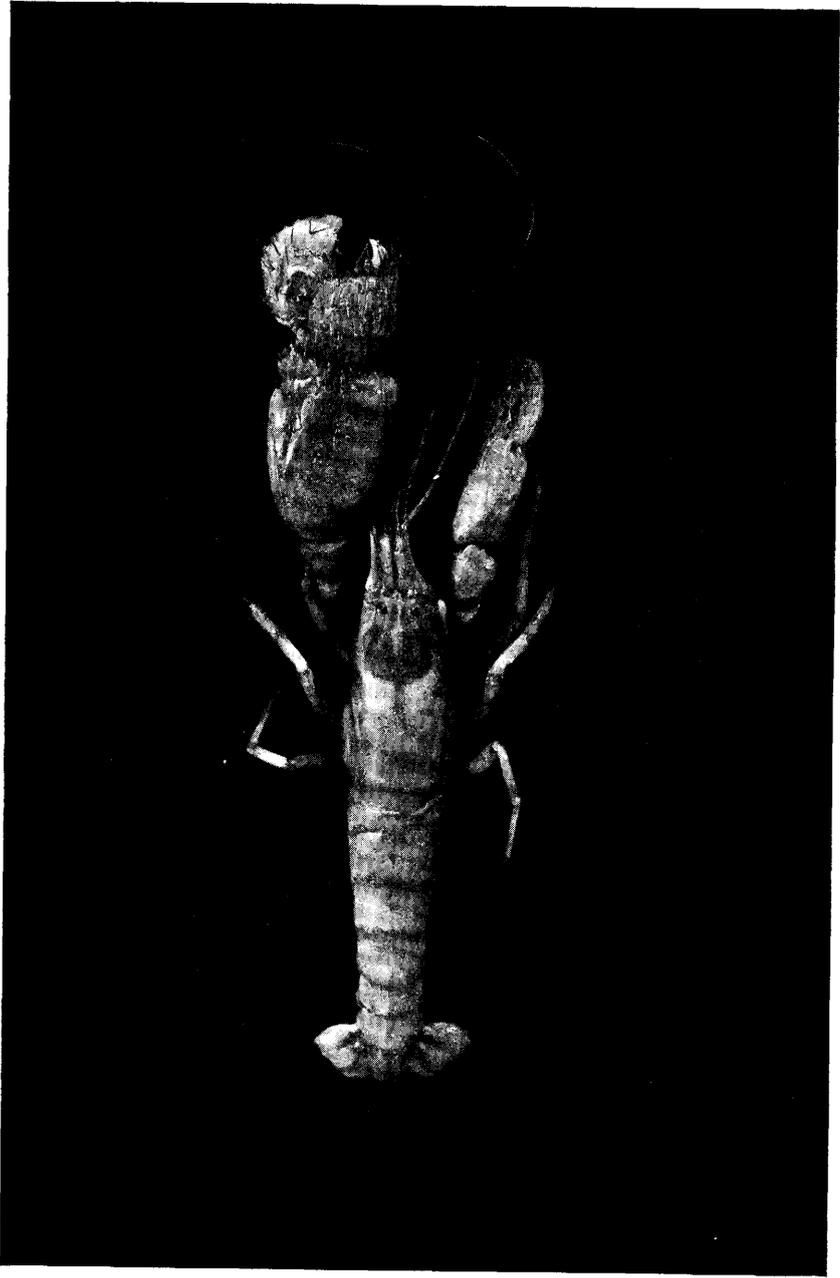


Fig. 21. *Alpheus heterochaelis* Say, $\times 2$.

its distal half more rounded than does *armillatus*; the carapocerite is a little shorter in *heterochælis* in relation to the scaphocerite than is the case in *armillatus*.

The large cheliped of *heterochælis* is shorter than that of *A. armillatus*; the upper and lower transverse grooves are somewhat similar, but the supermarginal groove of the inner face of *heterochælis* is conspicuous. The grooves and furrows of the dactyl are distinctly different, and the shape of the great basal tooth of the hinged finger and correspondingly the shape of the excavation on the lower finger are also distinctive. The smaller chela in the male is broad, elongated. The palm is of about equal length to the curved dactyl. The proximal dorsal area of the palm is circumscribed by an impressed line; the upper distal margin is notched and a groove runs back from the notch on either side; the groove of the inner side is deeper and joins the posterior impressed line; the distal articular margin is tridentate; the upper median tooth is small, obtuse, the lateral ones are more acute; these teeth are frequently brownish black like the tips of the fingers. The upper finger is broad, arched, beak-like; the lower finger has the tip bent upward slightly, the cutting edge excavate, while that of the hinged finger is produced to a median carina. The third and fourth pairs of ambulatory legs are moderately compressed, the ischial spine inconspicuous or more often lacking; the propodus armed with eight or nine small, articulated spines; the dactyl is flattish, curved, acute. The fifth legs are smaller, nearly terate; the dactyl similar to those of the preceding pairs.

AUTOMATE de Man

Automate haightæ, new species

Figure 22

TYPE.—An adult specimen, with both chelipeds attached; collected on the north shore of Tabogilla Island, Pearl Islands, Bay of Panama; a paratype with the greater chelipeds missing from the same locality; collected by Dr. Van Name and Mrs. Sherman P. Haight and deposited in The American Museum of Natural History. Cat. No. 6275. Named in honor of Mrs. Sherman P. Haight.

DISTRIBUTION.—Known only from the above locality.

MATERIAL EXAMINED.—Type and paratype.

COLOR.—Semitranslucent, creamy yellow.

TECHNICAL DESCRIPTION.—This species, which is the third to be described from American waters, is the second species to be found in the Bay of Panama. *A. rugosa* Coutiere, 1902, taken by the 'Albatross,' Station 2799, is the first record of the genus on the American Pacific coast. *Automate evermanni* Rathbun, taken by the 'Fish Hawk' at Aguadilla and Mayaguez Harbor, Porto Rico, is the only representative of the genus so far recorded from the West Indian region.

The present species is glabrous, with the carapace decidedly compressed laterally with a median sinus exposing the eyes, the frontal border of which is evenly a very little rounded, lateral margins of sinus curve forward toward the front, extending quite to midway the eyestalk. The species in this respect differs greatly from *A. evermanni*, as illustrated by Dr. Rathbun, who confines her description to the brief statement, "This species" [*evermanni*] "in its carapace and eyes resembles *A. dolichognatha* de Man," but figures a frontal sinus at the base of the eyes of *evermanni* entirely different from that figured by Dr. de Man for *dolichognatha*. The abdomen of

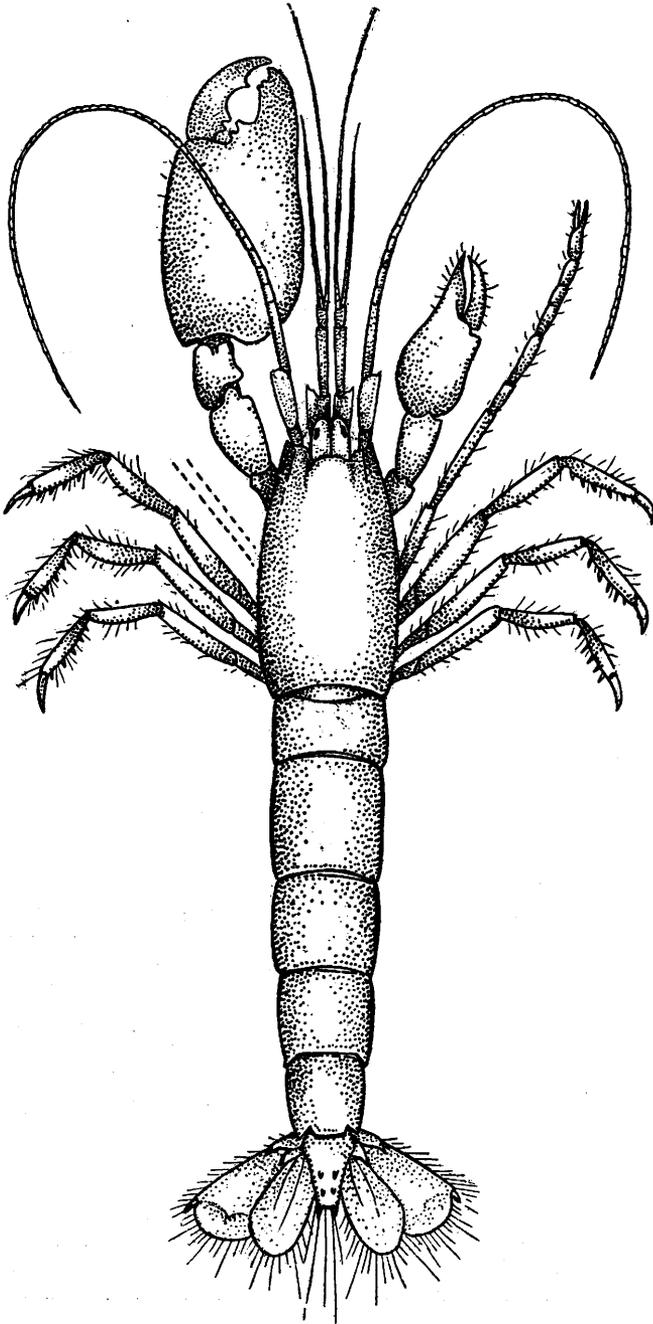


Fig. 22. *Automate haightæ*, new species, type, $\times 3$.

haightæ is slender, the second segment substantially the longest of the series; the telson is as long as the preceding abdominal segment but tapers so decidedly that it appears shorter; the distal margin is truncated, very slightly rounded, ciliated and armed at each lateral angle with a sharp spine; there are two pairs of submedian articulated spines on the dorsal surface of the telson.

The uropoda have the peduncle very short, the inner blade is one and two-fifths times as long as the telson and is narrower proximally, widening distally into a broad oval blade, ciliated marginally. The outer blade is not quite so long as the inner and is more broadly oval, with a sharp subdistal tooth on the outer lateral margin and a transverse suture line running inward from this; the cilia of the outer blade is quite long.

The eystalks lie close beside each other and are convex, with the terminal margin more sloping on the outer side than on the inner; the cornea small, circular, black, placed distally on the outer side of the stalk. The antennulæ have the first joint short but extending beyond the eye and reaching not quite so far forward as the acicule; the second joint is cylindrical, long, and slender, three times as long as the third peduncular joint, which is short; the flagellum is biarticulate, the outer branch two-thirds as long as the inner and much thicker for the proximal two-thirds of its length, finely tapered distally. The outer whip is a little longer than the inner. The acicule is lanceolate, its tip reaching to the base of the second peduncular article of the antennulæ. The antennæ have the first peduncular article three-fifths as long as the first article of the antennulæ; the scaphocerite is small, short, extending only two-thirds the length of the second peduncular article, the second peduncular article is one-third shorter than the first; the carpocerite is very long, slender, cylindrical, being 1.8 times as long as the scaphocerite and extending about one-fourth of its own length beyond the antennular peduncle; the antennal flagellum has its proximal article about four or five times as long as the succeeding articles; the flagellum is about twice as long as the carapace and consists of numerous fine annulations; no setæ are present.

The external maxillipeds are quite as long as the smaller first cheliped and have a distal article which is exactly as long as the propodus and dactyl of this cheliped, and is very slender, tapered distally; armed with a longitudinal series of horny spines, also with numerous bristly setæ.

The chelipeds are smooth, conspicuously unequal; the larger one has the merus but little longer than the carpus, with its upper margin rounded and its inferior distal margin truncated obliquely; the carpus is short, rounded on its upper surface and produced to a triangular process on its lower hinder margin, the propodus, including the dactyl, is 1.15 times as long as the carapace and its height is 0.6 of its length; the inferior margin is distinctly rounded posteriorly; the propodal finger is short, stocky, with two small, triangular teeth proximally and one larger one subdistal to the acute tip; the hinged finger has its dorsal contour convex, the tip acute, overlapping on that of the propodal finger; on the cutting edge there are three small triangular teeth proximally and another about halfway between the outer of these and the tip. The smaller cheliped has the proportion to the larger one shown in the figure and also differs in having the carpus cuplike distally and with no inferior lateral tooth; the fingers nearly as long as the palm, meeting throughout their entire length and devoid of teeth except the acute tips. The second leg is missing on the left side; that of the right side is longer than the small cheliped and has the ischium slender, elongate, laterally

compressed; the merus approximately subequal to the ischium; the carpus consists of five articles, the second of which is the longest of the series, being one and one-third times as long as the first article; the third and fifth articles are subequal, the fourth article being the shortest of the series; the third article is 0.6 as long as the second, while the fourth article is only 0.5 as long as the second; the propodus is small, its palm about equal to the fourth carpal article; the fingers almost as long, slender, tapering, with a very few setæ near the tips. The third, fourth, and fifth pairs of legs are monodactyl, decreasing very slightly in length in the order named; the third leg has its meral joint 0.4 as wide, medially, as long with the lateral margin convex, convergent at each end; the propodus is clavate, three-fourths as long as the merus and with a rounded tooth at the distal dorsal margin; the propodus as long as the carpus and has its inferior lateral margin set with a series of five horny spines and numerous setæ; the dactyl is half as long as the propodus, very little curved, with an acuminate horny top. The fourth has its merus about 0.3 as wide as long. The fifth leg has its merus scarcely at all dilated, being about 0.2 as wide as long.

Atyidæ

ATYA Leach

Atya occidentalis Newport

Figure 23

Atya occidentalis GRONOVIVS, 1764, p. 231, Tab. 17, Fig. 6, No. 988 of *Zoolophylacium*; Gronoviani, fasc. secund. Lugd. Batav. fol., (described and figured but without name). NEWPORT, 1847, Ann. Mag. Nat. Hist., XIX, p. 159. MILNE EDWARDS, 1864, Ann. Soc. Ent. de France, IV, p. 147. VON MARTENS, E., 1872, Arch. f. Naturg., Jahrg. XXXVIII, B. I., p. 135. KINGSLEY, 1878, Proc. Acad. Nat. Sci. Phila., p. 92. POCOCK, 1889, Ann. Mag. Nat. Hist., (1) IV, p. 11, Pl. II, fig. 3. BOUVIER, 1904, Bull. Mus. Hist. Nat., Paris, p. 137; 1905, Bull. Sci. de France et Belg., XXXIX, p. 117, Fig. 22; 1925, Encycl. Entomologique, Paris, IV, p. 312, Figs. 700-702.

Atya tenella SMITH, 1871, Report Peabody Acad. Sci., III, p. 94.

Atya scabra (in part) ORTMANN, 1895, Proc. Acad. Nat. Sci., Phila., p. 409.

TYPE.—The type of the species is deposited in the British Museum and was collected in Jamaica by Mr. Gosse.

DISTRIBUTION.—Known from the fresh-water streams of the West Indian Islands (Jamaica, Dominica, Cuba); also from Central America (Nicaragua and Panama).

MATERIAL EXAMINED.—Six specimens taken in pools of nearly dry brooks, Barro Colorado Island, Panama, April 5, 1926, by Dr. W. G. Van Name and F. M. Gaige.

TECHNICAL DESCRIPTION.—This species, which is the most abundant representative of the genus in the American tropics, is closely affiliated with *A. robusta* Leach, from New Caledonia, but *A. occidentalis* is readily distinguished by the fact that its rostrum has a more prominent carina, and also has its ventral margin more denticulate; the telson of *occidentalis* is distinctly longer than that of *robustus*. In the large males, the anterior ambulatories of *occidentalis* are more robust.

Both males and females are very stout with a short, thick, glabrous carapace, the rostrum which is decidedly carinated extends as far forward as the first peduncular article of the antennulæ and has a triangulate apex and is sharply angulated; on either

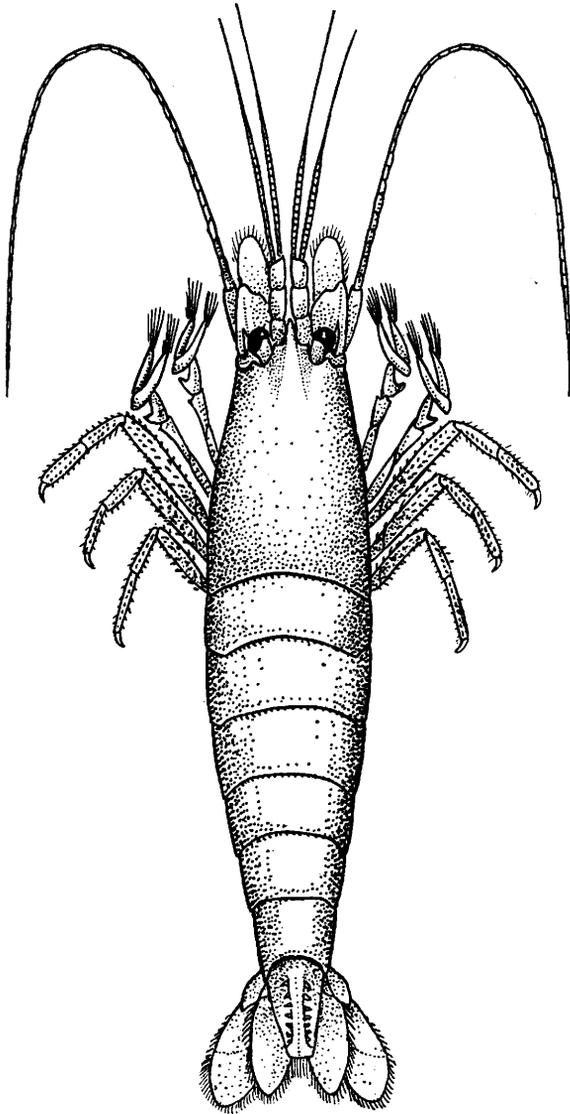


Fig. 23. *Atya occidentalis* Newport, $\times 1$.

side of the rostral carina there is a distinct groove running back from the subdistal angle as far as the base of the rostral carina, accentuating the supraorbital margin. The antennal tooth is short, triangulate; the pterygostomial angle is similar but in advance of the antennal spines. The epimeral region of the abdominal segments is

well developed, that of the second segment being produced into a broad, suboval lobe that greatly overlaps both adjacent segments. The telson is scarcely a millimeter longer than the preceding segment and tapers posteriorly, with the posterior margin truncate, very slightly rounded; armed at each distal angle with an articulated spine and fringed distally with close-set setæ. There is a median longitudinal sulcus on the posterior two-thirds of the telson, and seven submedian, articulated, blunt spines on either side, set in longitudinal series. The uropoda have the outer angle of the peduncle produced in a large triangulate tooth, the inner blade is wider distally, ovate, exceeding the telson by one half its length; the outer blade is wider and a little longer than the inner blade, and has the distal portion of the blade articulated, broadly convex and ciliated on the margin; there is a row of stubby spinules on the oblique posterior margin of the proximal portion of the blade, and one slightly larger spinule at its outer lateral angle.

The eyes are short, bulbous, the cornea black, convex. The antennulæ have the basal article excavate beneath the eye and with its outer lateral margin incised, forming a strong acuminate tooth; the distal end of this article is thicker and is fringed dorsally with stubby setæ; the second article is stocky, cylindrical, setose, extending as far forward as the line of articulation in the scaphocerite; the third article is shorter, only two-thirds as long as the preceding article; the flagellum has the inner whip much the longer and quite thick for the proximal third of its length; the slenderer outer whip is scarcely one half as long as the inner branch. The antennæ have the peduncular article short; the scaphocerite elongated, ovate, exceeding the antennal peduncle by the length of the entire distal portion of the blade and exceeding the antenular peduncle by about the distal three-fifths of this blade. The scaphocerite has the lateral margins of the proximal portion of the blade subparallel, the distal portion is unequally convex, the outer side of its margin more sloping than is the other side, both convex; the articulation is unevenly concave.

The first and second pairs of legs are approximately equal and similar. Each has the ischium very slender, produced on the inferior margin into an oblique process extending two-thirds the length of the meral margin and reinforcing it; the merus is slender, abruptly widened distally and with a concave excavation on the inner distal margin, which is angulated at its union with the lateral margin; the carpus is short, cuplike on its distal margin, with the free margin produced into a concave process for the reception of the backward-projecting rounded end of the propodus; the uropodus is of the typical atyid shape, long, slender, with the posterior two-fifths of its length projecting backward beyond the point of attachment to the carpus and rounded, the anterior end tapered and rounded and fringed on both sides of this tapered margin with a dense brush of close-set fine long setæ which equals in length the supporting propodus; the dactyl fits closely upon the propodus and is as long but slightly more slender, and bears distally a similar fringe of setæ. The ambulatory legs are stocky, successively decreasing in length from the first to third pairs; each with the merus thick, elongated; the carpus is about half as long as the merus; the propodus is about a third longer than the carpus; the dactyl is quite short, less than half the length of the propodus, armed with a curved, horny dactyl; also with several spinules on the proximal part; the carpus and propodus are both armed with numerous short, horny spinules set in approximate longitudinal series. The fifth leg has the propodus substantially longer in proportion to its carpus than do the fourth and third legs. The very large males have the ambulatories very robust.