

# Contributions to the Knowledge of the Alpheid Shrimp of the Pacific Ocean

## Part I. Collections from the Mariana Archipelago<sup>1</sup>

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THIS IS THE FIRST of a planned series of papers on the distribution in the Pacific of the shrimp of the family Alpheidae (previously Crangonidae; name of the family and of the type genus, *Crangon*, changed by action of the International Commission for Zoological Nomenclature in February 1955, Opinion 334). A large series of collections has been made available to me. The collections were taken over a broad sweep of the Pacific, from the Tuamotus in the east to the Marianas in the west and I have supplemented these by personal collections. The series of publications will consider the collections archipelago by archipelago, and I hope to conclude them by a summarizing paper giving all citations to published works dealing with the Indo-Pacific species and full records of distribution for each species.

This work has been undertaken in the hope that these shrimp, the most common on the reefs, the most easily collected and preserved, may prove to be of value as zoogeographical and ecological "indicator organisms." Such indicator species could be used as they are used in plankton analyses to characterize and recognize certain ecological groupings correlated with the physical environment. At this

early stage it is not known whether these species will prove of value in this respect.

Inasmuch as the concluding paper will carry all bibliographic citations to previous work in the Pacific, the individual papers will carry references only to the original descriptions of the species and to other papers used in the identification of the species.

The measurements used and the names of the ridges and grooves of the large chela in the genus *Alpheus* are the same as in my paper on the snapping shrimp of Hawaii (1953: 4, 59).

### COLLECTIONS AVAILABLE

There are two major collections available from Saipan. The first I made while I was stationed there in the United States Army Air Force during the years 1944 and 1945. Unfortunately, world wars do not lend themselves well to biological collecting, and I was fortunate to be able to obtain as many specimens as I did. Perhaps half of the specimens I collected, together with all of my field notes on the localities and environments of the collections, were lost. As a consequence, I cannot assign the species to more than the general locality of Saipan. Most of my collections were made on the beach and narrow fringing reef called Unai Obyan; a few were made in various parts of the broad lagoon west of the island; none were made in Bahai

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Laulau or on the north and east sides of the island because those areas were largely "out-of-bounds" with guerrilla action still taking place. The only station which I can positively identify is that for the collection dated 25 December 1944. It was made on the eastern side of the fringing reef before our camp, close to Cape Naftan; the water was about 3 feet deep within the "lagoon" of the fringing reef, the bottom was largely sand and extending above the water level were large boulders, upon the lower parts of which living coral was growing. This is the type locality for two new subspecies.

The other collection was made by Dr. Preston E. Cloud, Jr. and his party during the course of a geological survey of Saipan and is in the United States National Museum. Fortunately, there are thorough notes on the habitats of these specimens. The localities of the stations are shown in Figure 1; information on the habitats is given below:

A-5—1 mile offshore, depth 28 feet. Limesand bottom surrounds areas of what appear to be bare coral-algal limestone in horizontal layers. Scattered over the surface of the rock patches and also on the limesand are irregular blocks of dead coral. Patches of bright orange sponge were observed, but neither living plants nor corals were noted. April 6, 1949.

A-7—1.2 miles offshore (immediately south of uncovering reef SE of Mañagaha islet); depth 24 feet. Even to very slightly undulating bottom of fine- to coarse-grained limesand. April 6, 1949.

C-1—About 1,200 feet offshore; depth 10 feet. Limesand plain, dominantly coarse-grained and well sorted, with minor reef prominences up to about 20 feet in diameter. April 9, 1949.

C-7a—About 1.4 miles offshore; depth 8–9 feet around coral-algal bosses that rise to or near surface along line of transverse. Between coral and coral-algal masses the bottom is thinly coated with limesand, through which one can scrape to a hard undersurface of

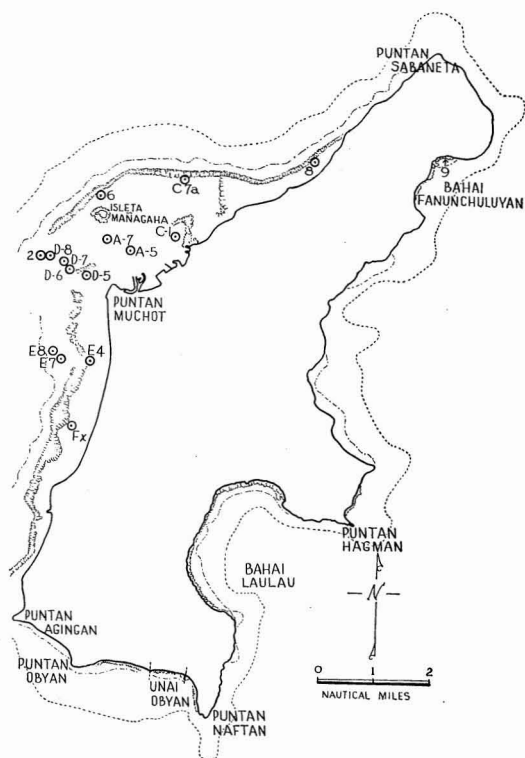


FIG. 1. Saipan, Mariana Archipelago,  $13^{\circ} 20' N$ ,  $140^{\circ} 40' E$ , showing collecting stations. The geographical designations are given in the local, non-anglicized, names (courtesy of Dr. P. E. Cloud, Jr.). Outer dotted line represents 100 fathoms, inner dashed line 10 fathoms. (Adapted from U. S. Hydrographic Office, Chart 6060.)

crustose coralline algae with bare hands. April 10, 1949.

D-5—About 0.6 mile off Muchot point between reef clusters at south side of Saipan harbor; depth 5–15 feet. Generally similar to D-6 (see below), but with rocky bottom and a lesser total area of limesand nearby. Bottom at immediate point of collecting is one of mostly dead coral-algal rock with a fairly rich veneer of living crustose coralline algae. It rises to within five feet of the water surface at some places, but has deep cracks, channels, pothole-like depressions, and irregular depressions, some floored with angular gravel of broken coral and algal material. Into and cutting across this irregular rock surface are

limesand-floored channels up to perhaps 10 feet deep (15 feet below water surface) and for the most part sharply undercut into the base of the bordering overhanging coral-algal rock. May 6, 1949.

D-6—About 0.8 mile off Muchot point, near entrance to Saipan Harbor; depth 4–17 feet. Point of anchorage at a depth of 4 feet over the edge of a very irregular reef surface in which the primary builders of the present time are crustose coralline algae. Green algae are fairly abundantly scattered over the irregular reef surface, and into it extend tongues of clean limesand with ripple marks aligned approximately parallel to the reef front. These limesand tongues merge seaward with larger areas of limesand at depths of 15–17 feet. In pothole-like depressions on the reef surface are minor accumulations of angular gravel of broken coral and coralline algae. May 6, 1949.

D-7—About 1 mile off Muchot point, near entrance to Saipan Harbor; depth 22 feet. Collecting point immediately south of a mooring buoy over a narrow tongue of limesand between two rocky mounds—the one to the east rising about 12 feet above the bottom and being perhaps 100 yards long. Although drab and dead-looking, the surfaces of these and similar nearby mounds have a large proportion of living, purplish pink, crustose coralline algae. This calcareous algal growth, however, appears to be mostly a surface veneer over dead coral centers, a scattered growth of living coral still persisting in spots that have not been completely covered over by algae. May 6 and 13, 1949.

D-8—About 1.3 miles off Muchot point, immediately east of outer channel buoy, entrance to Saipan harbor; depth 36–42 feet. Bottom dominantly of dead coral-algal rock with irregular patches and thin local veneers of limesand and coral-algal rubble. Living coral and crustose coralline algae are found only as occasional bits on the generally dead and rocky surface, perhaps because of the general murkiness of the water here at the

harbor exit. The individual rocky mounds are low, rising to an approximately consistent level only a few feet above the intervening limesand. May 13, June 26, 1949.

E-4—About 0.4 mile offshore; depth 5–9 feet. Bottom of calcareous gravel and coarse limesand, interspersed with patches of ramose coralline algae. May 3, 1949.

E-7—About 0.9 mile offshore just beyond seaward edge of south limb of barrier reef west of Saipan; depth 25–34 feet. Bottom is a rough and irregular rocky surface of dead coral and coral-algal material on which are occasional patches of veneering limesand. A few small patches of veneering coral were seen, and a little living coralline algae; but most of the floor is dead rock with a scattering of encrusting green algae. May 3, 1949.

E-8—About 1.1 miles offshore, just north of Schildkrote Rock, seaward from the barrier reef west of Saipan; depth 32–38 feet. Bottom is very rocky, rising abruptly to Schildkrote Rock, which has points within two feet of mean low tide. May 4, 1949.

FX—About 0.7 mile offshore, depth less than 6 feet at low tide. Calcareous gravel and limesand bottom at inboard edge of reef. April 18, 1949.

LOC. 2—North side of passage into Saipan harbor. Depths 40–45 feet over bottom of interspersed limesand and patch reefs. Specimens taken from a half-ton coral rock brought up on a ship's anchor and broken up with sledge hammers and picks. April 28, 1949.

LOC. 6—Just north of Mañagaha islet in lagoon west of Saipan. Collections from lagoon fringe of barrier reef. June 1949.

LOC. 8—In shoal water over broad fringing reef at northwest end of barrier-fringing reef complex west of Saipan. Depths less than 6 feet at low tide. Knolls of dead coral-algal rock and living corals common on calcareous gravel and limesand bottom. Various times between December 1948 and June 1949.

LOC. 9—Fanunchuluyan Bay at northeast end of Saipan. Sand and gravel platform covered by as much as 5 or 6 feet of water at low

tide and locally with numerous irregular bosses of coral-algal rock and patchy coral growth behind seaward edge of a fringing reef, 300 to 700 feet wide. December 25, 1948.

Further information on these stations and the marine ecology of Saipan may be found in Cloud's chapter, "Marine Geology and Shoal Water Ecology" in the forthcoming *Geology of Saipan*.

In addition to these two collections, there is one specimen reported in this study that was collected on Guam (about 100 miles south of Saipan) by a Mr. Seale in 1900 which is in the Bernice P. Bishop Museum of Honolulu.

Cloud's study on Saipan was made under the sponsorship of the United States Geological Survey and the Corps of Engineers, United States Army. The present study was begun with support from a grant administered by the United States National Museum and the Pacific Science Board under a contract between the Office of Naval Research, Biology Branch, and the National Academy of Sciences (NR160-175); some help in the final typing was obtained with funds from a National Science Foundation grant (NSF-G-1754).

The specimens collected by Cloud, together with the type specimens from my collection, will be deposited in the United States National Museum; the disposition of my personal collection has not yet been decided and it may be deposited either in the National Museum or in the Bernice P. Bishop Museum.

#### AUTOMATE de Man

##### Automate *johnsoni* Chace

*Automate johnsoni* Chace, U. S. Natl. Mus., Proc. 105 (3349): 13, fig. 7, 1955.

LOCALITIES: Banner, 2 specimens in 2 collections; Cloud 1 specimen each at D-8, E-7, E-8.

DISCUSSION: Of the five specimens in the collection, only one, an ovigerous female, had the chelae intact.

It is difficult to decide how these few fragmentary specimens should be named. *A. johnsoni* is at least very closely related to *A. gardineri* Coutière (1905: 854), and, in the opinion of Chace, perhaps identical with it. In the series of slight differences between the two forms, the specimens from Saipan are somewhat intermediate, and appear to differ from both forms in yet other ways.

The rostrum in *A. gardineri* is rounded and separated laterally from the margins of the carapace by slight grooves, whereas in *A. johnsoni* and in the present specimens it is anteriorly rounded and without lateral grooves. The eyes in *A. gardineri* are variable in shape, but are irregular on the lateral and anterior margins according to the figures, whereas in *A. johnsoni* and the Saipan specimens the peduncles and corneas present a smooth curve from the base to the anterior medial margin. Chace points out that the second antennular article is 2.5 instead of 4.0 times as long as broad in his specimen; however, according to Coutière's figures the proportions in his type and cotype vary from 3 to 4 times as long as broad, and he states in his text that the proportions vary with the size of the specimen; in the Saipan specimens the proportion is about 3 to 1. In both *A. gardineri* and these specimens the stylocerite does not reach to the end of the first article, and the scaphocerite does not reach past the middle of the second article of the antennules, whereas in *A. johnsoni* the stylocerite exceeds the first article in length and the scaphocerite reaches within 0.2 of the end of the second article. Further, the superior surface of the ischium of the large chela bears a strong spine in the Saipan specimens, a weak spine in *A. johnsoni*, and lacks a spine (according to the figures) in *A. gardineri*; neither Coutière nor Chace show or discuss any rounded teeth on the dactylus of the large chela, yet they are quite easily seen on the chela of these Saipan specimens. Finally, in the second legs the first two articles are shown to have a ratio of 10:18 by Coutière, 10:12 by Chace, and are about 10:13



in the Saipan specimens (the right and left carpi have slightly different proportions in the distal articles of the intact female).

I suspect that the differences between *A. gardineri*, *A. johnsoni*, and the Saipan specimens are either individual variations or geographic differences of only subspecific worth, but until more complete specimens are examined from other areas, it would be best to leave the two species standing. These specimens from Saipan have been placed in *A. johnsoni* because of the similarity of the anterior carapace and rostrum.

ATHANAS Leach

*Athanas djiboutensis* Coutière

*Athanas djiboutensis* Coutière, Paris Mus. d'Hist. Nat., Bul. 3(6): 234, 1897a; Soc. Philomath. Paris, Bul. IX, 5(2): 75, 1903, and Fauna and Geogr. Mald. and Laccad. 2(4): 856, 1905. [These two identical papers are partial redescriptions.]

*Athanas sulcatipes* Borradaile, Zool. Soc. London, Proc., [1898]: 1011, pl. 65, fig. 9, 1898.

LOCALITIES: Banner, 22 specimens in 6 collections. Cloud, 3 at locality A-5, 1 at A-7, 3 at C-7a (13 May 1949), 2 at D-5, 2 at Loc. 8, 1 at Loc. 6.

DISCUSSION: These specimens agree well with the original and the redescription of Coutière, except for several points of variation both of which have been remarked upon before by Tattersall (1921: 367-368). The first is the length of the rostrum in respect to the antennular peduncle, described by Coutière (1905) as reaching "presque l'extrémité du pédoncule antennulaire"; in this large series of specimens only few approach this length, while most reach to near the end of the second antennular article and a few reach only the middle of the same article. A second point of variation is found in the form and armature of the large chela of the males. On this appendage the ischium bears from one (as shown by Coutière) to four strong mov-

able spines; the outer inferior margin of the merus may be entire, bear a slight rounded indentation, or be divided into two shallow and broad lobes, the distal approximately half the length of the proximal; the palm of the chela proper varies, being both slightly thicker and less tapering than is shown by Coutière, and, in proportion to the fingers, the palm is relatively longer; finally, the dactylus may be strongly curved and cross the immovable fingers as shown by Coutière, or be less curved and meet the opposite exactly. The conical protuberance of the carpus of the small chela of the female may be lacking and the surface of the carpus away from the chela may be rounded. No great significance is attached to these variations, especially as they have been previously noted by Tattersall, and as the variations appear independently of each other in the individual specimens.

The eyes appear to have some degree of motion, they may be either extended from under the carapace or withdrawn slightly. This small motion would not be noteworthy except that in this species and in other members of this genus the lengths of the circumorbital spines are often compared relative to these corneas as part of the specific description.

*Athanas dubius* sp. nov.

Fig. 2

TYPES: Holotype a 7.3 mm. ovigerous female, collected from Saipan by A. H. Banner; allotype a male 7.8 mm. long and 7 paratypes collected by A. H. Banner in three collections; 1 paratype collected by P. E. Cloud, Jr., from locality E-8. Types to be deposited in the U. S. National Museum.

DESCRIPTION: Rostrum acute, triangular, sides not curved, tip reaching to end of second antennular article (Fig. 2a has somewhat foreshortened rostrum); rostrum and carapace rounded, without carina. Supracorneal spines not reaching to middle of cornea; carapace between base of supracorneal spines and ros-

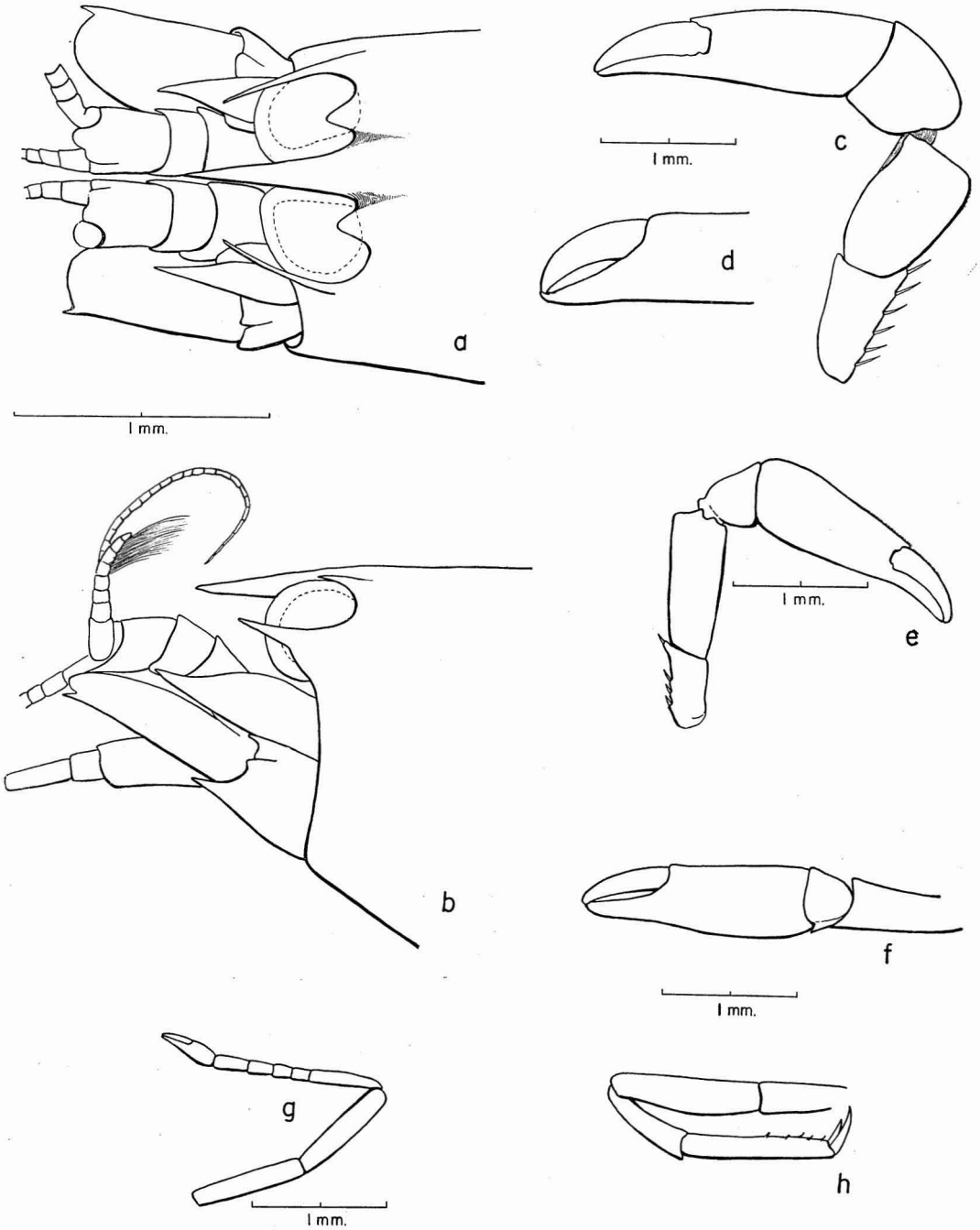


FIG. 2. *Athanas dubius* sp. nov. *a, b*, Anterior region, dorsal and lateral aspects; *c*, cheliped, male; *d*, large chela, finger, male; *e*, cheliped, female; *f*, chela, propodus and merus, female; *g*, second leg; *h*, third leg.

trum slightly depressed. Extracorneal spines strong, acute, reaching beyond corneas almost to end of first antennular article. Infracorneal spine absent, represented by a slight convexity on inferior margin of extracorneal spine. Pterygostomial angle rounded.

Portion of first antennular article in front of corneas about equal in length to second antennular article, latter about half as long as third article. Stylocerite acute, reaching end of second article. Lateral spine of basicerite reaching end of first antennular article. Scaphocerite with lateral spine very slightly longer than rounded portion, reaching slightly beyond end of antennular peduncle. Carpo-cerite shorter than scaphocerite.

Chelipeds showing slight sexual dimorphism and, in some cases, asymmetry. In type (female), large chela about 7 per cent longer than small chela, both of similar form. Ischium bearing four strong spines; merus unarmed, about 2.5 times as long as broad; carpus rounded, somewhat elongate, with distal end enclosing base of palm; chela almost cylindrical, slightly inflated proximally, three times as long as broad, with fingers occupying about distal third; fingers without teeth, dactylus slightly curved. Large chela in allotype slightly over 10 per cent longer than small chela, but of similar form. Ischium 0.8 as long as merus and bearing six strong spines; merus heavy, 0.6 as broad as long, half as long as chela, unarmed; carpus heavy, cylindrical and fitting over base of chela; chela cylindrical, tapering, 0.3 as broad as long, with fingers occupying slightly less than distal third; fingers unarmed, dactylus curved distally.

Carpal articles with ratio: 10: 2.6: 3.2: 3.7: 5.9.

Ischium of third legs unarmed, 0.5 as long as merus; merus unarmed, 0.2 as broad as long; carpus 0.6 as long as merus, 3 times as long as broad; propodus equal in length to merus, bearing 5 small spinules in distal half, terminal movable spine 0.6 length of dactylus; dactylus 0.3 length of propodus,

simple, slightly curved and gradually tapering to acute tip.

Telson half as wide posteriorly as anteriorly, 3.6 times as long as posterior margin is broad; sides straight with uniform taper; distal margin moderately convex; both dorsal spinules located posterior to middle.

Eggs of type specimen  $0.32 \times 0.50$  mm. in diameter.

DISCUSSION: In the group of paratypic specimens some variations are found, especially in the armature of the chelipeds. The number of spines on the ischium in the females varies from three to six, usually five or six; in the males the spines, always stronger than those of the female, vary in number from five to six. In some of the males the distal external angle of the merus is produced into a strong but rounded lobe; in one female the superior angle of the distal end of the merus carries a rather weak movable spine. Further, the degree of asymmetry varies from chelae that are equal to to slightly more asymmetrical than those of the types. Finally, on one female the carpus of the second legs on one side is divided into four articles while the other has the normal five. No marked variation was noticed in the other parts of the body or appendages.

The validity of this species is somewhat questionable for it is closely associated with *A. areteformis* Coutière (1903: 79; 1905: 860) and *A. erythraeus* Ramadam (1936: 13). Unfortunately the description of neither of these two species is complete. All three belong to the *nitescens* group of the genus in which the chelae are carried directed forward. All three also have simple dactyli on the posterior legs, the supracorneal spine well developed, the extracorneal spine greatly produced, and the infracorneal spine wanting. *A. dubius* differs from *A. areteformis* in that the dactylus of the large chela of the male is relatively longer, being over 0.6 the length of the palm in the former and 0.3 the length of the palm in the latter; in the latter, moreover, this dactylus is strongly curved. In comparing the chelae

of the female of *A. dubius* to *A. naifaroenis* (which Coutière states “. . . ne diffère aucunement. . .”) it is found that the palm is less expanded in *A. naifaroenis*, being without taper and having its breadth equal to only half the length of the fingers, instead of being equal to the length of the fingers as in *A. dubius*, also the ischium is unarmed in *A. naifaroenis* whereas in *A. dubius* it bears 3–6 spines.

There are also slight differences between *A. dubius* and *A. erythraeus*. Ramadam states that in the latter the sides of the rostrum are parallel for some distance from the proximal end, whereas in the former there is a uniform taper from the base to the tip; in his specimen, a female, the fingers of the chela have slightly rounded teeth, two on the side of the dactyl, one on the immovable finger, and in mine the fingers bear straight knife-like cutting edges.

However, these differences, and the differences between *A. erythraeus* and *A. areteformis*, are very slight, and the similarities, especially in the form of the anterior carapace and appendages, are great. It is reasonable to expect that when specimens are collected at localities between Ghardaqa in the Red Sea and the Maldive and Laccadive archipelagoes in the Indian Ocean and between these archipelagoes and the Marianas, intermediate forms may be found.

#### ARETE Stimpson

#### *Arete iphianassa* de Man

*Arete iphianassa* de Man, Ned. Dierk. Ver., Tidschr. II, 11(4): 312, 1910; Siboga Exped., 39a<sup>1</sup>(2): 164, pls. 3–4, fig. 11, 1911.

LOCALITIES: Cloud, 4 specimens at locality C-7a (2 each on 10 April and 13 May, 1949), 1 at D-8, 1 at Loc. 6.

DISCUSSION: These six specimens agree almost exactly with de Man's description and figures except that the tooth on the dactylus of the large chela of the male is less pronounced than shown in de Man's figure 11a.

#### ALPHEOPSIS Coutière

#### *Alpheopsis equalis* Coutière

*Alpheopsis equalis* Coutière, Paris Mus. d'Hist. Nat., Bul. 2(8): 380, 1896.

*Alpheopsis aequalis* de Man, Siboga Exped., 39a<sup>1</sup>(2): 177, 1911.

LOCALITIES: Banner, 17 specimens in 5 collections: Cloud, 1 specimen at Loc. 6.

DISCUSSION: These specimens show much of the variation in the rostrum, pterygostomial angle, coverage of the eyes, and in the large chelae like that already reported from Hawaii (Banner, 1953: 16). In addition they present several variations worthy of note. First, the base of the rostrum in most specimens is set off from the anterior portion of the carapace by definite angles, but in one specimen the margins of the carapace are continuous in a gradual concave curve to the tip of the rostrum, and in several specimens the condition is intermediate. Second, the ratio of the middle articles of the carpus is also variable, with the second article running from a third shorter to a third longer than the third article; the ratio of the lengths of the third and fourth articles also varies but less conspicuously. Finally, in a specimen normal in all other respects the carpus of the second leg is divided into six, rather than five articles. This development is symmetric, and the extra article appears to be equal in length to the normal third article and is adjacent (either proximal or distal) to it.

#### *Alpheopsis diabilus*, sp. nov.

Fig. 3

TYPE: A 9.2 mm. ovigerous female, collected by A. H. Banner.

DESCRIPTION: Anterior portion of carapace produced as short, triangular rostrum reaching two-thirds of length of visible portion of first antennular article, and as triangular extracorneal spines about half the length of rostrum; without ridges or depressions. Pigmented portion of cornea concealed in dorsal

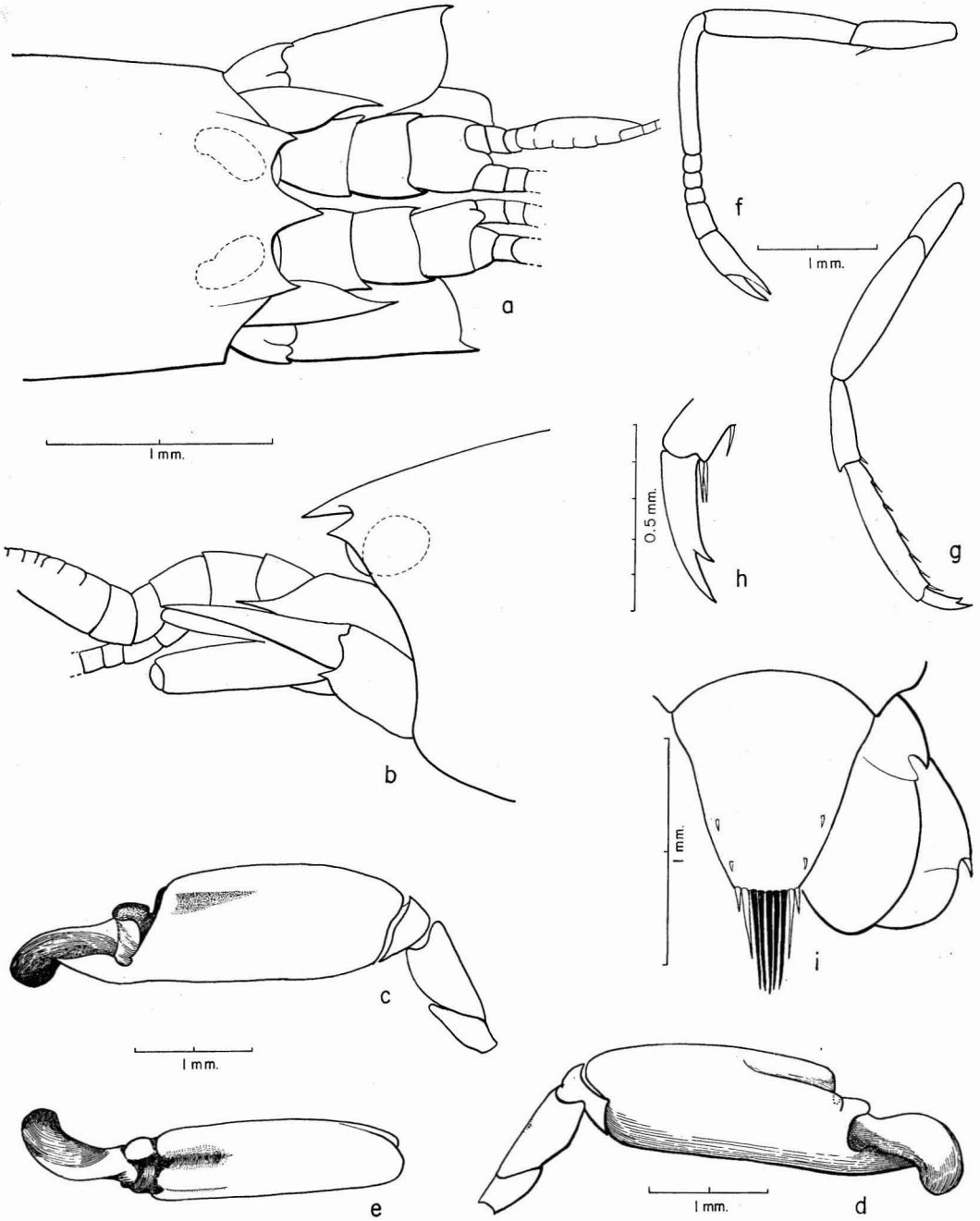


FIG. 3. *Alpheopsis diabolus* sp. nov. *a, b*, Anterior region, dorsal and lateral aspects; *c-e*, large cheliped, lateral, medial and superior aspects; *f*, second leg; *g*, third leg; *h*, third leg, dactylus; *i*, telson and uropod.

and lateral view, but outer margin of eyes visible in both aspects. Pterygostomial angle rounded.

Visible portion of first antennular article 1.3 times length of second article; second article approximately as long as third article and slightly broader than long; stylocerite acute with tip reaching to middle of second article; outer flagellum with basal portion before bifurcation very broad; bifurcation feeble. Basicerite of antennal peduncle with distal lateral tooth; scaphocerite with strong distal lateral tooth, slightly exceeding the length of rounded portion, subequal in length to antennular peduncle; carpocerite slightly longer than scaphocerite.

Merus of large cheliped as broad as inferior margin is long, subequal to maximum length of ischium; ischium and merus unarmed. Carpus short, rounded, with triangular projection on middle of inner margin. Chela compressed, superior and inferior margins rounded. Palm twice as long as ischium and merus combined, slightly over twice as long as broad; outer face with shallow rounded groove extending from dactylar articulation one-third length of palm; superior face marked by deep groove separating two sharp ridges, equal in length to lateral groove. Dactylus articulated to close about  $60^\circ$  to plane of chela, across pointed fixed finger; superior articular surface of propodus carried in rounded prominence beyond crests and grooves of palm to accommodate rotation. Dactylus broad, curved and flattened, without teeth, 0.4 length of palm. Only small tufts of setae located near fingers on chela.

Small cheliped lacking.

Carpus of second legs with ratio: 10: 1.5: 1.5: 1.5: 2.; short articles about as long as broad.

Second legs with ischium unarmed; merus 2.3 times length of ischium and 4.5 times as long as broad, unarmed; carpus 0.5 length of merus, with small movable spine on inferior distal angle; propodus as long as merus, armed with five inferior and two distal slender

spines; dactylus 0.3 length of propodus, with strong accessory tooth on inferior margin.

Pleura of sixth abdominal segment articulated.

Telson short and broad, 3.2 times as long as tip is broad, 3.0 times as broad anteriorly as at tip; tip almost straight, bearing two pair of spines, five heavy setae; longer spines three times as long as shorter, equal in length to breadth of tip of telson; anterior pair of dorsal spinules located about 0.7, posterior pair about 0.85 distance from base of telson, both pairs located near lateral margins. Outer uropod with strong spine at articulation; both uropods longer than telson.

Branchial formula with five pleurobranches, one arthrobranch and eight epipodites.

Eggs few,  $0.62 \times 0.36$  mm. in diameter.

DISCUSSION: This species plainly belongs to the genus *Alpheopsis* as is shown by the articulated pleopods of the sixth abdominal segment, by the general form of the anterior portion of the carapace and by the branchial formula. The form of the chela is somewhat similar to that of *A. trispinosus* (Stimpson) and *A. chilensis* Coutière (see Coutière, 1899, figs. 228–232).

Within the genus, however, it differs from all other forms except *A. fissipes* Coutière and (?) *A. biunguiculatus* Banner in the presence of biunguiculate dactyli on the third to fifth legs. From *A. fissipes* it differs principally in the presence of extracorneal teeth, the greatly elongate first carpal article of the second leg, and the difference in proportions and armature of the third legs. Similarly, it differs from (?) *A. biunguiculatus* in the extracorneal teeth, the carpus of the second legs, and the armature of the propodus of the third legs; it also differs in the branchial formula and the form of the telson. (In neither of these species are the chelae known.) As far as I have been able to determine, the form of the large chela, with the double grooves and the rotation of the flattened and unarmed dactylus is unique within the genus; however, in many of the species the chelae have not been described.



This specific name refers to the split unguis.

*Alpheopsis tetrarthri* sp. nov.

Fig. 4

TYPE: A 6.0 mm. female collected from a head of dead coral at Loc. 2 by Preston E. Cloud, Jr., 28 April 1949. Type to be deposited in the U. S. National Museum.

DESCRIPTION: Anterior carapace projecting as a broad curved collar, reaching almost to end of first article of antennular peduncle; anterior margin uniformly curved; dorsal surface smooth, without ridges or bosses. Rostrum small, triangular in dorsal view, tip reaching about to end of first third of second antennular article; in lateral view appears to be composed of a lamella hanging ventral to carapace proper, tip strongly depressed. Ptery-

gostomial angle projecting as acute spine; no other spines of anterior carapace developed.

Cornea of eyes large, entirely concealed from dorsal and lateral view by carapace.

Antennular peduncle short, heavy, with second article about as broad as long, approximately as long as third article; first article barely visible under projecting edge of carapace. Stylocerite acute, reaching to middle of second article, slightly beyond tip of rostrum. Flagella of usual size, about twice as long as peduncle. External flagellum with broad base bearing tuft of long bristles, but without trace of bifurcation.

Basicerite of antennal peduncle without tooth. Sphalocerite broad, well developed, with lateral spine small, reaching anterior tip of curved portion; tip of sphalocerite definitely exceeding antennular peduncle in

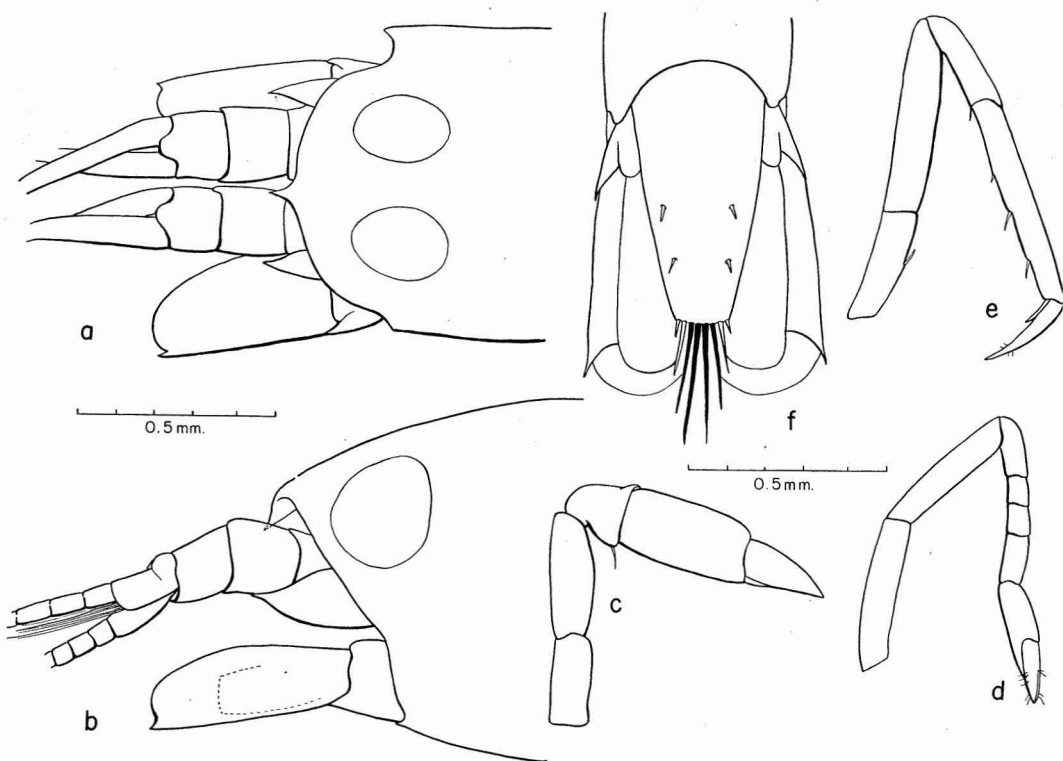


FIG. 4. *Alpheopsis tetrarthri* sp. nov. a, b, Anterior region, dorsal and lateral views (outline of distal portion of carapace dotted in b); c, cheliped; d, second leg; e, third leg; f, telson and uropods.

length. Carpocerite short, reaching only slightly beyond end of second antennular article.

Mouthparts not dissected.

One of first chelipeds lost. Chela of leg remaining small, as long as ischium and merus combined; palm about twice as long as broad, 1.5 times as long as tapering slender fingers. Carpus as broad as long, slightly cyanthiform distally. Merus rounded-triangular in section, about 2.5 times as long as broad. Ischium 0.7 as long as merus, of same width.

Second legs with carpus of only four articles with ratio: 10: 5: 7: 9. Chela relatively large, as long as merus.

Third, fourth, fifth legs similar. On fourth leg ischium 0.6 as long as merus, bearing movable spine; merus five times as long as broad, unarmed; carpus half as long as merus; propodus slightly longer than merus, bearing three slender spines on inferior margin, one distally; dactylus half as long as merus, slender, tapering to fine tip.

Pleura of sixth abdominal segment articulated.

Telson twice as long as broad anteriorly, with tip 0.4 as broad as base; two pairs of dorsal spines, anterior located at half length of telson, posterior midway between anterior pair and tip; tip shallowly arcuate, bearing four spines, longer pair as long as tip of telson is broad, four heavy setae. Uropods of usual form.

Branchiae difficult to discern, but apparently with five pleurobranches, arthrobranches either rudimentary or entirely lacking; seven or possibly eight epipodites.

DISCUSSION: Unfortunately this species is represented by a single defective specimen, possibly also immature. It appears to belong to the genus *Alpheopsis*. The form of the carapace and rostrum are similar to that of *Alpheopsis equalis* except that the carapace extends much farther forward and the rostrum is relatively smaller; the antennular and antennal peduncles are of the same general form

as *A. equalis* but of slightly different proportions; the small chela is almost identical to the small chela of *A. equalis*, as are the third and fourth legs; the telson and uropods, and the articulated sixth pleopods of the abdomen are also similar. The principal differences between *tetrarthri* and the other species of the genus are the presence of four articles in the carpus of the second leg in this species whereas in the others there are either three articles (*A. idiocarpus* Coutière) or five and a difference in the branchial formula which in this species is apparently 5-0-7, instead of 5-1-6 or 5-1-8. (It should be noted that (?) *Alpheopsis biunguiculus* Banner (1953: 19) has a rudimentary arthrobranch and only seven epipodites.) The species is assigned to this genus in spite of these possible fundamental differences because it has been accepted already that the number of articles in the carpus is not fixed in this genus, and because I could not determine the branchial formula to my satisfaction without tearing this unique specimen apart. Without the large chela, even if all the other characteristics were in complete agreement, any generic identification would be tentative.

Within the genus *Alpheopsis* this species can be separated readily from all other species by the presence of only four articles in the carpus of the second leg and by the extreme prolongation of the anterior margin of the carapace. Other minor differences occur between *tetrarthri* and the other species such as the proportions of the stylocerite and antennular peduncle; the proportions of the scaphocerite and antennal peduncle; the simple or bifid dactylus of the third legs; and the proportions of the telson.

SYNALPHEUS Bate  
Neomeris group

*Synalpheus charon obscurus*, subsp. nov.

Fig. 5

*Alpheus charon* Heller, K. Akad. Wiss. Wien, Sitzungber. 44: 272, 1861.

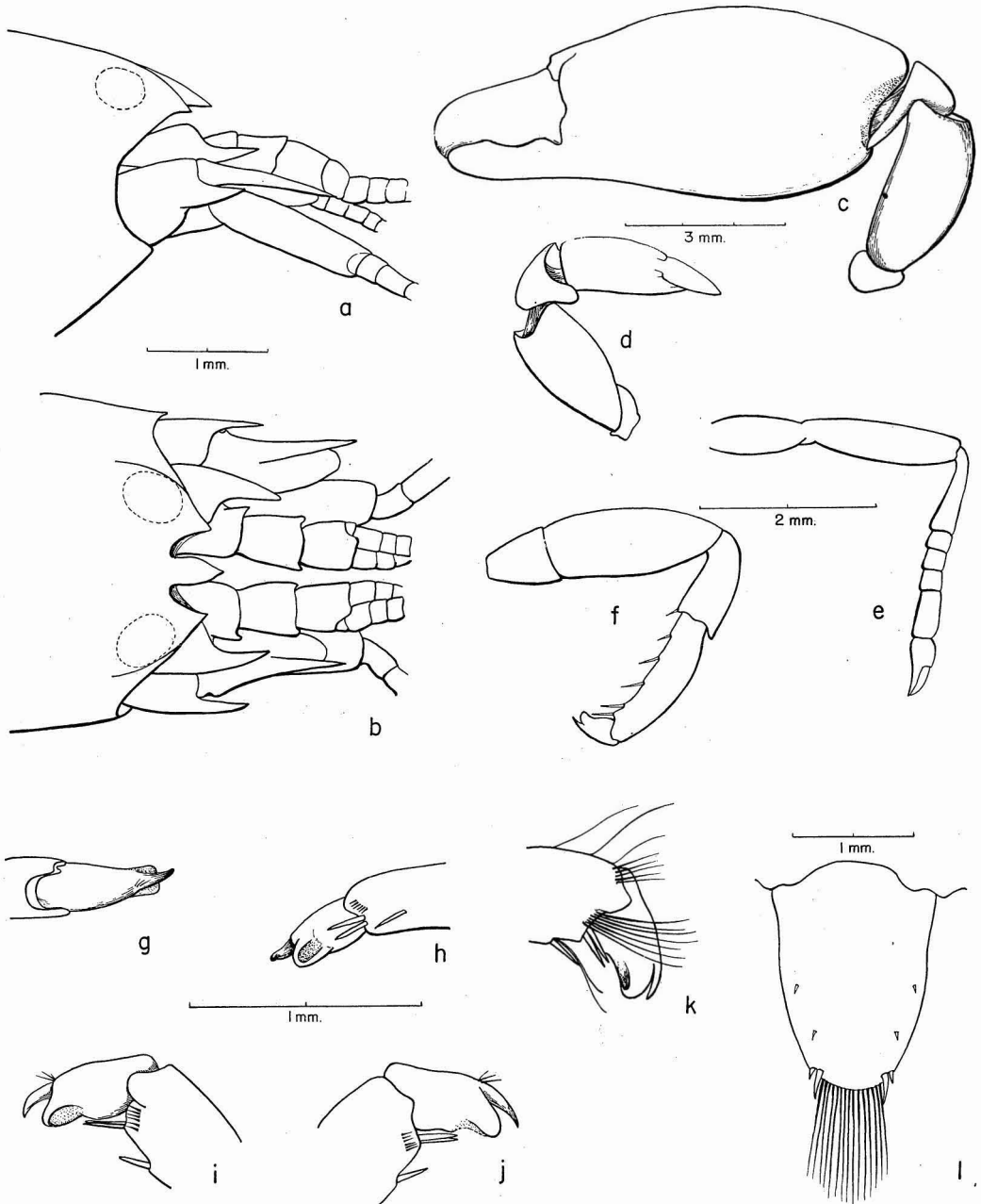


FIG. 5. *Synalpheus cbaron obscurus* subsp. nov. *a*, *b*, Anterior region, dorsal and lateral aspects; *c*, large cheliped; *d*, small cheliped; *e*, second leg; *f*, third leg; *g*, *h*, *i*, *j*, dactylus, third leg, superior, inferior, medial or anterior, and lateral or posterior aspects; *k*, dactylus, fourth leg; *l*, telson.

TYPES: Holotype a 13.5 mm. ovigerous female, collected by A. H. Banner from the reef flat on the S. E. side of Unai Obyan, Saipan, 25 December 1944; allotype, a 9.3 mm. male from the same location; paratypes, 14 other specimens from three collections, A. H. Banner, collector.

DESCRIPTION: Body heavy, compact. Rostrum with basal portion parallel sided, slightly over distal third tapering, tip acute, not reaching end of first antennular article. Orbital hoods acuminate, tips of orbital teeth not reaching end of rostrum.

First and second articles of antennular peduncle subequal in length, third slightly shorter. Stylocerite heavy, tip reaching to middle of second antennular article. Lateral spine of basicerite heavy, slightly shorter than stylocerite. Lateral tooth of scaphocerite as long as antennular peduncle, definitely longer than the squamous flattened portion.

Merus of large cheliped unarmed, slightly curved, twice as long as broad. Chela 2.5 times as long as broad, with heavy fingers occupying distal 0.28; superolateral margin of palm continued over dactylar articulation as slight rounded tooth. Merus of small cheliped likewise unarmed; carpus slightly greater in diameter than palm of chela. Chela small, 0.3 the length of the large chela, 0.3 times as broad as long, with fingers occupying distal 0.4.

Carpal articles of second legs with ratio: 10:2.3:2.7:2.7:6.2.

Ischium of third legs unarmed, about one third as long as merus; merus unarmed, 2.4 times as long as broad; carpus half as long as merus, armed with single movable spine on inferodistal angle; propodus 0.8 as long as merus, bearing four inferior and two distal spines; dactylus heavy, with superior unguis simple, tapering, inferior unguis massive, concave on inferior surface; dactylus may or may not be flanked with long setae arising from distal end of propodus.

Telson 2.8 times as long as posterior margin is broad, and 2.0 times as wide anteriorly as

posteriorly; margins without uniform taper, but concave in anterior third, convex in middle third and almost straight (but not parallel) in distal third. Dorsal spinules small.

Eggs numerous,  $0.41 \times 0.63$  in diameter.

Male similar to female in form and proportions.

DISCUSSION: This subspecies can be separated from the typical subspecies, *S. charon charon*, by the following characteristics: 1, The rostrum is parallel-sided in at least the basal half rather than uniformly tapered. 2, The meri of the third legs, are 2.4 instead of 3.0 times as long as broad. 3, The superior unguis of the dactyli of the third legs is not as broad basally and has a uniform taper to the tip rather than with a broad basal plate which is abruptly narrowed to a curved tip. Otherwise the two varieties are almost identical aside from minor and insignificant differences in the proportions of the second legs, telson, etc.

Because of the unique concavity of the dactyls of the posterior legs, found only in *S. charon* in this genus, it was considered that this form is merely a subspecific modification. On Saipan no true *S. charon charon* were collected; however, in the Gilbert Islands both subspecies were found (to be reported upon in a later publication).

#### *Synalpheus paraneomeris* Coutière

Fig. 6

*Synalpheus paraneomeris* Coutière, Fauna and Geog. Mald. and Laccad. 2(4): 872, pl. 71, fig. 7, 1905.

LOCALITIES: Banner, 64 specimens in 6 collections; Cloud, 19 specimens at Loc. D-6, 8 at Loc. 6.

DISCUSSION: The variation in this species has been discussed by Coutière (*loc. cit.*) and Banner (1953: 40 *et seq.*). The great variation noticed in the Hawaiian specimens is duplicated and even exceeded in the specimens from Saipan. Like the Hawaiian specimens, they vary in the length of the rostrum relative

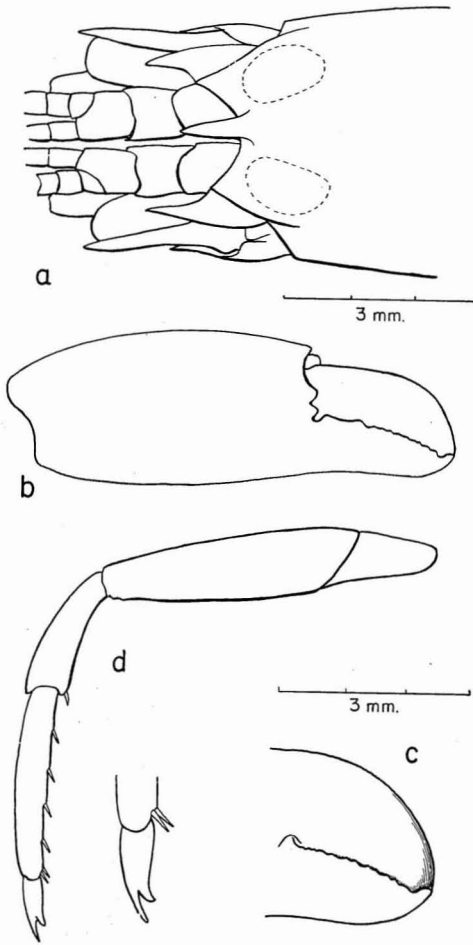


FIG. 6. *Synalpheus paraneomeris* Coutière. Aberrant specimen. *a*, Anterior region, dorsal aspect, showing asymmetry in orbital hoods; *b*, large chela, lateral aspect; *c*, large chela, fingers, showing details of teeth; *d*, third leg; *e*, third leg, dactylus enlarged.

to the orbital teeth and antennular peduncle, in the antennular peduncle, in the basicerite and scaphocerite of the antennal peduncle, in the large cheliped, in the relative lengths of the carpal articles of the second legs, in the dactyli of the third legs, in the general proportions of the telson. In addition, variations occur in the relative length of the carpocerite, which varies from only slightly longer to considerably longer than the scaphocerite, and in the rostrum and in the large cheliped.

In the 19 specimens from Cloud's collec-

tion D-6 the length of the rostrum relative to the lengths of the orbital hoods, and its relative breadth were measured. (In one specimen the rostrum was entirely lacking, a condition interpreted as the result of an accident of heredity or environment.) The ratio of rostral length to orbital hood length ranged from 1:1 to 1.6:1, with the following distribution:

ROSTRAL LENGTH ÷ LENGTH ORBITAL HOOD	SPECIMENS
1.0.....	3
1.1.....	4
1.2.....	4
1.3.....	2
1.4.....	1
1.5.....	0
1.6.....	4

ROSTRAL LENGTH ÷ ROSTRAL WIDTH AT BASE	SPECIMENS
1.5.....	3
2.0-2.9.....	6
3.0-3.9.....	7
4.0-4.5.....	2

In a collection of 25 specimens made by the author, a series of specimens in which all chelae were intact, the relative lengths of the fingers were measured, and these measurements correlated with the sex of the specimens and are tabulated below:

CHELA LENGTH ÷ FINGER LENGTH	SPECIMENS	
	Male	Female
2.9.....	2	
3.0.....	2	
3.1.....		
3.2.....	1	1 (?)
3.3.....		
3.4.....		
3.5.....	1	2
3.6.....		3
3.7.....		4
3.8.....		3
3.9.....		1
4.0.....	1 (?)	2
4.1.....		
4.2.....		2

The interpretation of this second series of variations is simple: the length of the fingers relative to the chela is a sexually dimorphic

characteristic. (It should be remarked that males in other samples from Saipan had a ratio as low as 2.8:1.) The interpretation of the variations in the rostrum is more difficult, especially in view of the four specimens which seem so different in having the rostrum 1.6 times as long as the orbital hoods. However, these four specimens did not bear correlating difference in their other characteristics; for example, their rostral width ratios were 1.6, 1.6, 3.3, and 4.3, or, in words, two had very broad rostrums, one average, and one very narrow. So it would appear that this, too, was merely a variation.

In one collection there are two males with the chela:finger ratio of 3.0:1 in which the cutting edge of the fixed finger had shallow denticulations. One of these specimens is shown in Figure 6. The specimens are within the range of variation for the species, although the unguis of the dactylus of the third legs is a bit narrower and more parallel-sided than is usual for the species.

This species is the most perplexing I have encountered. If such wide variation is found here, why do other species appear to be so constant? Then, should not this be interpreted as more than one species? If the variations were discontinuous, or even if the variations were continuous, but their continuity could be established only by samples from separate localities or habitats—if, for example, those with the short rostrums were only found in the Marianas, those with long rostrums in Hawaii, and those in the intermediate condition were found in Micronesia—then descriptions of separate subspecies or species would be justified. But such separation seems unjustified when the range of variation is found in one habitat and in specimens collected at one time. If such variation is found in *S. paraneomeris*, should not similar variation be looked for in other species which are separated by small, but discrete, differences? For example, *S. biunguiculatus* (Stimpson) (as redescribed by Banner, 1953: 33) basically is separated from this species by the relatively

smaller lower unguis of the dactylus of the third leg—could not this, too, be an inherent variation that may be ignored by a breeding population? I fear that the answer to this fundamental question can be arrived at only by the almost impossible task of raising the shrimp through several generations.

#### Coutierei Group

#### *Synalpheus coutierei exilipes* Coutière

Fig. 7

*Synalpheus biunguiculatus* var. *exilipes* Coutière, Fauna and Geog. Mald. and Laccad. 2(4): 874, pl. 71, fig. 10, 1905. [*nec. Alpheus biunguiculatus* Stimpson, Acad. Nat. Sci., Phila., Proc. 1860: 31] *Synalpheus coutierei* Banner, Pacific Sci. 7(1): 36, 1953.

LOCALITY: Cloud, an 8.5 mm. ovigerous female collected at Loc. 6.

DESCRIPTION: Rostrum narrow, tapering, suddenly acute at tip, tip reaching almost to end of first antennular article. Orbital teeth narrow, tapering, slightly shorter than rostrum; orbital hoods slightly inflated anteriorly.

Second antennular article 1.4 times as long as broad, or as long as first article, and one third longer than third article. Stylocerite as long as first antennular article and as lateral spine of basicerite. Basicerite with superior lateral angle projecting as small acute tooth. Scaphocerite as long as antennular peduncle. Carpocerite 6.5 times as long as broad in lateral view, tip reaching beyond end of antennular peduncle.

Large chela of usual shape for genus, 2.7 times as long as broad, with fingers occupying distal 0.2. Merus twice as long as broad, superior margin slightly arcuate and terminating in feeble tooth. Small chela with fingers tapering, occupying distal 0.4.

First carpal article of second leg equal to the sum of the lengths of the four following; second, third, and fourth articles subequal;



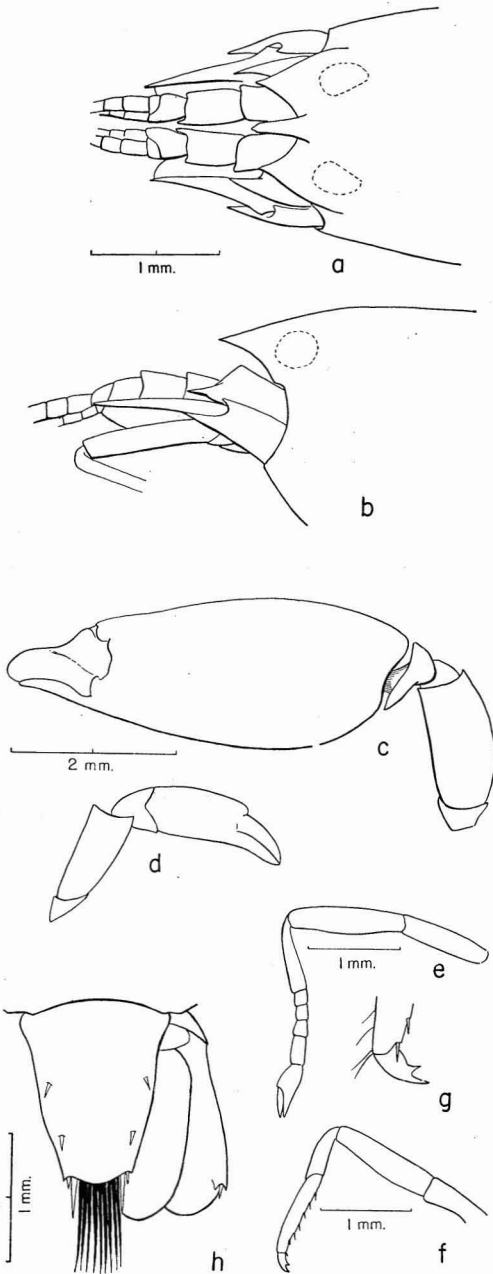


FIG. 7. *Synalpheus coutierei exilipes* Coutière. *a*, *b*, Anterior region, dorsal and lateral aspects; *c*, large cheliped; *d*, small cheliped; *e*, second leg; *f*, third leg, *g*, third leg, dactylus; *h*, telson and uropods.

fifth article slightly shorter than the lengths third and fourth combined.

Merus of third legs unarmed, tapering dis-

tally, 4.0 times as long as broad. Carpus 0.38 as long as merus, with superior margin terminated by tooth. Propodus 0.8 as long as merus, bearing six inferior and two terminal weak spines. Dactylus about 0.25 as long as of propodus, heavy, with superior unguis thin, curved and acute, inferior unguis at about 90° to inferior margin of dactyl, triangular, acute and broader at base than superior unguis.

Telson 2.7 times as long as posterior margin is broad, 2.2 times as broad anteriorly as posteriorly; lateral margins as shown in Figure 7*b*; posteriolateral angles slightly projecting and acute; posterior margin arcuate. Anterior pair of dorsal spinules slightly before the middle, posterior pair 0.8 of length posterior from base.

DISCUSSION: This specimen shows a series of differences from Coutière's subspecies (or variety). The rostrum and the orbital teeth are slightly shorter, the first antennular article is slightly longer, the lateral spines of the stylocerite and the basicerite are slightly shorter. Coutière did not describe the large and small chelae, but if the large chela bore a tooth as did his *S. biunguiculatus* (*op. cit.*, fig. 8*a*), there, too, lies a difference. However, the proportions of the third legs are almost exactly the same with the depicted dactyli varying on either side of the condition found here.

Certainly the two forms are not identical, but they are so similar that in light of the variation in *S. paraneomeris* Coutière, no great importance should be attached to the slight differences. However, it is possible that if there were a series of specimens available the differences would be found to be constant enough to consider this as a distinct subspecies.

### *Synalpheus anceps* sp. nov.

Fig. 8

TYPES: Holotype, an ovigerous 9.5 mm. female, collected from Saipan by A. H. Banner. Allotype, a 7.3 mm. male; paratypes, 13 specimens of both sexes, all collected by

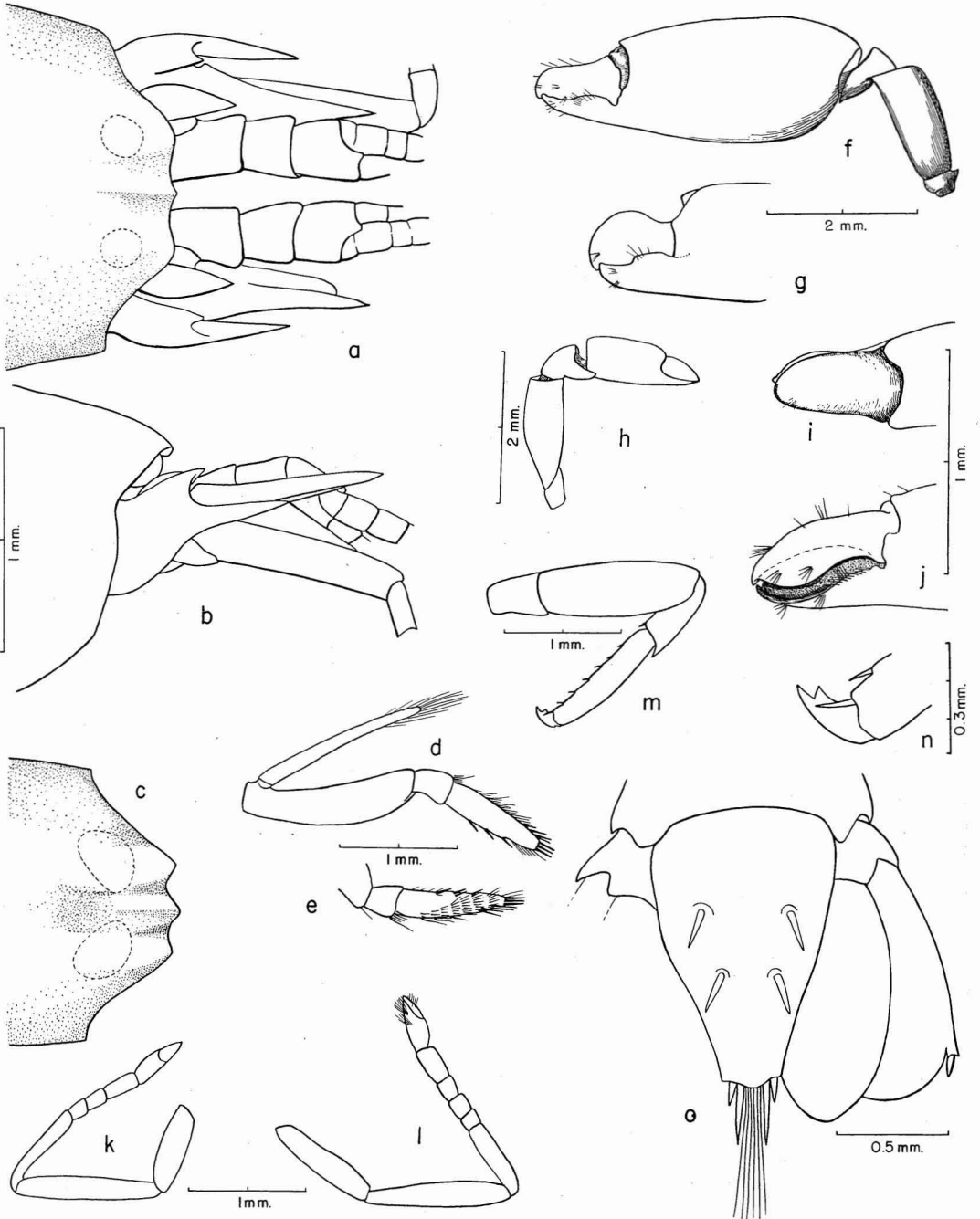


FIG. 8. *Synalpheus anceps* sp. nov. *a, b*, Anterior region, dorsal and lateral aspects; *c*, anterior region, another specimen; *d, e*, third maxilliped; *f, g*, large cheliped; *h*, small cheliped; *i*, spatulate dactylus of small cheliped, type; *j*, same, paratype female; *k*, second leg, right side; *l*, same, left side; *m*, third leg; *n*, third leg, dactylus; *o*, telson and uropod.

Banner at three different times. Types to be deposited in the U. S. National Museum.

**DESCRIPTION:** Anterior portion of carapace almost truncate anterior to eyes, rostrum produced into very slight angle; in lateral view anterior margin depressed; orbital hoods low but slightly higher than median area of carapace; rostral carina short, low and rounded. Pterygostomial angle of carapace slightly projecting but rounded; cardiac notch present. Cornea of eyes visible under carapace in lateral view.

Second antennular article 0.8 as long as broad, 0.7 as long as visible portion of first and 0.8 as long as third article. Stylocerite slightly shorter than basal article, acute but with lateral spine poorly developed. Outer flagellum with secondary ramus consisting of two articles; both flagella only slightly longer than base.

Basicerite with superior tooth heavy but short, subacute; lateral tooth heavy, long and acute, reaching to end of second antennular article. Scaphocerite with heavy lateral spine reaching beyond end of antennular peduncle, 1.2 times as long as the narrow squamous portion. Carpcerite longer, slender, reaching considerably beyond end of scaphocerite.

Third maxillipeds of normal form, with inner face of terminal article bearing numerous bristles and movable spinules.

Merus of large cheliped triangular, with definite margins between the faces, outer face 2.3 times as long as broad; superior distal and inferior internal angles unarmed. Carpus expanded and short. Chela 2.4 times as long as broad, 3.3 times as long as fingers, rounded in side view, laterally slightly compressed; short, heavy, rounded tooth above dactylar articulation. Dactylus heavy, compressed, with distal margin strongly arcuate; dactylus with usual "plunger" and without adhesive plaques. Very light scattered setae on both fingers.

Small cheliped with merus as long as that of large chela, but more slender. Carpus hemispherical but with inferior projecting flange

that covers base of chela. Chela as long as merus, 1.6 times as long as broad, with fingers occupying distal third. Dactylus of peculiar shape, rounded on superior surface and rounded distally, with tip bearing strong, acute tooth at about 90° to fixed finger. Fixed finger broadened to meet dactylus and with tip projecting as two rounded teeth which articulate with dactylar tooth.

Second legs with ischium and merus heavy; carpus of right leg with four articles (ratio 10:1.5:1.7:2.7), that of the left with five (ratio 10:1.2:1.5:1.5:2.7).

Ischium of third legs unarmed. Merus 3.0 times as long as broad, unarmed. Carpus 0.4 as long as merus, armed with heavy terminal tooth on superior margin and small movable terminal spine on inferior margin. Propodus heavy, 5 times as long as broad, 0.8 as long as merus, armed with six slight spines on inferior margin. Dactylus biunguiculate, superior spine heavy and curved, inferior spine shorter, heavy and at about 90° to inferior margin.

Abdomen very broad, shallow, pleura expanded and second pleura bearing deposit of fat. Pleopods long and broad.

Uropods of usual form, outer bearing single distal lateral spine. Telson 5 times as long as posterior margin is broad, base 3.3 times as broad as tip; inner pair of spines of tip as long as tip is broad; dorsal spines about 0.7 as long as inner distal spines, located at 0.3 and 0.6 of the length posterior from articulation.

Nine eggs, 0.73 × 1.13 mm. in diameter.

Branchial formula: 5-1-2.

Allotype not exhibiting sexual dimorphism in any character except abdomen, which is less expanded, with shorter pleura and pleopods.

**DISCUSSION:** This series of 15 specimens exhibits variation in a number of characteristics. In some the anterior carapace projects relatively further (Fig. 8c), the truncate portion is narrower in dorsal view and less depressed in lateral view, and the orbital projections and rostrum are more pronounced,

also the rostral carina is slightly higher but still neither strong nor sharp. In one specimen, the front of the carapace is straight, showing no vestige of either the orbital teeth or the rostrum. In general the larger specimens have the straighter front. The pterygostomial angle also varies in the amount of projection but in no case is it definitely angular.

In all specimens the eyes are fully concealed in dorsal view, but with part of the cornea visible in lateral view, as is shown in Figure 8*b*.

No great variation has been noted in the antennular peduncle. However, the superior tooth of the basicerite is stronger and more acute in some specimens and its tip may reach almost as far forward as does the stylocerite. In many the flattened portion of the scaphocerite is more reduced, and in several the lateral spine of the scaphocerite does not reach past the middle of the third antennular article. The carpocerite is always markedly longer than the antennular peduncle.

On the large cheliped the distal superior margin of the merus may project to form a slight, rounded tooth and the inferior external margin in some specimens projects slightly more than it does on the type. The tooth above the dactylar articulation may be either more or less well developed than on type. The small cheliped does not show marked variations.

All specimens except one had four articles to the carpus of the second legs, and that one, like the type, had five articles in the carpus of the one second leg remaining on the specimen.

The proportions of the telson varied somewhat, and the dorsal spinules varied from about half the length to much larger than those in the type; in one specimen the posterior pair reach almost to the tip of the telson.

In the ovigerous females the size of the eggs was relatively constant, depending upon their maturity, but the number varied from five to fifteen.

Although the number of articles of the carpus, the almost flatly truncate anterior margin of the carapace, and the exposure of the cornea of the eyes in lateral view is unlike any other species of the genus *Synalpheus*, this species has been placed in this genus for the following reasons: 1, The anterior teeth of the carapace approaches this condition in some of the species of the genus, e.g., *S. tanneri* Coutière (1909: 77). 2, The general form of the antennular and antennal peduncles of this species is definitely like other species of *Synalpheus*. 3, The pterygostomial angle of this species at least approaches the usual form for the genus. 4, The large and small chelae are like other species of the genus, both in general form and in the presence of the plunger on the dactylus of the large chela and in the absence of adhesive plaques on the propodus and dactylus. Moreover, the form of the small chela is almost identical to that of *S. pescadorensis* Coutière (1905: 887). 5, The form of the third legs is similar to other species of the genus and the form of the telson is often found in the genus. 6, The branchial formula is that of *Synalpheus*.

The essential differences, then, between this and other members of the genus are in the four articles to the carpus of the third legs—which is variable in this species and has been found to vary in other species of this genus (Coutière, 1909: 20; Banner, 1953: 29), and in the exposure of the eyes, which may be merely the result of the reduction of the anteriorly projecting portion of the carapace.

Within the genus this species appears to fall in the old "Biunguiculatus" group, now better called the Coutièrei group (Banner, 1953: 37). Within this group it is related to those with a subspatulate dactylus of the small cheliped, but it can easily be separated by the extreme reduction of the orbital teeth and rostrum, by the lateral exposure of the cornea, and by the condition of the carpus of the second legs.

The name does not refer to any "two-faced" condition but rather to variation in the num-

ber of secondary articles in the carpus of the second legs.

ALPHEUS Fabricius  
Megacheles group

*Alpheus tuthilli* (Banner)

Fig. 9

*Crangon tuthilli* Banner, Pacific Sci. 7(1): 63, fig. 19, 1953.

LOCALITY: Banner, one specimen, Saipan.

DISCUSSION: This specimen, a 16 mm. female, agrees in all characteristics with the specimen described from Hawaii except that the orbital teeth and lateral spine of the basicerite are slightly longer when compared to the rostrum.

The specimen has intact the small chela which was lost in the type specimen. In it the merus is 3 times as long as broad and 0.5 as long as the entire chela; it bears no superior spines, but the inferior internal margin bears 14 short movable spines and terminates in a small acute tooth. The ischium bears 5 similar spines. The chela is about 5 times as long as broad (the palm proper twice as long as broad), with the fingers 0.55 as long as the chela. The fingers are long and thin, only slightly curved, and have crossing tips. The

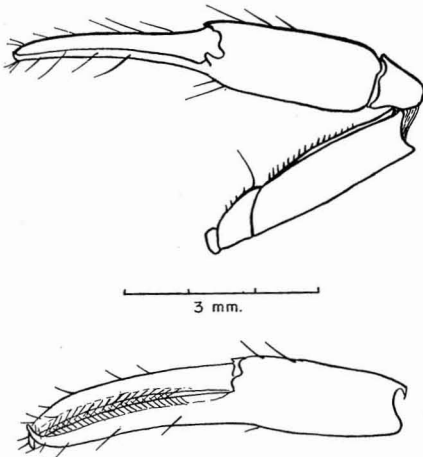


FIG. 9. *Alpheus tuthilli* (Banner). Small chela, female.

opposing faces of the fingers produced as cutting edges that are each flanked on the inner side by a regular row of short stiff setae. The chela bears only occasional long setae.

*Alpheus* species 1

LOCALITY: Banner, one specimen, Saipan.

DISCUSSION: This specimen without chelae belongs to a new species of the Megacheles group, wherein it is related to the *A. bailstonei* Coutière complex. Because the specimen is incomplete, the description and name will be deferred until a subsequent publication when a more complete specimen will be described.

*Alpheus oahuensis* (Banner)

*Crangon oahuensis* Banner, Pacific Sci. 7(1): 64, fig. 20, 1953.

LOCALITY: Banner, 2 specimens in one collection, Saipan.

DISCUSSION: These two specimens, a male and a female, differ in only two ways from the type described from shallow water in Hawaii. The lateral spine of the basicerite is longer and more acute, and the dactylus of the large chela, instead of being thin and crested in the middle and bulbous on the end, is relatively thicker in the middle and not distally expanded. The latter difference may be of significance, but inasmuch as the specimens are otherwise so similar, even to the opposing ridges of the fingers of the small chela, the specimens are assigned to this species.

*Alpheus collumianus* Stimpson

*Alpheus collumianus* Stimpson, Acad. Nat. Sci. Phila., Proc., 12: 30, 1860.

*Alpheus collumianus probabilis* subsp. nov.

Fig. 10

Three variants of this species occur in the present collections and because of the constancy of the differences exhibited are described as subspecies.

TYPES: Holotype, an ovigerous female 15

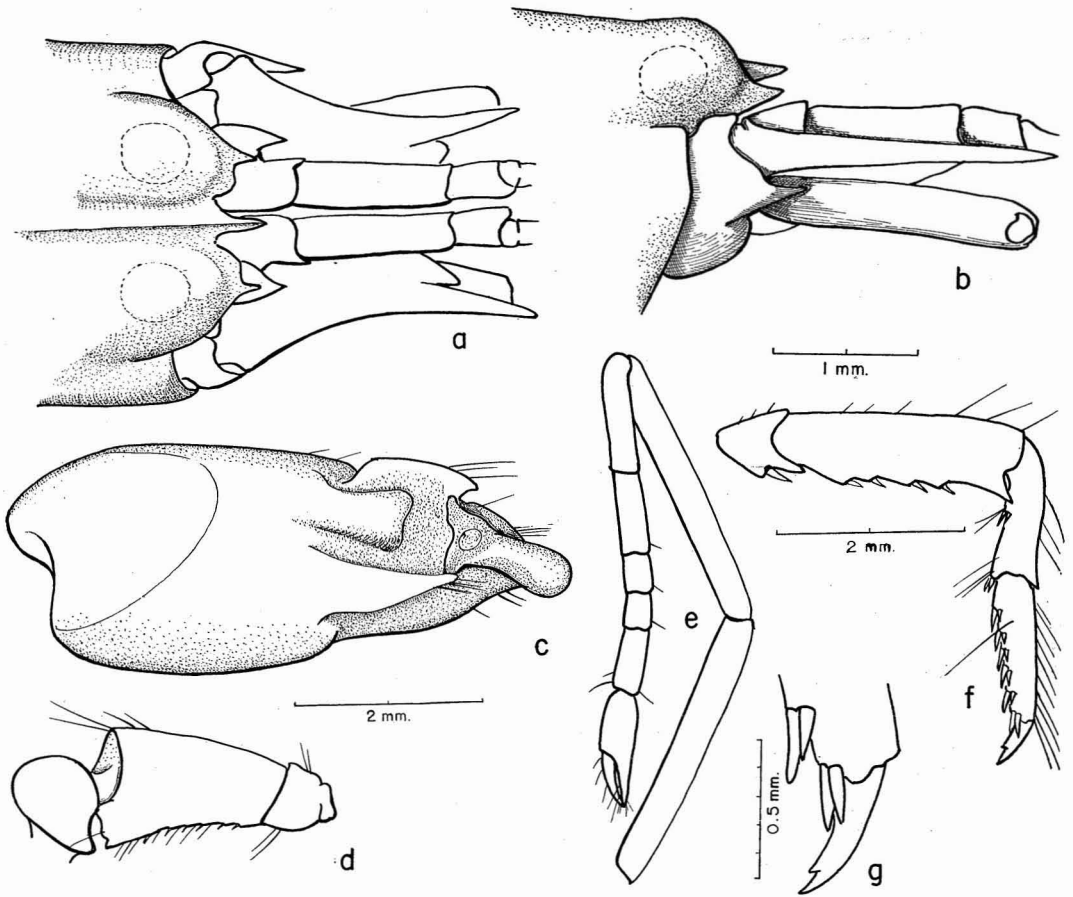


FIG. 10. *Alpheus collumianus probabilis* subsp. nov. *a, b*, Anterior region, dorsal and lateral aspects; *c*, large chela; *d*, large cheliped, merus; *e*, second leg; *f*, third leg; *g*, third leg, dactylus.

mm. long, collected by Preston E. Cloud, Jr., from Loc. C-7a, 13 May 1949. Paratypes: 1 specimen each from Cloud's localities A-7 and C-7a (10 April 1949). All types to be deposited in the U. S. National Museum.

**DESCRIPTION:** Rostrum acute, short, reaching 0.7 of visible portion of first antennular article, about twice as long as broad at base; depressed in lateral view so that tip is only slightly higher than orbital teeth. Rostral carina strong, narrowly rounded, extending posteriorly to orbital hoods, but lower than orbital hoods in lateral view. Orbital hoods inflated, rounded, and bearing short acute orbital teeth. Margin of carapace between orbital teeth and rostral base dorsoventrally flattened and expanded to form extended area

in front of anteromedial portion of orbital hoods, base of rostrum demarked from this area by deep rounded indentations. Orbitorostral grooves deep but rounded, extending to posterior portion of orbital hoods.

Antennules with second article about twice as long as first and three times as long as third article, four times as long as broad. Stylocerite with well-developed spine reaching almost to end of first antennular article. Scaphocerite longer than antennular peduncle, laterally strongly concave, squamous portion reduced, reaching only to end of second antennular article. Carpcerite as long as antennular peduncle. Basicerite with strong lateral spine, tip reaching beyond end of first antennular article.



Large chela heavy, compressed, 2.4 times as long as broad, with dactylus slightly over 0.2 as long as the entire chela. Superior crest distal to transverse groove strong, narrow, ending in a strong tooth, proximal to transverse groove indistinct. Plaque crest heavy and rounded; superior and palmar grooves deep and distinct on distal third of face of palm. Inferior depression deep and sharply delimited; shoulder rounded. (For explanation of terms see Banner, 1953, fig. 17*e*.) Chela bearing scattered setae. Carpus of usual form. Merus 0.3 as long as chela, 1.4 times as long as internal face is broad at point of maximum width; inferior internal margin bearing six short strong spines and terminating distally in strong acute tooth.

Small chela lacking in all specimens.

Carpal articles of second leg with ratio: 10:8:4:4:6.

Third legs with ischium bearing strong movable spine; merus 3.3 times as long as broad, with inferior margin bearing four strong spines and terminating distally in strong acute tooth; carpus about 0.5 as long as merus, bearing pair of short spines on middle of inferior margin and another pair on inferior distal angle; propodus 0.7 as long as merus, bearing six pairs of short strong spines on inferior margin (including the terminal spines); dactylus biunguiculate, with inferior unguis about 0.3 as long as and smaller at base than distal unguis. Appendage bearing scattered setae.

Telson 2.0 times as broad at base as at tip, 3.3 times as long as tip is broad, with lateral margins almost straight and anterior pair of dorsal spines located at half distance from base to tip.

DISCUSSION: See under *A. collumianus inermis*, below.

*A. collumianus medius* subsp. nov.

Fig. 11

*Crangon collumiana* Banner, 1953, Pacific Sci. 7(1): 67, fig. 21.

TYPES: Holotype, a 19 mm. male, collected by A. H. Banner. Paratypes: Banner, 7 specimens from 4 collections. Cloud, 1 specimen at A-7, 3 at D-6, 1 at E-8, 8 at Loc. 6, 1 at Loc. 8.

DESCRIPTION: Rostrum acute, short, reaching half the length of visible portion of first antennular article, about as long as broad at base, only slightly depressed in lateral view. Rostral carina high but broadly rounded, reaching posteriorly to middle of orbital hoods, only slightly lower than orbital hoods in lateral view. Orbital hoods inflated, rounded, and bearing orbital teeth somewhat shorter than rostrum. Margin of carapace between orbital teeth and rostral base dorsoventrally flattened and expanded; base of rostrum demarked from this area by prominent but shallow indentation. Orbitorostral grooves anteriorly deep but disappearing at level of posterior portion of eyes.

Antennular peduncle with second article about 1.5 times as long as first article, 2.0 times as long as third, and 3 times as long as broad, otherwise similar to *A. collumianus probabilis*. Stylocerite also similar, but with spine less pronounced. Basicerite, carpocerite, and scaphocerite as described for *A. c. probabilis*.

Large chela as described for *A. c. probabilis*. Merus 0.2 as long as chela, 1.3 times as long as internal face is broad, inferior internal margin bearing only setae, and terminating in a strong but rounded tooth.

Small chela of male 0.7 as long as large chela, 3.0 times as long as broad, with the curved heavy fingers occupying 0.55 length of chela and somewhat expanded laterally; superior crest present and terminating distally in strong tooth, proximally at transverse groove; palmar crest and associated grooves poorly demarked; shoulder rounded. Carpus with short blunt tooth projecting over base of palm. Merus almost half as long as chela, 2.2 times as long as outer face is broad; inferior internal margin armed only with light setae and terminating in a low rounded lobe. Small chela of female very similar to that of

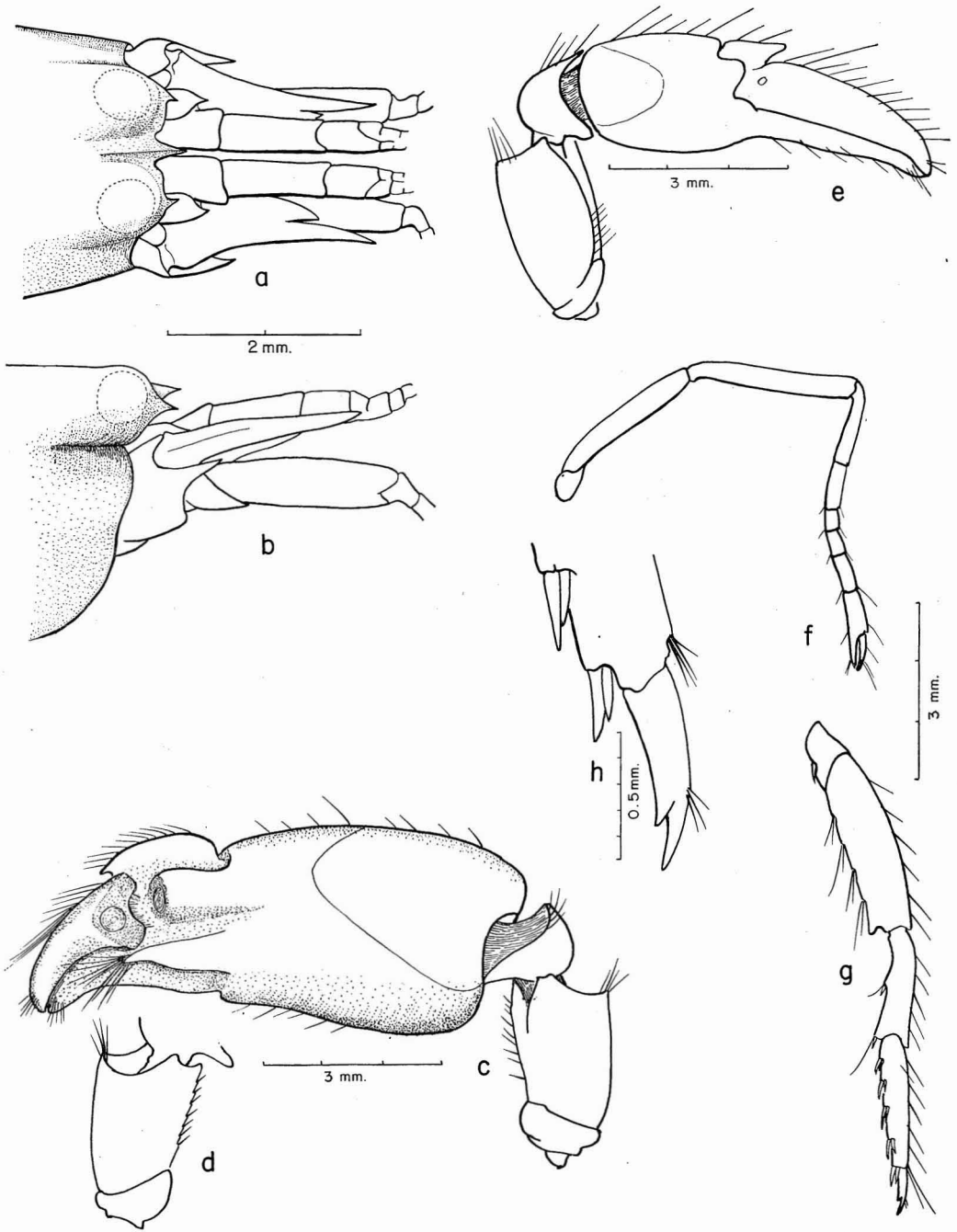


FIG. 11. *Alpheus collumianus medius* subsp. nov. *a, b*, Anterior region, dorsal and lateral aspects; *c*, large cheliped; *d*, large cheliped, merus, medial side; *e*, small cheliped; *f*, second leg; *g*, third leg; *h*, third leg, dactylus.

male, except somewhat smaller in proportion to large chela, with sculpturing of palm proximal to dactylar articulation less pronounced and dactylus without basal expansion, instead rounded.

Carpal articles of second legs with ratio: 10:8:3:4:5.

Third legs similar to *A. c. probabilis* except that merus is 3.6 times as long as broad, bears setae instead of movable spines on inferior margin, and margin terminates in rounded tooth; distal articles are correspondingly more slender and spines slightly smaller; lower unguis of dactylus slightly larger.

Telson 2.0 times as broad at base as at tip, 2.8 times as long as broad at tip, with anterior pair of dorsal spines slightly anterior to middle.

DISCUSSION: See under *A. collumianus inermis*, below.

*A. collumianus inermis* subsp. nov.

Fig. 12

TYPES: Holotype, a male 16 mm. long, collected by Preston E. Cloud, Jr. *et al.* from locality D-7. Paratypes: Cloud, 1 specimen at Loc. D-6, 2 specimens from Loc. D-7. Types to be deposited in the U. S. National Museum.

DESCRIPTION: Rostrum short, acute, reaching a little past middle of visible portion of the first antennular article, about as long as broad at the base, tip depressed in lateral view, no higher than front of orbital hoods. Rostral carina only slightly lower than orbital hoods, depressed towards tip, rounded and terminating before middle of eyes. Orbital hoods inflated, rounded, not bearing any teeth in type, but in other specimens bearing very slight acute teeth. Margin of carapace between orbital hoods and rostral base flattened but not extended; base of rostrum demarcated by only very slight broadly rounded indentation. Orbitorostral grooves rather shallow and rounded.

Antennules with second article about 2.0 times as long as first and third articles, 2.5 times as long as broad. Spine of stylocerite

much reduced. Carpocerite and scaphocerite as in *A. collumianus probabilis*; lateral margin of basicerite projecting almost at approximately 90°.

Large chela 2.5 times as long as broad, fingers occupying 0.25 total length; otherwise like *A. c. probabilis*. Merus 0.27 as long as chela, 1.8 times as long as broad, with inferior internal margin armed with setae and terminating in small rounded shoulder.

Small chela (loose in vial, either from type or from 16 mm. female) almost 0.6 as long as large chela, 3.4 times as long as broad, with fingers occupying 0.4 entire length. Sculpturing on palm not marked, but superior crest strong distally and terminating in strong acute tooth. Merus 0.6 as long as chela, 2.3 times as long as broad, with inferior internal margin unarmed.

Carpal articles of second legs with ratio: 10:9:4:4:7.

Third legs with ischium bearing strong spine; merus 3.7 times as long as broad, inferior margin unarmed except for rounded tooth distally; carpus and propodus similar to *A. c. probabilis* except carpus bears neither middle nor terminal spines, and propodal spines are smaller; dactylus with inferior unguis strongly reduced.

Telson similar in form to *A. c. probabilis*, but 2.5 times as broad anteriorly as posteriorly, 3.5 times as long as posterior margin is broad, and with anterior pair of dorsal spinules located 0.4 of length posterior to articulation.

DISCUSSION: The three groups of specimens described above as three subspecies are obviously related. When the inherent minor individual variations are allowed for, they are similar in form of the orbital hoods proper, the antennules and antennae (save for the basicerite and the stylocerite in the last subspecies), in the form of the large chela, in the ratios of the carpal articles of the second legs, in the spiny propodi and biunguiculate dactyli of the third legs, and in the general form of the telsons.

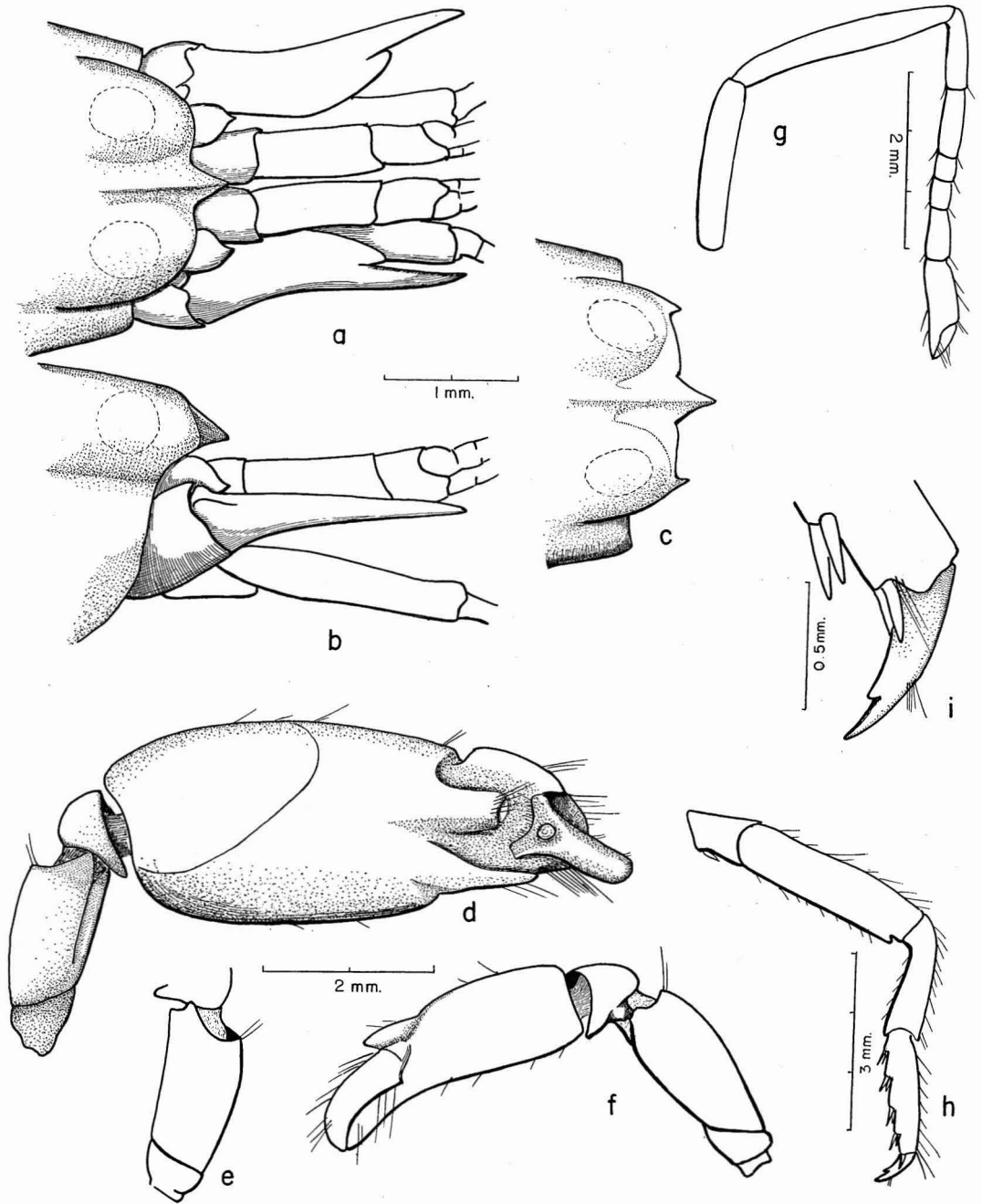


FIG. 12. *Alpheus collumianus inermis* subsp. nov. *a, b*, Anterior region, dorsal and lateral aspects (type); *c*, anterior region (paratype); *d*, large cheliped; *e*, large cheliped, merus, medial aspect; *f*, small cheliped; *g*, second leg; *h*, third leg; *i*, third leg, dactylus.

They differ, however, in the following points:

1. The orbitorostral front. This can best be understood by comparing Figures 10*a*, 11*a*, 12*a*. It should be noted that in three of the four specimens of *A. c. inermis* there are very short orbital teeth, and that *A. c. medius* can be considered a very logical intermediate between the other forms.

2. The stylocerite. Again *A. c. medius* is intermediate between the strong spine of *A. c. probabilis* and the very small spine of *A. c. inermis*.

3. The basicerite. In both *A. c. probabilis* and *A. c. medius* the lateral angle is produced into a strong tooth whereas in *A. c. inermis* it varies from a rounded right angle to a slightly acute angle.

4. The merus of the third legs. *A. c. probabilis* bears four spines and a very strong terminal tooth, *A. c. medius* bears strong bristles corresponding to the spines, and rounded and weaker tooth, and *A. c. inermis* bears scattered weak bristles and a small rounded tooth.

5. The carpus of the third legs. *A. c. probabilis* and *A. c. medius* bear both middle and distal inferior spines (although *A. c. medius* may often lack the middle spines), and *A. c. inermis* bears no spines.

Differences in the proportions of the antennules, antennae, large and small chelae, second and third legs, and telsons probably would not be found to be very significant if larger populations were measured.

In view of the striking similarities yet pronounced differences, it was difficult to decide whether these should be described as separate species or subspecies. There is no way of determining from the specimens and data at hand whether they represent separate ecological groups that would interbreed freely if mixed, or separate co-mingling species that cannot or will not interbreed; however, there is some indication from the collection data that they are separated ecologically, and their

similarities lead me to believe they are merely subspecies.

Without Stimpson's type for comparison—and as far as I have been able to determine, Stimpson's type for this species has been lost like his types for the other alpheids he described—it is difficult to decide which of these, if any, is similar to the specimen for which he gave such a short diagnosis. However, he did state about the third legs, "mero lato, inferne spinuloso et apicem unidentato," which could be applied only to the form described above as *A. collumianus probabilis*. Inasmuch as the original type came from the Bonin Islands, only about 800 miles to the north of Saipan, it is probable that this is identical with the typical subspecies, but because of the distance and the lack of specimens from the Bonins it is inadvisable to assume this to be exactly the same form as would be found there. According to the Copenhagen decisions (paragraph 35, sect. 7) "... the neotype . . . [should come] from as near as possible to that locality [from which the holotype was obtained. . . .]," so the description of this subspecies as *A. collumianus collumianus*—which would be essentially the establishment of a neotype—would be of questionable legality.

Without re-examining the specimens it is impossible to be certain to which subspecies the specimens reported by Coutière, de Man and others belong. However, as they did not remark on the differences, it is likely they were *A. collumianus probabilis* (or *A. c. collumianus*). The specimens reported from the Hawaiian Islands by Edmondson and myself definitely belong to *A. c. medius*.

#### *Alpheus deuteropus* Hilgendorf

*Alpheus deuteropus* Hilgendorf, K. Akad. Wiss. Berlin, Monatsber. 1878: 834.  
*Crangon deuteropus* Banner, Pacific Sci. 7(1): 70, fig. 22, 1953.

LOCALITIES: Banner, 1 specimen; Cloud, Loc. 8, 4 specimens. These specimens agree

almost perfectly with the specimens from Hawaii if the range of variation there is considered.

#### Macrochirus group

##### *Alpheus gracilis* var. *simplex* (Banner)

*Alpheus gracilis* Heller, K. Akad. Wiss. Wien, Sitzungber. 44: 271, Taf. 3, figs. 19–20, 1861.

*Crangon gracilis* var. *simplex*, Banner, Pacific Sci. 7(1): 75, fig. 25, 1953.

LOCALITY: Banner, 4 specimens from one collection, Saipan.

DISCUSSION: These four specimens agree well with the form described from Hawaii with two exceptions: the dorsal carina, which is lacking in the Hawaiian form and present between the orbital hoods in the typical subspecies, is present but only as a low and obtusely angular ridge in these specimens (it is not delimited, however, by the deep orbitorostral furrows which are found in the typical form); the inferior convexity of the dactylus of the third legs of the Hawaiian form is here developed as a low but flattened protuberance with proximally and distally rounded margins.

Three of the specimens have black spines on the uropods; in the fourth the spines are dark brown.

##### *Alpheus edmondsoni* (Banner)

*Crangon edmondsoni* Banner, Pacific Sci. 7(1): 78, fig. 26, 1953.

LOCALITY: Banner, 2 specimens from one collection, Saipan.

These specimens fall well within the range of variation noted in Hawaii.

##### *Alpheus ventrosus* Milne-Edwards

*Alpheus ventrosus* Milne-Edwards, Histoire Naturelle des Crustacés, 2: 352, 1837.

*Alpheus laevis* Randall, Acad. Nat. Sci. Phila., Jour. 8(1): 141, 1839.

*Alpheus obesomanus* Boone, Vanderbilt Mar. Mus., Bul. 6: 135, 1935 [partim].

*Crangon ventrosa* Banner, Pacific Sci. 7(1): 84, fig. 28, 1953.

LOCALITIES: Banner, 2 specimens in one collection; Cloud, Locs. 6, 8, 9, one specimen each.

DISCUSSION: Two variations are noted in these specimens. First, in several of the smaller specimens, especially in a 15 mm. ovigerous female from Cloud's locality 9, the interorbital continuation of the rostrum is high and narrow, almost a rounded carina, instead of flat and broad across the top. In this respect these specimens resemble *A. latipes* (Banner) more closely than they do *A. ventrosus*.

In the two specimens of my own collection, the external spines of the uropods in the 16 mm. female are light brown, and in the accompanying 15 mm. male they are dark brown, almost black. Such dark spines are found in the Macrochirus group and this is often used as a specific characteristic but it has not been remarked upon before in this species.

##### *Alpheus nanus* (Banner)

*Crangon nanus* Banner, Pacific Sci. 7(1): 90, figs. 30, 31, 1953.

LOCALITIES: Banner, 8 specimens in 3 collections; Cloud, locality D-6, 2 specimens.

DISCUSSION: These specimens agree perfectly with those from Hawaii except that about half of these bear up to six weak spinules or short bristles on the inferior internal margins of the meri of the large and small chelipeds.

##### *Alpheus paragracilis* (Coutière)

*Alpheus paragracilis* Coutière, Paris Mus. d'Hist. Nat., Bul. 3(7): 304, 1897b.

*Crangon paragracilis* Banner, Pacific Sci. 7(1): 96, fig. 33, 1953.

LOCALITY: Cloud, Loc. 6, 2 specimens.

These specimens agree well with those described from Hawaii.



## Obesomanus subgroup

*Alpheus microstylus* (Bate)

*Betaeus microstylus* Bate, Challenger Repts. 24: 566, pl. 101, fig. 6, 1888.

*Alpheus obesomanus* de Man, Arch. Naturg. 53: 520, 1888; Abhandl. Senckenb. Naturf. Gesells. 25: 867-869, 1902.

*Alpheus malleodigitus* Coutière, Les Alpheidae, p. 223, 316 (figs. 270-272, 400) 1899 [nec *A. malleodigitus* (Bate)].

*Alpheus microstylus* Coutière, Fauna and Geog. Mald. and Laccad. 2: 884, pl. 76, fig. 23, 1905.

LOCALITIES: Banner, 5 specimens in one collection; Cloud, 15 specimens at locality A-5, 4 at FX.

DISCUSSION: The few specimens of this species exhibit some interesting variations. The scale of the antenna is usually similar to that depicted by Coutière (1905) but in several specimens it is shortened, and in one the squamous portion is so reduced that it does not reach to the end of the second antennular article. The merus of the large chela usually bears an obtuse tooth distally on the inner inferior margin, but in some specimens this tooth is acute, and in one small specimen it is reduced to a slight rounded eminence. The ratio of the first two articles of the carpus of the second legs varies from slightly less than 1:3 to more than 1:4. Finally, the propodus of the third legs is armed with five to seven spines instead of only five, as described by Coutière.

*Alpheus lutini* Coutière

*Alpheus lutini* Coutière, Fauna and Geog. Mald. and Laccad., 2: 885, pl. 76, fig. 24, 1905; de Man 1911, Siboga Exped. 39a<sup>1</sup>: 346, pl. 14, fig. 69 [additional description].

LOCALITIES: Banner, 65 specimens in 8 collections; Cloud, 2 specimens at localities A-7, 3 at C-1, 1 at C-7a (13 May 1949), 6 at D-5.

DISCUSSION: This species is more variable than has been indicated previously, and shows

variation in most of the structures commonly measured. For example, the squamous portion of the scaphocerite, while always poorly developed, may be twice as large in some specimens as in others; the lateral spine of the scaphocerite may equal the antennular peduncle in length, or it may reach only slightly beyond the end of the second antennular article (in one specimen the spine of the left scale reached to the end of the second antennular article, whereas the right reached only to the middle of the same article). Coutière stated that the second legs were 3 times as long as the carapace, whereas in these specimens they vary from about 2 times to more than 3.5 times as long. Similar variations in proportions occur in the chelae and in the third legs.

Except for these variations these specimens agree very well with Coutière's description. At times however, this variation caused difficulty in the use of de Man's key (1911), for while de Man stated that the small chela was less than 3.0 times the length of the fingers (Coutière's ratio was 2.5), it was actually found to be as much as 3.2 times this length.

*Alpheus phrygianus* Coutière

*Alpheus phrygianus* Coutière, Fauna and Geog. Mald. and Laccad. 2: 886, pl. 77, fig. 25, 1905.

LOCALITIES: Banner, 2 specimens in one collection; Cloud, 3 specimens at locality A-5, 2 at A-7, 2 at C-1, 3 and 4 at C-7 on 4 April and 13 May 1949, respectively, 2 at D-5, 2 at D-8, 2 at E-7.

DISCUSSION: This species is abundant in the Saipan collections, but few of the specimens are intact, probably in part because most of the specimens died with the long thoracic legs outspread.

In general the specimens agree with Coutière's description of specimens from the Indian Ocean; however, far greater variation is seen in these specimens than was noted by Coutière for his four specimens.

In the younger specimens (less than 10 mm. long) the antennular peduncle is shorter, especially the second article. In the antenna, the spine on the scaphocerite varies from about two-thirds the length of the second antennular article (on an 8 mm. specimen) to less than one-third its length on mature specimens; the squamous portion in some specimens is as depicted by Coutière, arising abruptly at slightly more than half of the length of the outer spine, but in others it tapers gradually to near the tip of the spine, with most of the specimens intermediate in condition; in most the squamous portion is without setae as described by Coutière, but in a few there are some short feeble bristles along its margin; finally, the antennal peduncle varies from reaching the tip of the second antennular article to reaching only two-thirds its length. The large chela does not exhibit any marked variation. In the small chela most of the specimens have fingers more nearly 1.3 times the length of the palm than 1.0 as in the type specimen. Coutière remarked that the second leg varies from 2.2 to 4 times the length of the carapace; in a few of these specimens the second legs are almost 5 times the length of the carapace. On the third leg the spine on the inferior distal margin of the merus usually is small and subacute like that depicted by Coutière, but in several it is strong and acute, and in one it is reduced to a rounded protuberance; on the propodus there are usually seven instead of five spines. The telson usually approaches the proportions given by Coutière, but in some the tip is relatively broader so the length is only 3.2 times the breadth of the tip instead of 4.5. These variations do not appear to be consistent enough to be of taxonomic importance.

*Alpheus perplexus* sp. nov.

Fig. 13

(?) *Alpheus* species, de Man, Siboga Exped. 39a<sup>1</sup> (2): 349, pl. 15, fig. 71, 1911.

TYPES: Holotype, an 18.8 mm. male col-

lected by Preston E. Cloud, Jr., from locality A-7; allotype, an ovigerous female 20.4 mm. long, same location. Types to be deposited in the U. S. National Museum.

DESCRIPTION: Front of carapace straight (in type) to concave (in allotype); orbital hoods somewhat inflated and rounded; interorbital carina slight and rounded, not reaching to anterior margin of carapace or posterior to end of orbital hoods.

Second antennular article 2.1 times as long as visible portion of first, 2.3 times as long as third, and 3.3 times as long as broad. Stylocerite rounded. Scaphocerite reaching slightly beyond end of second antennular article; carapocerite reaching almost to end of third antennular article; basicerite unarmed.

Large chela of type specimen heavy, 2.8 times as long as broad, flattened, and with fingers occupying 0.2 of entire length. Only distal third of chela sculptured; superior crest interrupted by deep, abrupt transverse groove, distal to transverse groove crest thin, high, terminating in a rounded shoulder. Plaque crest heavy, rounded, separated from superior and inferior crest by deep grooves. Inferior crest pronounced, distally high and thin, terminating in a rounded shoulder flanking dactylus. Inferior shoulder rounded. Fixed finger very short, distally notched to receive dactylus. Dactylus closing almost across end of palm, heavy, rounded, nearly hammer-shape. Merus 0.3 as long as chela, 3.1 times as long as broad, without teeth or spines, with inferior external margin rounded.

Large chela of female of similar armature, but relatively much smaller than that of male, 3.9 times as long as broad.

Small chela lacking in male; in female chela 4.5 times as long as broad, with heavy fingers occupying distal 0.3; small tooth projects superior to articulation at approximately 90°.

Second legs long, strong, with merus about 0.7 as long as large chela in type. Carpal articles with ratio: 10:11:3:4:5.

Third legs with ischium armed with rather weak spine; merus almost 4 times as long as

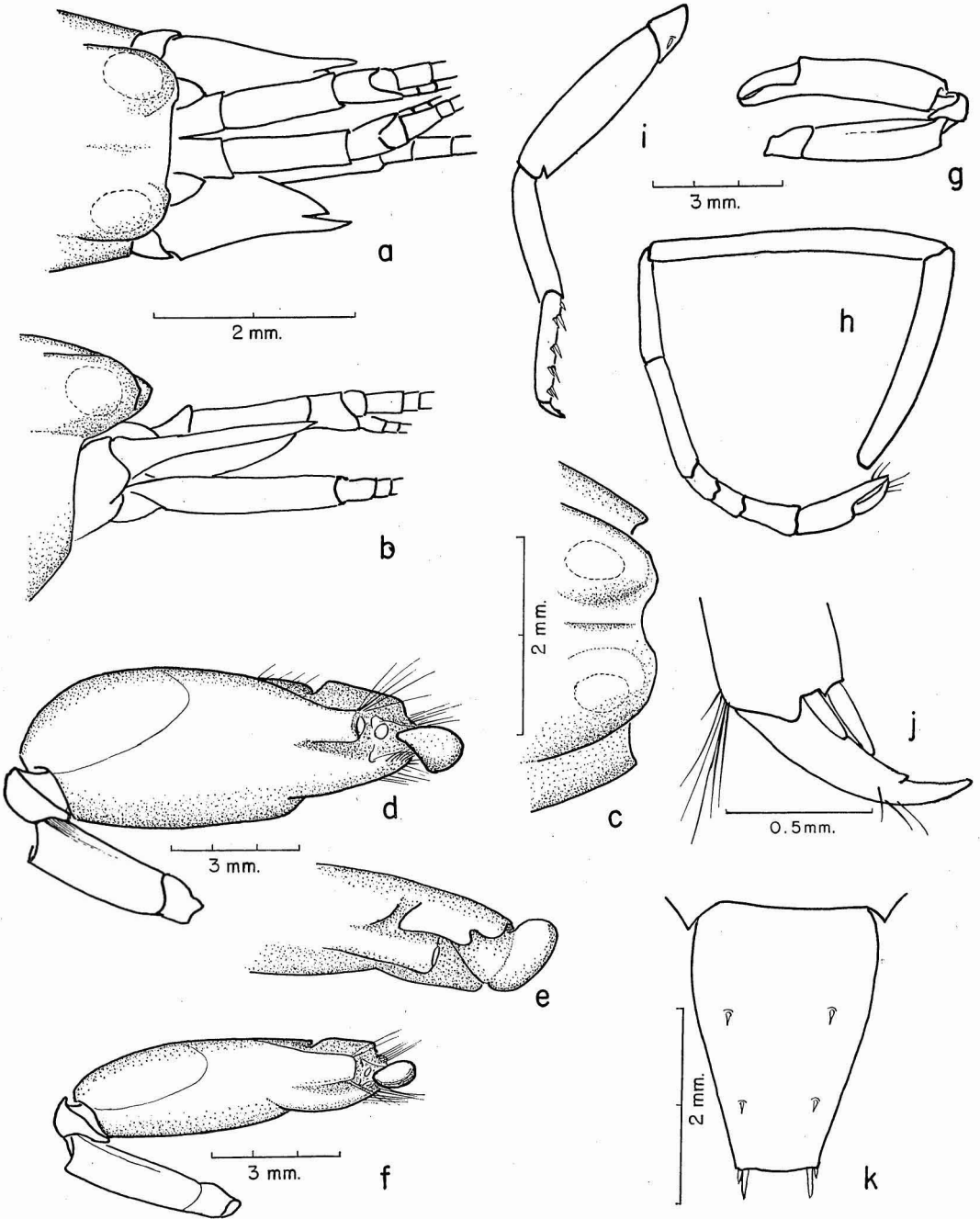


FIG. 13. *Alpheus perplexus* sp. nov. a, b, Anterior region, dorsal and lateral aspects, type specimen; c, anterior region, dorsal aspect, allotype (specimen asymmetrical); d, e, large cheliped, lateral and superior aspects, type specimen; f, large cheliped, allotype; g, small cheliped, allotype; h, second leg; i, third leg; j, third leg, dactylus; k, telson.

broad, armed with weak sub-acute tooth distally; carpus 0.7 as long as merus, unarmed except for two rounded projections distally; propodus 0.6 as long as merus, armed with one single and five pairs of spines on inferior margin; dactylus curved, with very slight secondary tooth (on female secondary tooth somewhat larger).

Telson 3.3 times as long as posterior margin is broad, 2.3 times as wide anteriorly as posteriorly; sides slightly rounded, both pairs of dorsal spinules small, anterior pair 0.4, posterior pair 0.7 length of telson posterior to articulation. Inner uropod with several weak spinules on outer distal margin.

DISCUSSION: This species is difficult to assign to an infrageneric group, for the anterior carapace and second legs are very much like those found in the *Obesomanus* group, but the large chela is more like those found in the *Macrochirus* group. The dactylus of the large chela, which should be hammer-shaped in the *Obesomanus* group, is intermediate between the form found in many species of the *Megacheles* and *Macrochirus* groups and those found in the *Obesomanus* group.

Only on the basis of the lack of a rostrum and of orbital teeth was this species assigned to this group. Within the group it is definitely separated from all other named species by the form of the large chela and by the fact that the dactyli of the third and fourth legs carry a small secondary unguis.

The species appears to be similar to the specimen that de Man briefly described but left unnamed because it lacked both of the chelae and the second legs. Between the two specimens there are differences in proportions of the antennules, antennae, third legs and telson, but these differences are slight and probably not significant. Also de Man's specimen had a slight rostrum with the interorbital carina reaching to its tip, while neither of these specimens show a trace of the rostrum, and the interorbital carina terminates posteriorly to the margin of the carapace. This too, in view of the fact that the two specimens available

show some variation, and that marked variation has been reported for species showing a similar frontal region, may be without significance. The armature and general form of the 3rd legs are similar. (De Man described the stylocerite as acute, but figured it as similar to those of these specimens.)

The difference between the form of the large chela in the male and the female is interesting. While in most species the chela of the female is considerably smaller than that of the male, it is seldom that the proportions are so pronouncedly different. It is possible, of course, that these specimens represent two species, but as they are similar in other characteristics, as they bear similar sculpturing on the large chela, and as they were collected together at the same station, it seems unlikely that they are other than a single dimorphic species.

*Alpheus chamorro* sp. nov.

Fig. 14

TYPE: Holotype, a 7.5 mm. male collected by A. H. Banner. Specimen to be deposited in U. S. National Museum.

DESCRIPTION: Anterior margin of carapace projecting beyond orbital hoods as narrow, somewhat flattened shelf; rostrum small, tip rounded; rostral carina low but sharp, extending from behind orbital hoods to tip of rostrum. Orbital hoods inflated, rounded, and anteriorly set off by medial flat orbitocarinal area.

Second antennular article 1.7 times as long as broad; first and third articles subequal in length and 0.7 as long as second article; stylocerite short, anteriorly acute. Basicerite unarmed. Scaphocerite with heavy lateral spine reaching to end of third antennular article, with reduced squamous portion reaching to end of second article. Carpoperite longer than antennular peduncle.

Large chela round, inflated, 2.6 times as long as broad and 2.2 times as long as high (*i.e.*, when the dactylus is seen in profile), fingers occupying the distal 0.25. In profile,

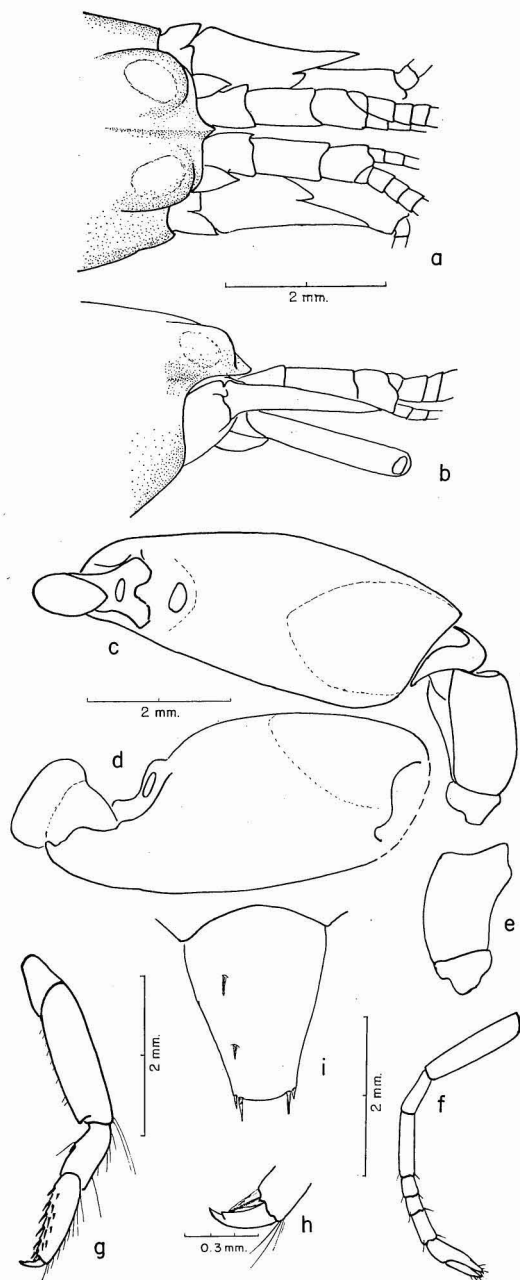


FIG. 14. *Alpheus chamorro* sp. nov. *a, b*, Anterior region, dorsal and lateral aspects; *c, d*, large cheliped, lateral and inferior aspects; *e*, merus, large cheliped, medial aspect; *f*, second leg; *g*, third leg; *h*, dactylus, third leg; *i*, telson (dorsal spinules lacking in specimen).

chela slopes abruptly toward articulation of dactylus; palmar adhesive plaque borne upon rounded eminence protruding from slope. Fixed finger short, cleft to accommodate dactylus. Dactylus short, heavy, but not as strongly hammer-shaped as in some other members of the group. Merus short, heavy, 0.4 as long as chela, outer face 1.4 times as long as broad; inferior internal margin bearing heavy rounded protuberance but otherwise unarmed.

Small chela lacking in specimen.

Carpal articles of second legs with ratio: 10:14.7:4.7:4.0:7.3.

Ischium of third legs unarmed. Merus 3.3 times as long as broad, bearing rounded tooth of moderate development on inferior distal margin. Carpus heavy, 1.6 times as long as broad, 0.35 as long as merus, armed with short heavy spine in middle of inferior margin and distally with two heavy subacute projections. Propodus correspondingly heavy, 0.6 as long as merus, armed with six pairs of spines along inferior and inferodistal margins, with scattered smaller spines adjacent. Dactylus strongly curved bearing small secondary unguis that is difficult to discern.

Uropods of usual form. Telson short, broad and abruptly tapering, 3.1 times as long as distal margin is broad, 2.3 times as wide proximally as distally; dorsal spinules well developed on left side only, anterior spinule 0.3, posterior 0.7 of length posterior to articulation.

DISCUSSION: While the general form, even to the shape of the anterior carapace and the secondary unguis on the dactylus of the third legs is very reminiscent of *A. paralcione* (Coutière) of the Crinitus subgroup, the hammer-shaped dactylus of the chela of this species shows that it definitely belongs to the Obesomanus subgroup.

Unlike all species of the Obesomanus subgroup except *A. perplexus* Banner (above) and, if distinct, *A. species de Man* (1911: 349), *A. chamorro* has a biunguiculate dactylus on the third legs.

This species can be distinguished easily from *A. perplexus* by the form of the large chela, which is rounded in this species but bears deep sculpturing in *A. perplexus*.

The comparison of this species, *A. perplexus* and de Man's *A.* species shows the difficulty of trying to identify an incomplete specimen, for although the chelae show that *chamorro* and *perplexus* are not even closely related, each is similar enough to de Man's description of his broken specimen to be confused with it. *A. chamorro* is quite like de Man's specimen in the configuration of the anterior carapace and the bases of the antennae and antennules, but dissimilar in the structure of the third legs; *A. perplexus* is less like de Man's specimen in the anterior carapace but more similar in the third legs. After careful consideration it appears that the legs are more constant in their character than the anterior carapace, so de Man's specimen has been assigned, but still with doubts, to *A. perplexus*.

It should also be noted that *A. chamorro* shows affinity to *A. bradyus* Coutière (1906: 891) in the Crinitus group. While there are

specific characteristics adequate to separate them easily, such as the dactylus of the third legs and the slight proximal projection of the "head" of the dactylus of the large chela, in general configuration the two species are strikingly similar, even to the shape of the eminence that bears the palmar adhesive plaque and the rounded protuberance on the inferior internal margin of the large chela. While the two species may merely show convergent evolution, or may be closely related on the limits of their respective groups, this may also indicate that the groups were separated upon artificial criteria.

The specific name has reference to the Chamorro people, the original inhabitants of the Mariana Islands.

#### *Alpheus* species 2

Fig. 15

SPECIMEN: A 11.2 mm. female, nonovigerous, collected by A. H. Banner.

DESCRIPTION: Anterior carapace without trace of rostrum, rostral carina, or orbito-rostral furrows but uniformly inflated and rounded over eyes.

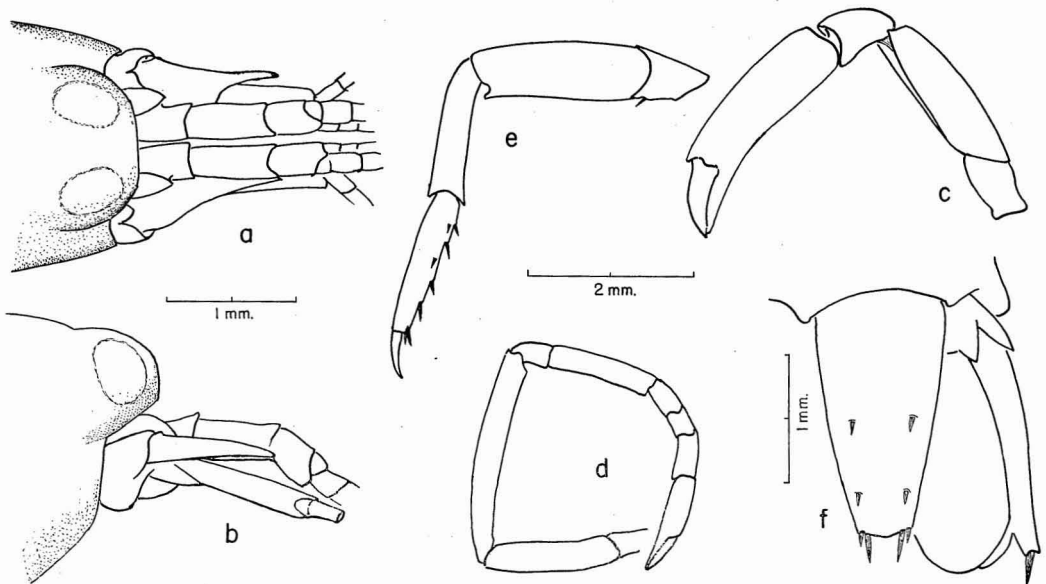


FIG. 15. *Alpheus* species 2. *a, b*, Anterior region, dorsal and lateral aspects; *c*, small cheliped; *d*, second leg; *e*, third leg; *f*, telson and uropods.



Antennular peduncle with second article 2.5 times as long as broad, 1.7 times as long as visible portion of first and third article which are subequal. Stylocerite without lateral spine, rounded, reaching half length of basal article. Upper flagellum slightly shorter than peduncle, lower shorter than upper. Basicerite unarmed. Lateral spine of scaphocerite reaching to end of second antennular article; flattened portion reduced, narrow, reaching only to first third of second antennular article. Carpocerite approximately as long as antennular peduncle. Flagellum of usual form.

Large chela lacking. Small chela rounded, regular, slightly curved toward fingers, 4.0 times as long as broad, with fingers occupying distal 0.3. Carpus somewhat elongate. Merus unarmed, outer face 3.6 times as long as broad, 0.7 as long as chela.

Carpal articles of second legs with ratio: 10:30:8:7:13.

Ischium of third legs bearing reduced spine. Merus 4.1 times as long as broad, distal inferior margin bearing tooth of moderate size. Carpus 0.66 as long as merus, distally produced into superior and inferior acute teeth of moderate size. Propodus 0.83 as long as merus, bearing eight spines irregularly placed on inferior and distal margins. Dactylus simple, curved, 0.26 as long as merus.

Telson 2.8 times as long as posterior margin is wide; anteriorly 1.5 times as wide as posteriorly; margins very slightly convex. Uropods of normal form; distal spine of outer uropod not black.

DISCUSSION: Without the large chela on this specimen, it is impossible to assign it even to group. The reduction of the orbital teeth and the reduction of the scaphocerite together with the armature of the third legs, would indicate that it may belong to the *Obesomanus* group, but, without knowing whether the dactylus of the large chela is hammer-shaped or not, it cannot be assigned for certain. Certainly the unique character of the front of the carapace does not show close

relationship to any group or to any species of the genus *Alpheus* known to me.

The form of the rostral front appears to be similar to that described by Armstrong (1949: 12) as characteristic of his new genus, *Thunor*. However, on all other characteristics for this genus—absence of the cardiac notch on the carapace, the absence of anal tubercles, the absence of an articulation in the outer uropods (the ocular beak was not examined)—this species differs from *Thunor* and resembles *Alpheus*. In view of the wide variation in the rostral front found in *Alpheus* the one similarity was not considered to be of generic importance.

Because the specimen is imperfect it has been left unnamed.

#### Crinitus subgroup

#### *Alpheus cloudi* sp. nov.

Fig. 16

TYPE: Holotype, a unique ovigerous female 17.6 mm. long, collected by Preston E. Cloud, Jr., at locality D-5. Specimen to be deposited in the U. S. National Museum.

DESCRIPTION: Body form short, heavy. Anterior portion of carapace depressed when seen in lateral view. Orbital hoods inflated, rounded, demarked from anteromedial portion of carapace and overhanging anterolateral portion. Anteromedial portion of carapace broad, flat, projecting, margins almost straight; rostrum proper poorly demarked from adjacent portions of carapace, short, broad, with tip reaching beyond middle of visible portion of first antennular article. Rostral carina low but sharp reaching posteriorly from tip of rostrum to slightly behind orbital hoods. Eyes small, not filling orbital hoods.

Second antennular article about 2 times as long as broad, 1.3 times as long as visible portion of basal article, 2.4 times as long as distal article. Stylocerite short, heavy, with acute tip reaching almost to end of first antennular article. Basicerite bearing small spine. Scaphocerite reaching to near end of



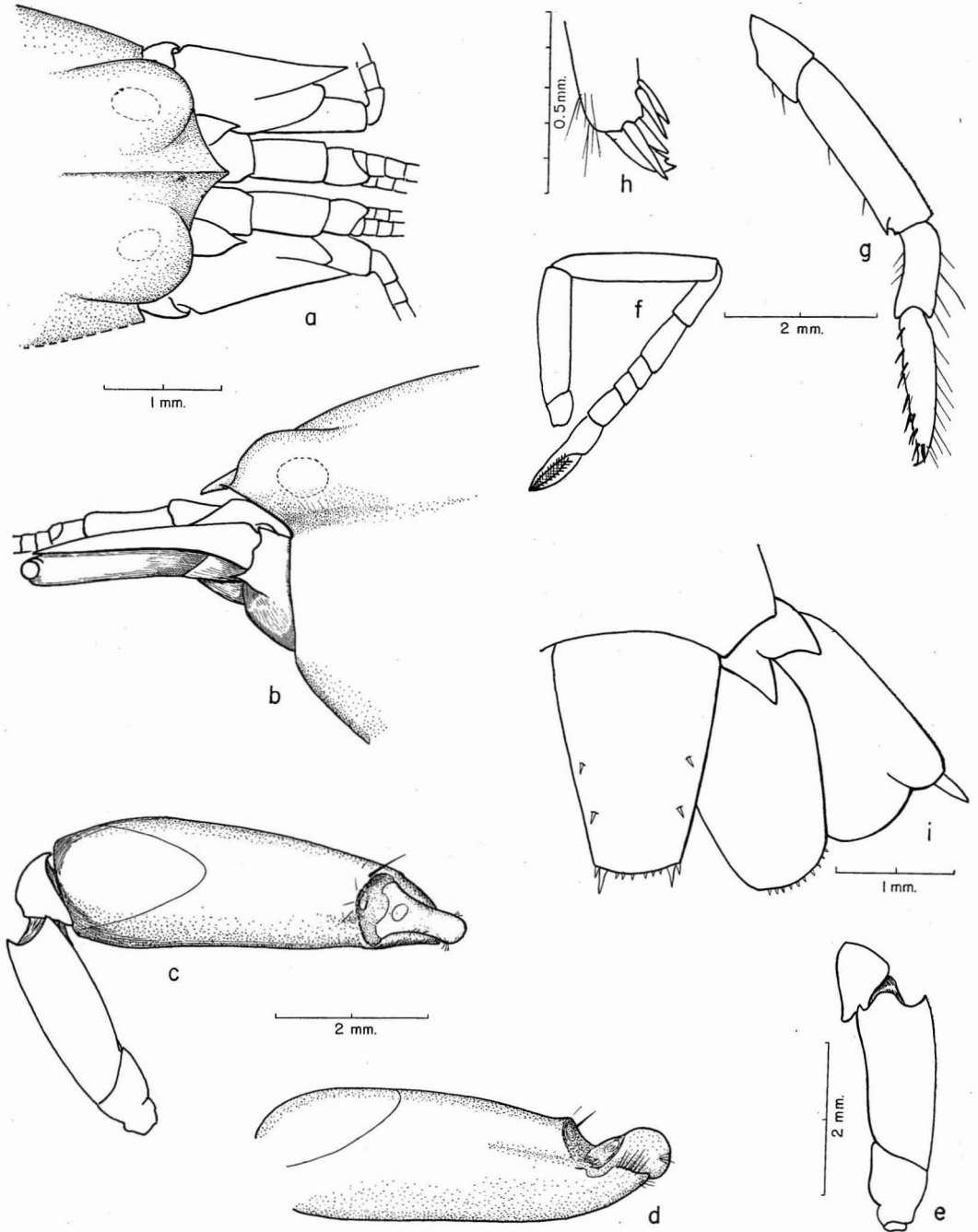


FIG. 16. *Alpheus cloudi* sp. nov. *a*, Anterior region, dorsal aspect (right margin distorted in specimen but reconstructed in drawing); *b*, same, lateral aspect; *c*, large cheliped, lateral aspect; *d*, large chela, inferior aspect; *e*, large cheliped, merus, medial aspect; *f*, second leg; *g*, third leg; *h*, third leg, dactylus, posterior or lateral aspect; *i*, telson and uropod.

antennular peduncle, squamous portion reaching to end of second antennular article; outer margin almost straight. Carpocerite reaching slightly beyond end of antennular peduncle and scaphocerite.

Large chela subcylindrical, as broad as high, slightly tapering distally, 3.1 times as long as broad. Palm below and immediately proximal to adhesive plaque with slight longitudinal depression. Dactylus 0.23 as long as entire chela, somewhat crested, rounded. Chela almost devoid of setae. Merus 2.6 times as long as broad, almost 0.5 as long as chela; superior margin distally projecting as small rounded tooth; inferior internal margin terminating distally in small acute tooth that is difficult to discern.

Small chela lacking.

Second legs relatively short, heavy. Carpal articles with ratio: 10:9:3.5:3.5:5.5; first article 3 times as long as broad. Chela 1.5 times as long as first carpal article, palm occupying slightly over 0.3 the entire length; fingers arched, tips crossing, bearing stiff combs of setae that cross.

Third legs heavy, ischium unarmed. Merus 4 times as long as broad, distal inferior margin armed with tooth of moderate development.

Carpus 0.38 as long as merus, both distal margins projecting as rounded teeth. Propodus 0.7 as long as merus, strongly tapering, distally only half as broad as proximally; inferior margin bearing 11 strong acute spines. Dactylus short, partially hidden, especially in anterior or median view, by propodal spines, some of which are equal in length to dactylus; dactylus heavy, curved, bearing slight biunguiculation that is difficult to discern both because of spines and normal rotation of dactylus.

Abdomen broad, rather soft. Sixth abdominal segment without spines or teeth. Telson 2.0 times as broad anteriorly as posteriorly, 3.4 times as long as broad posteriorly; sides straight, posterior margin slightly arcuate; anterior pair of dorsal spinules 0.5, posterior pair 0.8 of distance to tip from articulation;

tip bearing about six very small spinules in addition to usual posterolateral spines. Uropods of usual form, inner bearing about 10 spinules along distolateral margin similar to those on tip of telson.

DISCUSSION: This species apparently belongs to the Crinitus subgroup in spite of the fact that the chela bears a short, shallow, longitudinal groove. Within the group it appears to be most closely related to the species *A. alcyone* de Man, *A. providencei* Coutière, *A. arethusa* de Man, and *A. paralcione* Coutière. From *A. alcyone* it may be separated by the lack of spines on the merus of the third legs as well as other characteristics. It is separated from *A. arethusa* and *A. paralcione* by a combination of characters, one of the more conspicuous being the lack of spines or teeth on the sixth abdominal segment. It appears to be somewhat related to *A. providencei*, especially in the frontal regions of the carapace, the antennular and antennal peduncles, the general form of the third leg and the trace of biunguiculation of its dactylus but it can easily be separated by the more elongate rostral triangle, the presence of a spine on the basicerite, the more elongate large chela, the armature of the merus of the cheliped, the shorter second article of the carpus of the second legs, the short dactylus of the third legs, and the form and armature of the uropods and telson.

The species was named in honor of Preston E. Cloud, Jr., U. S. Geological Survey, who collected this and many of the other specimens reported in this study.

#### *Alpheus brevipes* Stimpson

*Alpheus brevipes* Stimpson, Acad. Nat. Sci. Phila., Proc. 12: 30, 1860.

*Crangon brevipes* (Stimpson) Banner, Pacific Sci. 7(1): 103, figs. 35-37, 1953. [Neotype established.]

LOCALITIES: Banner, 2 specimens in 2 collections; Cloud, 8 specimens at Loc. D-8, 1 at Loc. 6.

DISCUSSION: These specimens, together

with the specimens from Arno, Onotoa, and Palmyra to be reported upon in later papers, parallel the variation already reported from Hawaii (Banner, 1953: 103). It should be noted under the variation of the frontal region of the carapace that only rarely were the "Orbital hoods acute in front, with their apices curved inward," a characteristic given by de Man in his key (1911: 315); instead the ridges of the orbital hoods were usually rounded, and often did not slope medially towards the ventral side.

### *Alpheus bucephalus* Coutière

*Alpheus bucephalus* Coutière, Fauna and Geog. Mald. and Laccad. 2: 890, pl. 78, fig. 29, 1905.

LOCALITIES: Banner, 12 specimens in four collections; Cloud, 3 specimens at D-5, 3 at D-8, 1 at E-4, 1 at FX.

DISCUSSION: Several of the larger male specimens which otherwise agree with the characteristics of the species have broadened fingers on the small chelae, a trait that is not supposed to occur in this species. However, as the specimens are similar to *A. bucephalus* in all other characteristics, and as they were in a mixed collection with smaller specimens without the broadened finger, they have been assigned to this species. This peculiarity will be discussed in a future paper.

### *Alpheus bradypus* Coutière

Fig. 17

*Alpheus bradypus* Coutière, Fauna and Geog. Mald. and Laccad. 2: 891, pl. 78, 79, fig. 30, 1905.

LOCALITY: Banner, 8 specimens in 1 collection, Saipan.

DISCUSSION: This group of eight specimens agree quite well with Coutière's description of his two damaged specimens. The most conspicuous differences between the two lie in the following characteristics: 1, The second antennular article is slightly longer than that

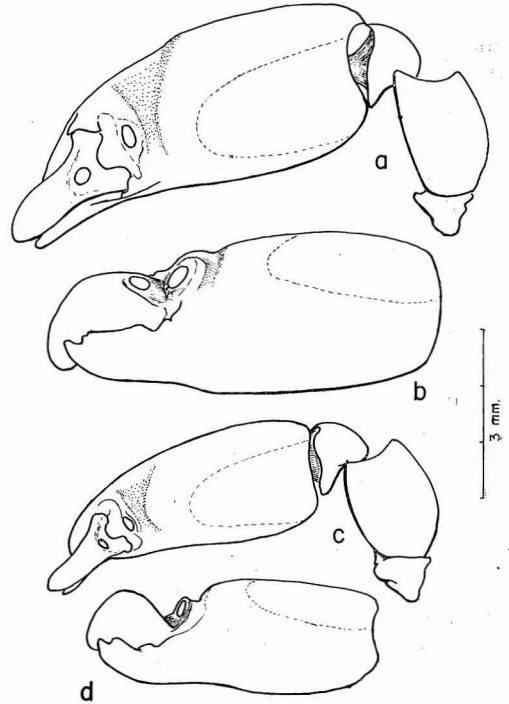


FIG. 17. *Alpheus bradypus* Coutière. *a, b*, large chela male; *c, d*, large chela, female.

described by Coutière. 2, There is a small, poorly developed and difficult to discern tooth on the basicerite, while Coutière reported his specimens as unarmed. 3, In none of the males did the dactylus of the small chela show the fringe of setae depicted by Coutière; moreover the small chelae of the males and females were more alike, showing less sexual dimorphism. 4, The internal ramus of the uropods bears a row of numerous, although poorly developed denticles along its distal margin. These differences may in part be due to individual variation, so common in related species of this group, or they may be due to geographical variation; certainly it seems inadvisable at the present state of knowledge of the species to divide it into subspecies on the basis of these characteristics.

Both of Coutière's specimens were without the large chela. As most of these specimens are complete, I have shown the chelae of a mature male and a mature female in Figure

17. These chelae are dimorphic both in size and proportions. However, in both sexes there is a poorly demarked shallow depressed area on the upper side of the chela proximal to the articulation of the finger. This depression appears slightly more distinct in the female than in the male, possibly because the chela is more slender. The merus is unarmed on all margins but the inferior internal margin projects slightly distally.

There is some variation in the proportions of the antennular peduncle. The scaphocerite in one specimen, instead of reaching slightly past the middle of the third antennular article, reaches beyond it by half its length. In the same specimen the reduced squamous portion of the scaphocerite gradually tapers to its end which is opposite the distal end of the second antennular article instead of being more abruptly truncate opposite to the middle of the same article. Otherwise this specimen is similar to the others.

#### *Alpheus eulimene* de Man

*Alpheus eulimene* de Man, Siboga Exped. 39a<sup>1</sup> (2): 364; pl. 16, fig. 76, 1911.

LOCALITY: Cloud, 2 specimens at C-7a, 10 April 1949.

DISCUSSION: *A. eulimene* de Man and *A. styliceps* Coutière (1905: 889, pl. 78, fig. 28) are very closely related species, separated principally by the form of the frontal portion of the carapace and by the proportions of the third leg and the armature of the fourth. The two specimens from Saipan, a 9.0 mm. female and a broken and distorted male of 7.8 mm., lie somewhat intermediate between the two species. In *A. eulimene* the front of the carapace is almost straight in front of the orbital hoods, abruptly giving rise in the middle to a very short rostrum; it bears a dorsal carina that continues posteriorly to the middle of the carapace. In *A. styliceps* the anterior margin of the carapace curves gradually into a larger rostrum, but the carina does not extend posteriorly to the orbital hoods. In these spec-

imens the rostrum is like *A. styliceps*, except that the curve is less gradual and the base of the rostrum more abrupt; the dorsal carina is like *A. eulimene*. In *A. eulimene* and in these specimens the merus of the third legs is slightly over 4 times as long as broad, while in *A. styliceps* it is only 3 times as long; in de Man's species and in these specimens the merus of the fourth leg is unarmed, while in Coutière's it bears a strong distal tooth. If the distinction between these species is maintained after more specimens are examined, then these two specimens appear to belong to de Man's species.

There are several further minor differences between these specimens and de Man's description. In the male the scaphocerites are asymmetrically developed, with that of the right being reduced as described by de Man, but that of the left better developed, with the tip of the lateral spine reaching beyond the end of the antennular peduncle and the squamous portion reaching to the middle of the third, not the second, antennular article. In the female the palm of the small chela is 1.9 times as long as broad and as long as the fingers, instead of 1.5 times as long as broad and longer than the fingers. Unfortunately the small chela is lacking in the male. De Man gives lengths for the articles of the carpus of the second leg which produce the ratio of 10:14.4 for the first two articles, yet his drawing shows a ratio of 10:17.5, more like these specimens (in the female they have the ratio of 10:18.5). Finally, in the dactylus of the third leg, de Man shows a uniform tapering curve, but these specimens have a rounded thickening two-thirds of the length distally, similar to that described for *A. gracilis* var. *simplex* (Banner, 1953: fig. 25k).

#### *Alpheus pachychirus* Stimpson

*Alpheus pachychirus* Stimpson, Acad. Nat. Sci. Phila., Proc. 12: 30, 1860.

LOCALITIES: Banner, 1 specimen; Cloud, 1 specimen at E-4, 3 at Loc. 9.

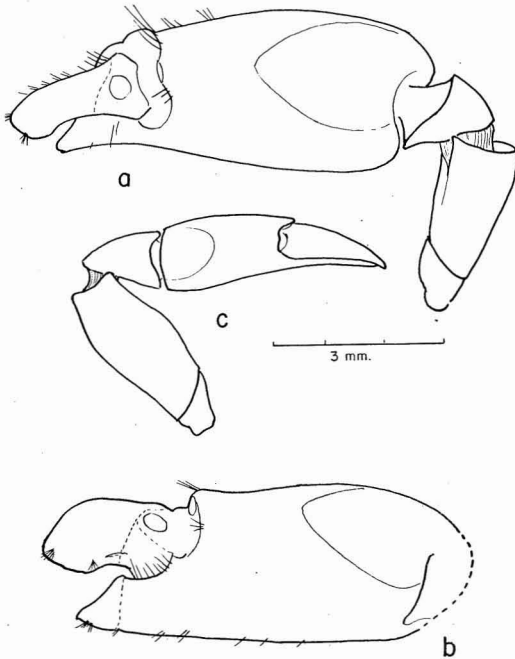


FIG. 18. *Alpheus ovaliceps* Coutière. a, b, Large chela; c, small chela.

### *Alpheus ovaliceps* Coutière

Fig. 18

*Alpheus ovaliceps* Coutière, Fauna and Geog. Mald. and Laccad. 2(4): 888, pl. 77, fig. 27, 1905.

LOCALITY: Banner, 3 specimens, Saipan.

DISCUSSION: This species was described by Coutière on the basis of a single male from Minikoi. It has not been reported since then.

These three specimens, two males and a female, agree almost perfectly with the description and figures of Coutière, even to the two long and broadened bristles on the penultimate article of the third maxilliped. However, they do differ in two characteristics. In the Indian Ocean specimen the large chela had a marked taper towards the dactylar articulation and proximal to this articulation there was a slight transverse groove; in the present specimen, the chela maintains its full diameter throughout, and there is no such groove. The small chela is essentially similar

in the two sets of specimens. (I have drawn the small cheliped of the female particularly to show the form of the merus, similar in both sexes.) Secondly, the outer spine of the uropod was reported by Coutière as being dark brown, whereas in these three specimens it is colorless.

Within this group variations are so common that no great significance is attached to these differences. Possibly if other specimens from the Indian Ocean are compared to these from the Western Pacific the differences would be found to intergrade; if they did not, at most they would justify the erection of a subspecies for the Pacific form.

### *Alpheus frontalis* Milne-Edwards

*Alpheus frontalis* Milne-Edwards, Histoire Naturelle des Crustacés, 2: 356, 1837.

LOCALITY: Banner, 1 specimen, Saipan.

### Diadema subgroup

#### *Alpheus diadema* Dana

*Alpheus diadema* Dana, U. S. Explor. Exped. 13: 555, pl. 35, fig. 7, 1852.

*Alpheus insignis* Heller, K. Akad. Wiss. Wien, Sitzungber. 44: 269, taf. 3, fig. 17-18, 1861.

*Crangon diadema* Banner, Pacific Sci. 7(1): 118, fig. 43, 1953. [Neotype established.]

LOCALITIES: Banner, 15 specimens in 3 collections; Cloud, 18 specimens at locality D-5, 1 at Loc. 8.

#### *Alpheus gracilipes* Stimpson

*Alpheus gracilipes* Stimpson, Acad. Nat. Sci. Phila., Proc. 12: 31, 1860.

*Crangon gracilipes* Banner, Pacific Sci. 7(1): 115, fig. 41, 1953.

LOCALITIES: Banner, 55 specimens from 8 collections; Cloud, 10 specimens at locality D-5, 2 at D-6.

DISCUSSION: The specimens of this species from Hawaii bear *balaeniceps*-shaped dactyli on the small chelae in both sexes; in these from Saipan, however, only the small chela

of the males is broadened and bears the characteristic fringe of setae. In the females the dactylus is slender, tapering uniformly to the acute tip, and lacking all traces of the fringe. Both sexes lack the slight transverse depression proximal to the dactylus.

It is likely that this is a separate subspecies, distinct from the form in Hawaii. However, the decision will be deferred until specimens are examined from other archipelagoes. When Tahitian specimens (the type locality) are examined it will be possible to decide, if a new name is to be applied, which form is similar to Stimpson's type.

***Alpheus paracrinitus* Meirs var.  
*bengalensis* Coutière**

*Alpheus paracrinitus* var. *bengalensis* Coutière,  
Fauna and Geog. Mald. and Laccad. 2(4):  
901, pl. 82, figs. 37-37a, 1905.

LOCALITIES: Banner, 17 specimens in 7 collections; Cloud, 1 specimen each at localities A-5, D-5, FX.

DISCUSSION: Variation is found in these specimens in the relative lengths of the antennular peduncle, the scaphocerite, and the carpocerite. In most the antennular peduncle does not reach to the tips of the other two, and most often the scaphocerite and the carpocerite are subequal. Only on a few specimens is the carpocerite considerably longer than the scaphocerite, as was commonly found in Hawaii (Banner, 1953: fig. 40a, b). In some specimens, on the other hand, the tips of the three parts reach essentially the same point. Variation is also found, as in Hawaii, in the armature of the merus of the large and small chela. In several specimens the fingers of the large chela are proportionately shorter, not more than about 0.2 the length of the chela; in other specimens the fingers of the small chela are much more hirsute. In all of the specimens the first and second articles of the second leg are subequal, the criterion for the separation of this variety from the parent species.

Brevirostris group

***Alpheus rapax* Fabricius**

*Alpheus rapax* Fabricius, Sup. Ent. Syst., p. 405, 1798 [see de Man, 1909: 147-155 for synonymy].

LOCALITY: Guam, collected by Seale, 1900 (Bernice P. Bishop Mus. No. 161).

DISCUSSION: This sole specimen is definitely *A. rapax* as redescribed by de Man. The Hawaiian specimen of this species showed two differences from de Man's redescription: the merus of the small cheliped was lacking in a distal spine on the inferior internal margin, and the third legs were not densely hirsute. This specimen has a very small tooth on the merus, but, as in the Hawaiian specimen, the third legs bear only scattered setae.

***Alpheus* species 3**

Fig. 19

LOCALITY: A 12 mm. male from Loc. 2, collected by P. E. Cloud, Jr.

DESCRIPTION: Rostrum acute, reaching about 0.7 length of visible portion of first antennular article, rostral triangle slightly longer than broad. Rostral carina strong, extending posteriorly half length of carapace. Orbital hoods inflated, rounded, similar in development to *A. rapax* Fab.

Second antennular article twice as long as broad, 1.3 times as long as first article, about 2 times as long as third. Stylocerite with acute lateral tooth projecting almost to end of first antennular article. Spine of basicerite of moderate development, relatively shorter than stylocerite. Scaphocerite with tip of lateral spine noticeably longer than antennular peduncle; spine exceeding flattened portion in length. Carpocerite slightly longer than scaphocerite.

Third maxillipeds, if extended straight, reaching beyond antennular peduncle. Last article 3.0 times as long as penultimate and 4.0 times as long as broad.

Merus of large cheliped 2.8 times as long



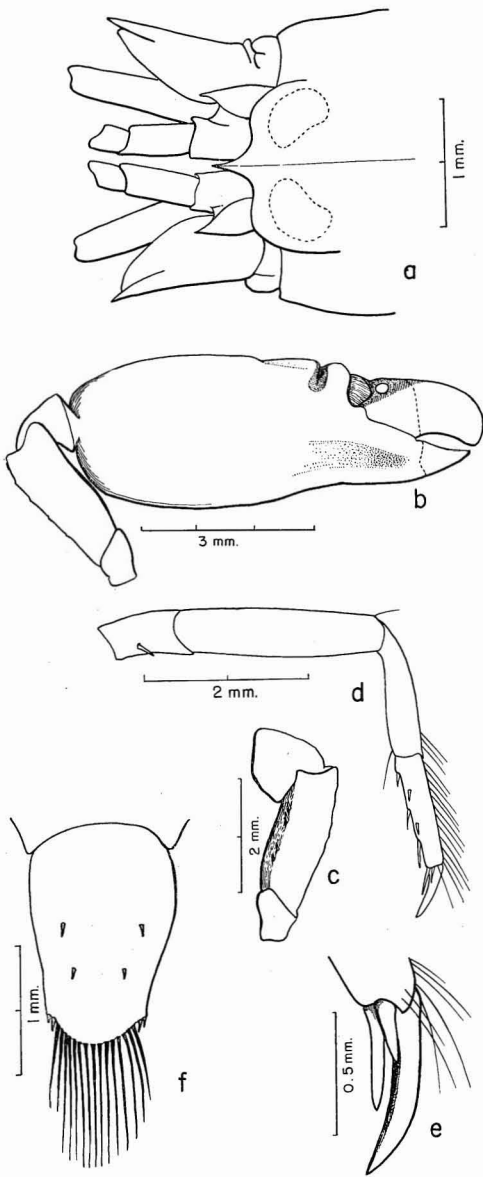


FIG. 19. *Alpheus* species 3. *a*, Anterior region, dorsal aspect; *b*, large chela; *c*, large cheliped, merus; *d*, third leg; *e*, third leg, dactylus; *f*, telson.

as broad, superior margin slightly irregular, inferior internal margin bearing four irregularly placed moveable spines. Chela 2.5 times as long as broad, with palm 1.85 times as long as fingers, with short transverse groove on superior margin, shallow depression on

external face of base of fixed finger; chela with but few scattered setae.

Small cheliped and second legs lacking.

Ischium of third legs 0.3 as long as merus, bearing movable spine. Merus slightly over 4 times as long as broad, unarmed. Carpus half as long as merus, unarmed. Propodus tapering, as long as carpus, bearing five strong spines on or near inferior margin and two distally. Dactylus half as long as propodus, simple, curved, somewhat flattened on inferior margin. Distal end of carpus and entire propodus bearing long fine setae along superior margin.

Telson in specimen asymmetrical, 2.2 times as long as posterior margin is broad, anteriorly 1.4 times as broad as posteriorly; lateral margins anteriorly convex, posteriorly concave, with convexity of right side more pronounced than left; tip broadly arcuate. Dorsal and terminal spines of slight development.

DISCUSSION: It is unfortunate that this specimen is in such poor condition; in addition to lacking the small chela, both second legs, one of the third legs, both fourth legs and one of the fifth legs, the tissue within the exoskeleton is partially shrunken and withdrawn, leaving the exoskeleton without support; the exoskeleton, as a consequence, is difficult to discern and often distorted.

The form of the chela and the anterior carapace plainly places this species within the *Brevirostris* group. The groove of the chela, together with the keel on the carapace, the lack of a tooth on the merus of the third leg, and the narrowness of the same article serves to separate this species from all other species in the group except *A. brevirostris* (Olivier) and *A. savuensis* de Man. It is plainly different from the former in the scaphocerite, for in *A. brevirostris* the flattened portion reaches almost to the tip of the spine (de Man, 1909: fig. 15), and in the large chela, which appears much heavier in the palm and which has a dactylus that is about three times as heavy as the fixed finger (Coutière, 1899: fig. 281).



This form shows a closer relationship to *A. savuensis*, but can be separated from that species by a series of characteristics such as: the rostrum, which is shorter in *A. savuensis*; the rostral carina, which reaches only slightly past the orbital hoods; the stylocerite, which does not bear an acute tip like this form; slight (and possibly not significant) differences in the relative lengths of the antennular peduncle, scaphocerite and carpocerite; similar differences in the dactylus of the third legs, which de Man describes as not flattened, but which are slightly flattened on the inferior face in this specimen. In spite of these differences, which at best are minor, there appears to be much in common in general form between the two, especially in the large chela and third legs.

As the small chela and the second legs are so important in the separation of species in this genus and group, to say that this sole mutilated specimen is or is not the same as *A. savuensis* would be questionable. Likewise, if the specimen were considered as distinct from de Man's, little could be gained by the establishment of this defective specimen as a type for a new species.

#### Edwardsi group

#### *Alpheus ladronis* sp. nov.

Fig. 20

TYPES: Holotype, a 10.8 mm. male, collected by A. H. Banner, Saipan; allotype, a 13.0 mm. ovigerous female; paratype, a partially broken ovigerous female, same length; both females from same collection as male. Types to be deposited in the U. S. National Museum.

DESCRIPTION: Rostrum small, acute, reaching almost to middle of visible portion of first antennular article; lateral margins of base demarked from almost straight orbitorostral margins; sharp rostral carina extending to near posterior margin of eyes, continuing low and rounded, and soon merging with curvature of carapace; in lateral view carina higher

than orbital hoods, depressed anteriorly. Orbital hoods relatively low, rounded, separated from carina by shallow rounded depressions.

Second antennular article 1.7 times as long as broad, 1.1 times as long as first, 1.5 times as long as third. Stylocerite reaching to end of first antennular article. Basicerite armed with small, acute tooth. Lateral spine of scaphocerite reaching to end of third antennular article, squamous portion almost as long. Carpocerite reaching slightly beyond end of scaphocerite.

Large chela compressed, 2.6 times as long as high, with fingers occupying the distal 0.3. Transverse groove proximal to dactylar articulation shallow and rounded, continuous on inner face as shallow rounded depression, U-shaped in outline, and on outer face as deeper, well-delimited groove extending proximally past middle of palm. Shoulder on inferior margin conspicuous, extending up both inner and outer faces. Dactylus and fixed finger with acute tips. Merus 0.3 as long as chela, with outer inferior margin rounded, superior distal margin slightly produced into a low, obtuse tooth, inferior internal margin bearing a strong tooth subterminally.

Carpus of second legs with ratio: 10:7:3:3:6.

Small chela 4.1 times as long as broad, fingers slender, tapering (not belaaniceps-shaped), occupying distal 0.6. Merus slender, unarmed.

Third legs with ischium unarmed; merus 4.6 times as long as broad, carpus 0.5 as long as merus, with superior margin continuing distally as rounded projection; propodus 0.77 as long as merus, armed along inferior margin with six relatively long, slender spines; dactylus simple, curved, slightly less than 0.3 as long as merus.

Telson 2.1 times as long as broad posteriorly, 1.6 times as broad anteriorly as posteriorly; margins rounded, with arcuate posterior margin a continuation of curved lateral margins. Dorsal spinules on type asymmetrical, as shown in Figure 20*i*. Lateral spine

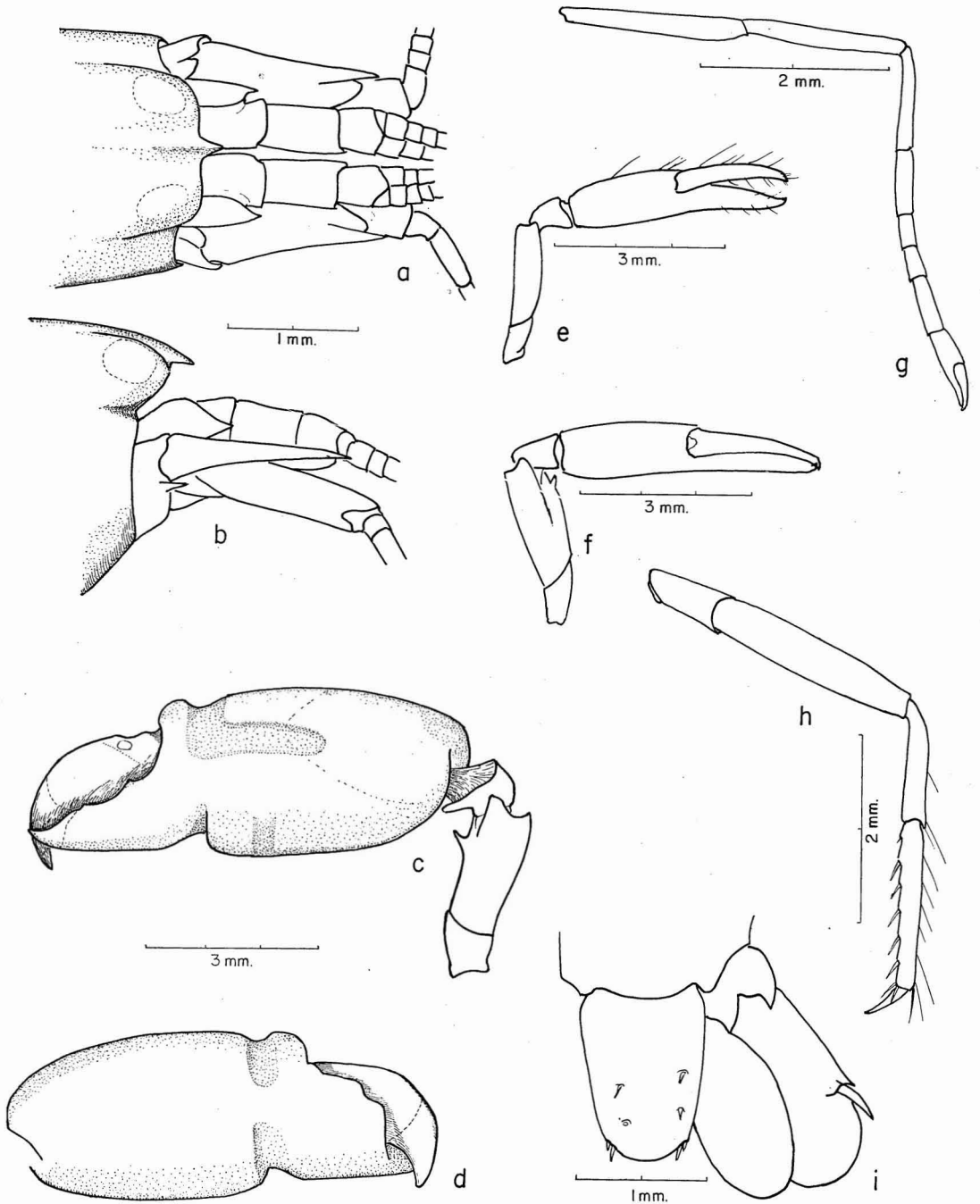


FIG. 20. *Alpheus ladronis* sp. nov. *a, b*, Anterior region, dorsal and lateral aspects; *c, d*, large chela, lateral and medial aspects; *e*, small cheliped, male (type); *f*, small cheliped, female (allotype—setae not shown); *g*, second leg; *h*, third leg; *i*, uropods and telson.

of outer uropod strong but exceeded by distal curved margin.

DISCUSSION: The two paratypes differ in two important ways from the type: in both the merus of the small chela carries a tooth similar to that of the large cheliped, and in both the margins of the telson are less rounded, with a more pronounced taper in the posterior half (in one the anterior margin is 1.9, in the other 3.0, times the breadth posteriorly). Other lesser differences were noted in the fingers of the large chela, which are more rounded, in slight difference in proportions in the carpus of the second legs, and in the uropods, which do not protrude as far beyond the lateral spine. It is likely that the difference in the fingers of the large chela, and it is possible that difference in the armature of the merus of the small chela, are secondary sexual characteristics; the other differences probably are normal variation.

This species plainly belongs to the Edward-sii group, and within that group appears to be most closely related to *A. bouvieri* A. Milne-Edwards and *A. bastardi* Coutière. From the latter it differs in the form of the rostrum, the more slender form of the small cheliped, and, if a specimen from Yap to be reported in a later publication is the same as Coutière's species, in the presence of the meral spines of the large chela and the absence of ischial spines of the third legs. From *A. bouvieri* it differs most notably in the absence of sexual dimorphism in the small chela; it apparently also differs in the presence of teeth on the basicerite and the merus of the large chela. Unfortunately, complete descriptions are not available for either of the species and it is possible that *ladronis* will be found either to be more closely related or more widely separated when the types are compared.

The specific name is derived from Magellan's name for the Mariana Islands.

#### *Alpheus pacificus* Dana

*Alpheus pacificus* Dana, U. S. Explor. Exped. 13: 544, pl. 34, fig. 5, 1852.

*Crangon pacifica* Banner, Pacific Sci. 7(1): 138, fig. 50. [Neotype established.]

LOCALITY: Banner, 2 specimens from one locality, Saipan.

DISCUSSION: Although these specimens are small and immature, they compare well to specimens of similar size from Hawaii. It is notable that in the large collection of specimens from Saipan only two specimens of this species were found, yet it is one of the most common in Hawaii.

#### *Alpheus leptochirus* Coutière

*Alpheus leptochirus* Coutière, Fauna and Geog. Mald. and Laccad. 2(4): 914-916, pl. 87, fig. 54, 1905.

SPECIMEN: Banner, a single specimen, Saipan.

DISCUSSION: This sole specimen, a male, is very similar to the female reported from Hawaii (Banner, 1953: 133, fig. 48) in all characteristics, and in those points where the Hawaiian specimen differs from the type, it is more similar to the Hawaiian specimen than to the type, except that in the first two carpal articles of the second leg the ratio is 10:9, intermediate between the ratio of 10:11 in the Hawaiian specimen and 10:7 in the type. Another slight point of difference is in the armature of the merus of the small and large chelae, which, instead of bearing movable spines as did the previous forms, bear short stiff setae.

#### *Alpheus dolerus* sp. nov.

Fig. 21

TYPES: Holotype, a 17.0 mm. male collected on Saipan in 1944 by A. H. Banner; allotype, a 14.6 ovigerous female from the same collection; paratypes, 12 specimens in 6 collections by A. H. Banner; 1 specimen from Loc. 6, collected by P. E. Cloud, Jr.

DESCRIPTION: Rostrum acute, reaching to end of first antennular article, continued posteriorly to slightly behind corneas as low

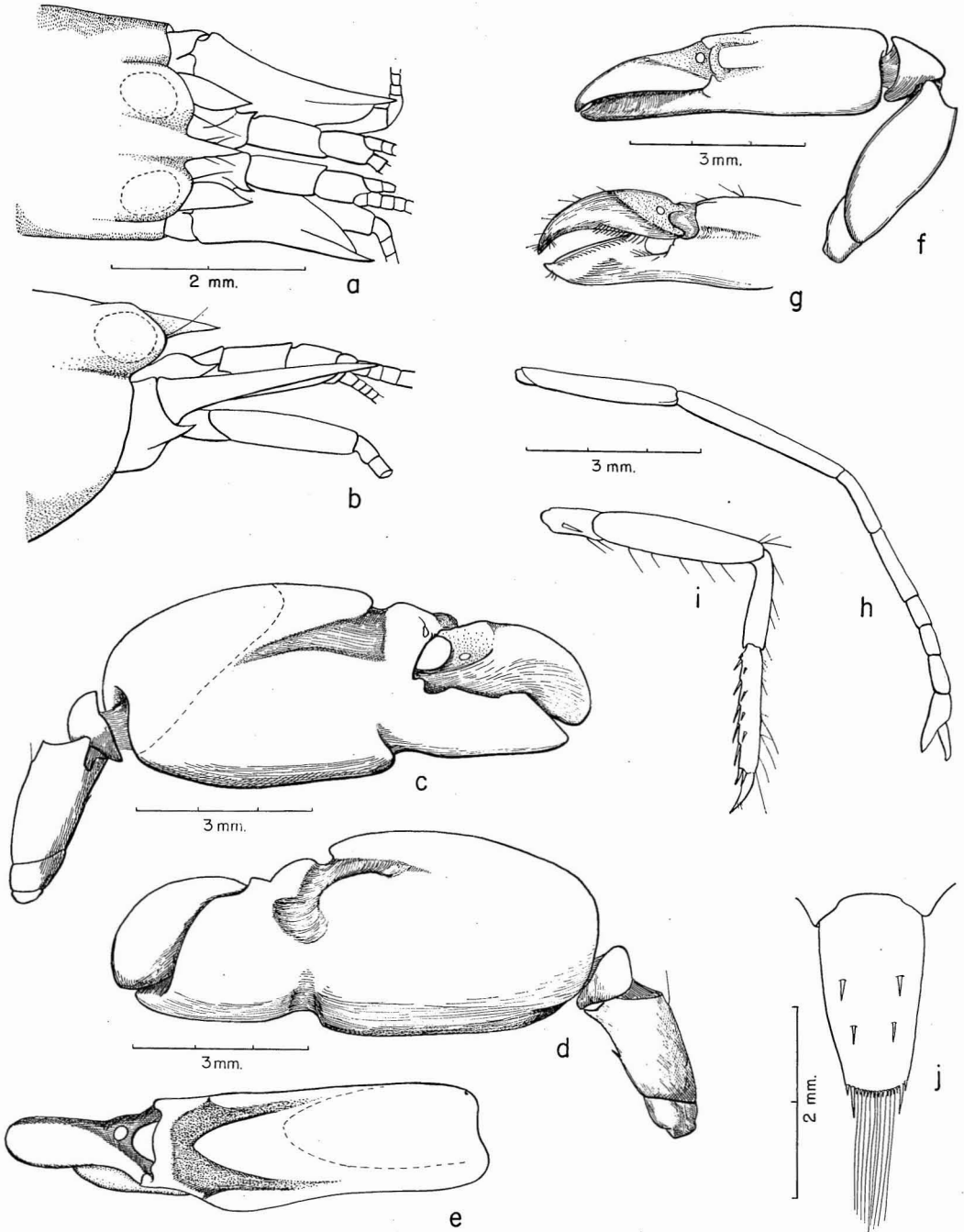


FIG. 21. *Alpheus dolerus* sp. nov. *a, b*, Anterior region, dorsal and lateral aspects; *c, d, e*, large chela, lateral, medial and dorsal aspects; *f, g*, small chela; *h*, second leg; *i*, fourth leg; *j*, telson.

rounded ridge; lateral margins bearing two stiff setae. Orbital hoods rounded, slightly inflated; orbitorostral area depressed, shallow, rounded.

Second antennular article twice as long as broad, slightly longer than first and third articles; lateral spine of stylocerite reaching to end of first antennular article. Lateral spine of basicerite small but acute; tip of spine of scaphocerite reaching beyond end of antennular peduncle; squamous portion of scaphocerite narrow, reaching to end of antennular peduncle; carpoperite slightly shorter than scaphocerite.

Large chela compressed, massive, 2.6 times as long as broad, with fingers occupying distal third. Palm with sculpturing common for group, superior transverse groove continuous with triangular depressed areas on either face; proximal margin of groove, when seen in profile, vertical to margin of palm. Inferior lobe slightly distal to superior groove, strong, and continuing to 0.25 height of palm on outer face; rounded on inner face. Dactylus heavy, compressed, superior margin rounded. Length of merus equal to about 0.5 height of palm, outer face less than 2.5 times as long as broad; inferior internal margin sharp, bearing single movable spine in middle, and distally produced into strong, acute tooth.

Small chela 3.2 times as long as broad, with fingers occupying distal 0.5; palm proximal to adhesive plaque slightly raised, rounded, with shallow depressions on either side; no teeth about digital articulation. Dactylus slender, tapering and curved, with slight trace of setiferous expansion on proximal portion; inner face bearing knife-like ridge that meets corresponding ridge on fixed finger; knife ridges of both fingers paralleled by row of short stiff setae. Merus half as long as chela, slightly over twice as long as broad, bearing movable spine and distal tooth like that of large cheliped on inferior internal margin.

Carpus of second legs with ratio: 10:11:4.2:4.5:5.8.

Ischium of third legs bearing strong mov-

able spine; merus 4.3 times as long as broad, distally unarmed; carpus 0.5 length of merus, superior and inferior margins produced but rounded; propodus 0.7 as long as merus, bearing five strong spines on inferior margin, five smaller spines near margin, two strong spines distally. Dactylus simple, tapering, curved, 0.25 length of merus.

Telson 3.3 times as long as tip is broad, 1.8 times as broad anteriorly as posteriorly; lateral margins slightly concave in posterior third; tip broadly arcuate, larger spines about half as long as tip is broad, tip also bearing series of short spinules above bases of setose bristles; anterior pair of dorsal spines before middle.

Paratype similar to holotype in all characteristics except that length of merus of large chela is approximately equal to height of palm and relatively more slender.

DISCUSSION: The specimens in the paratypic series exhibit the normal and expected variations. In some, especially the smaller specimens, the rostrum is shorter, in one extreme case reaching only to the middle of the visible portion of the first antennular article. On the meri of both chelae the number of spines is variable, from none (especially on the smaller cheliped) to three; in one specimen, of questionable identity because it was small and broken, there are eight movable spines. The large chela itself often is somewhat more slender, in one reaching the maximum of 3.0 times as long as broad. In several specimens the tips of the fingers are calcified and white. The relative lengths of the spines on the propodus of the third legs are also variable, some being shorter and others being longer than those depicted for the type specimen. In the telson of many specimens the margins of the anterior portions are straighter and more parallel, posteriorly the margins are more deeply concave, the tip is relatively narrower.

In one female from the collection that produced the type and allotype the setae, but not the spines, of the telson, uropods and

posterior pleopods were dark, almost black, contrasting with the alcohol-bleached body.

This species plainly belongs to the Edwardsii group of the genus, and can be separated from most other members of the group by the form of the rostrum, the lack of a meral tooth, the simple dactylus of the third legs, and the simple condition of the dactylus of the small chela in both sexes. In the key of de Man (1909: 325) this species comes out to *A. haanii* Ortmann, but the two species cannot be confused because *haanii* bears deep grooves arising both medially and laterally to the orbital hoods that almost encircle the orbital hoods according to de Man's redescription of the type specimen (1897: 751); moreover, the second carpal article is definitely shorter than the first (ratio of 2.3:1.5 instead of 10:11).

This species looks very similar to the specimens which I identify as *A. leptochirus* Coutière. If it were not for the lack of the fringe of setae on the dactylus of the small chela of the male, the two would have been considered to be a single species. In fact, the great similarity renders questionable the use of this fringe of setae as a specific characteristic. However, as there is no evidence, only suspicions, about the validity of this accepted criterion, it was decided to describe this species as new.

The name is derived from the Greek *doleros*—deceptive.

#### *Alpheus parvirostris* Dana

*Alpheus parvirostris* Dana, U. S. Explor. Exped. 13: 551, pl. 35, fig. 3, 1852.

LOCALITIES: Banner, 65 specimens in 9 collections; Cloud, 2 specimens at A-5, 1 at C-7a, 6 at D-5, 2 at Loc. 6.

DISCUSSION: These specimens agree very well with the redescription given by de Man (1911: 432) and with the short original description. There are several minor but noteworthy variations, however. De Man stated that the length of the first carpal article of the

second legs was about twice the length of the second article, whereas in most of these specimens it ranges from 1.5 to 1.8 times as long. The tooth on the inferior margin of the third and fourth legs varies in its development, with that of the fourth legs at times lacking, and that of the third legs quite small; this variation appears to be roughly correlated with size, with the smaller specimens showing a poorer development of the meral tooth. Like de Man's specimens, these specimens showed variation in the relative lengths of the stylocerite, scaphocerite and especially the lateral spine of the basicerite.

Coutière's statement of distribution for this species (1905: 906), that it is found "depuis le cap jusq'aux îles Sandwich. . . ." is not based on any other published record, and the species was not found in the extensive Hawaiian collections previously reported upon (Banner, 1953). It is likely the statement is erroneous.

#### THUNOR

In 1949 Armstrong (1949: 12) erected a new genus *Thunor* for the species described by Schmitt as *Crangon rathbunae* (1924: 74) from the Barbados. He separated *Thunor* from *Alpheus* (*Crangon*) primarily on the basis of four characteristics: 1, The obsolescence of the ocular beak, the anterior projection arising between the bases of the eye stalks. 2, The absence of the cardiac notch, a notch on the posterior margin of the carapace between the attached dorsal region and the bases of the branchiostegites. 3, The lack of anal tubercles, projections on the ventral side of the telson flanking the anus and engaging the inner uropods. 4, The absence of a transverse articulation on the outer uropod. There were also two other characteristics that Armstrong evidently considered as less important: The rostrum was absent and the outer branch of the palp of the first maxilla lacked setae. Otherwise the genus was like *Alpheus* with the large chela like that of the *Obesomanus* group; moreover, the type species, *T. rath-*



*bunae* has an elongation of the antennular peduncle and the extreme reduction of the parts of the antennal base that is also common in the *Obesomanus* group. Armstrong felt that *T. rathbbunae* was most closely related to *A. idiocheles* Coutière (printed *idocheles*, *lapsus calumi*), an unusual species that Coutière placed in the *Megacheles* group with doubts. These two species are closely related; as I am tentatively accepting *Thunor* I am transferring the species *idiocheles* to this genus and adding another species here referred to as *T. species 1*.

To review the validity of this separation I have examined specimens that I consider to be related to *T. rathbbunae*, to *T. idiocheles* or to the *Obesomanus* group. These include specimens identified as *T. idiocheles*, *A. lutini* Coutière, *A. microstylus* (Bate), *A. phrygianus* Coutière, *A. perplexus* and *A. chamorro* and three specimens, possibly belonging to new species, too incomplete for specific identification, *A. species 2*, and *T. species 1*. The characteristics of these species are discussed in their individual sections; here only the way they meet the criteria of Armstrong is considered.

1. The ocular beak. As this characteristic is impossible to see unless the specimen is either distorted in capture or the intact specimen torn apart, I do not feel inclined to ruin one of the small number of specimens representing some species. The character was not examined in *A. lutini*, *A. perplexus*, *A. chamorro*, and *A. species 2*, in the others it is as follows:

*T. idiocheles* and *T. species 1*—lacking.

*A. microstylus*—present but poorly developed.

*A. phrygianus*—present, of moderate development.

2. The cardiac notch. In most specimens this characteristic is difficult to discern because the posterior margin of the carapace is not well defined, and, being transparent, tends to be indistinguishable from the opaque white of the underlying tissues.

*T. idiocheles*, *A. lutini*, *microstylus*, and *chamorro*—cardiac notch present.

*A. phrygianus*—cardiac notch lacking, but dorsal region set off from brachiolegites by an angle.

*A. species 2*—region rounded where cardiac notch should occur.

*T. species 1*—slightly developed cardiac notch in male, margin without notch but angular, not rounded, in female.

3. The anal tubercles. In those species in which they are present, they are well developed in the form of a small papillose structure; otherwise there is no vestige of them.

*T. idiocheles*, *T. species 1*—lacking anal tubercles.

*A. lutini*, *microstylus*, *phrygianus*, *perplexus*, *chamorro*, and *A. species 2*—anal tubercles present.

4. Articulation of the outer uropod. Often this is difficult to see in preserved specimens. It can best be checked by bending the tip of the uropod ventrally and noting whether it bows in a rounded fashion or bends sharply along the line of articulation.

*T. idiocheles*, *T. species 1*—without articulation.

*A. lutini*, *microstylus*, *phrygianus*, *perplexus*, *chamorro*, and *A. species 2*—with articulation.

In this series of species, e.g., *A. species 2* and *T. species 1*, as well as those previously reported, e.g., *A. microstylus*, the presence or absence of the rostrum is variable within the species. In no specimens were the maxillae examined.

To recapitulate Armstrong's criteria: the ocular beak as the basis for working separation appears to be valid but impractical, especially where only a few specimens are available; the cardiac notch appears to be too variable; leaving for the separation of the two genera only the two characteristics, the anal tubercles and articulation of the uropods. If this separation is made, then *T. idiocheles*, and *T. species 1* belong to *Thunor*.

Opposed to this separation would be a series of characteristics, for the species agree well with *Alpheus* for the most part. The ex-



treme form of the rostral front of *T. ratbbunae* is approached in a number of species plainly belonging to *Alpheus* (including *A. species* 2); the peculiar development of the antennules and antennae is approached by many species of the *Obesomanus* group; the large and small chelae are similar to those found in the *Obesomanus* group; there is nothing in the second and subsequent thoracic legs and pleopods that would serve to separate the two genera; even the brachial formula is the same.

I, therefore, am in doubt as to the validity of this separation, and believe that at most the species of *Thunor* should be put into a group or subgroup within the genus *Alpheus*. However, until more closely related species are examined in reference to these differences and similarities in order to better determine the constancy of the differences, I will recognize the genus *Thunor*.

### *Thunor idiocheles* (Coutière)

Fig. 22

*Alpheus idiocheles* Coutière, Fauna and Geog. Mald. and Laccad. 2(4): 883, pl. 75, fig. 21, 1905.

LOCALITIES: Banner, 5 specimens in 4 collections; Cloud, 1 specimen at locality D-7.

DISCUSSION: These specimens agree very well in almost all characteristics with those in Coutière's description. However, there are some variations that should be noted. The rostrum is found to vary slightly in proportions, from a slight triangle to one that reaches as far anteriorly as the rounded anterior end of the stylocerite. In all specimens the rostral carina is marked. The carpopocerite and lateral spine of the scaphocerite in one specimen are equal in length to each other and reach only to the end of the second third of the second article of the antennular peduncle, in other specimens they are unequal with the carpopocerite only reaching to the end of the second antennular article, and in one specimen the spine of the scaphocerite reaches to the end of the second antennular article and the

carpopocerite exceeds it, reaching almost a third the length of the third antennular article. Of the four specimens which retain a large chela, three have a length-breadth ratio of 3, instead of 3.5 as reported by Coutière. The telsons are quite variable, and in none were the posterolateral spines poorly developed as those shown by Coutière. Finally, four of the six specimens have a strong brown spine on the external margin of the outer uropod; the other two have more slight and colorless spines; in none are there two short brown spines as described by Coutière.

Two of the specimens have such markedly dissimilar telsons that they were originally thought to be of a different species. These are the specimens illustrated in the figures. Unfortunately neither specimen has its large chela intact. However, as they agree very well otherwise with intact specimens identified as this species, and as the telsons of the four intact specimens are also variable, it is thought that this difference probably is not of significance. Similar wide variation has been reported by Armstrong in *Thunor ratbbunae* (Schmitt).

Coutière did not remark upon the lack of an articulation in the outer uropod, and, to the contrary, he showed a line that could be interpreted as an articulation in his figures. None of the Saipan specimens has an articulation although some show a slight line starting transversely from the region of the lateral spine, similar to that shown by Coutière. This faint line, possibly a rudimentary articulation, does not reach to the opposite margin in any specimen.

The cardiac notch of the carapace is present and the anal tubercles are lacking in all specimens.

### *Thunor species 1*

Fig. 23

SPECIMENS: An 8.5 mm. male (carapace length 3.7 mm.) lacking large and small chelae, and one of each pair of posterior

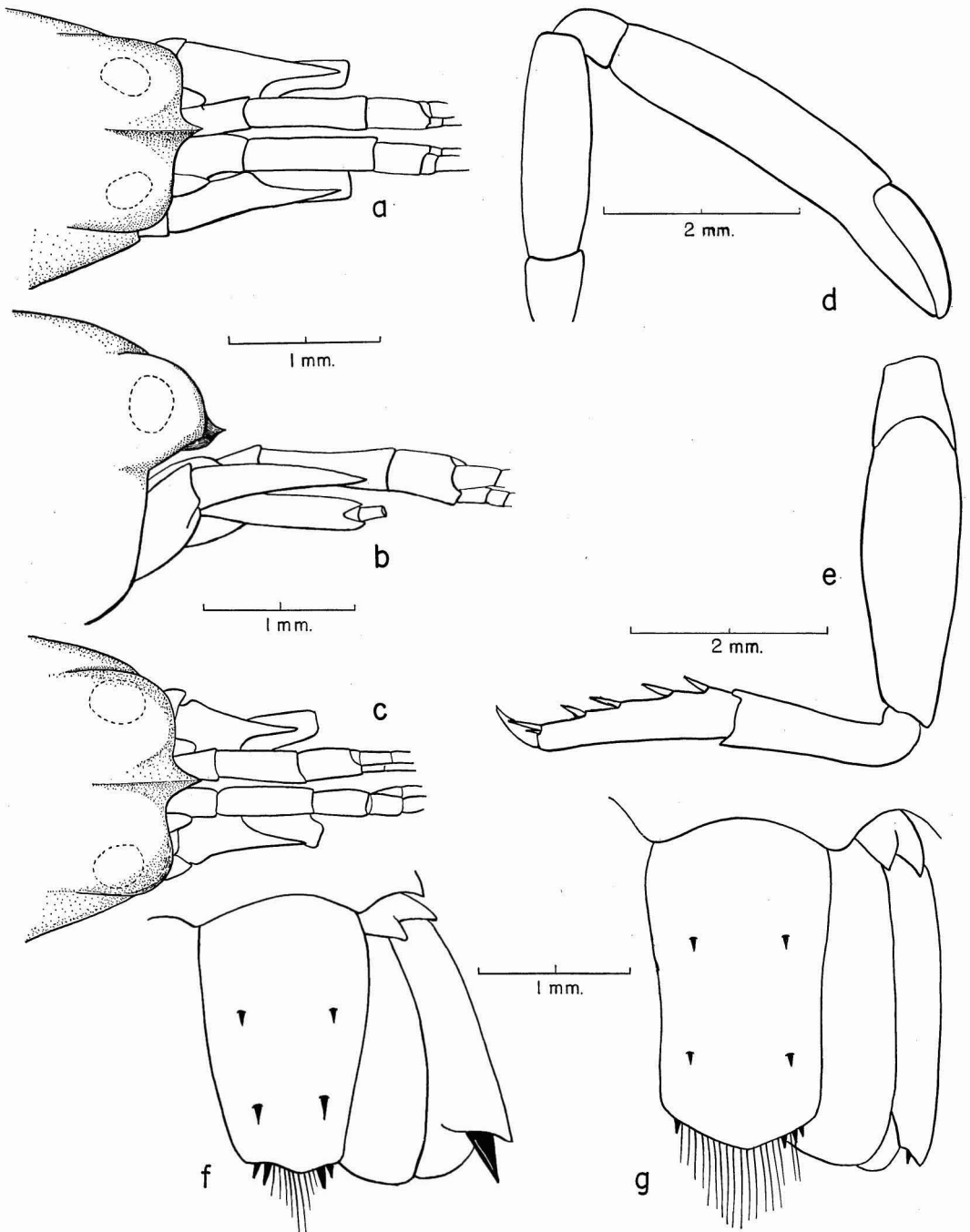


FIG. 22. *Thunor idiocheles* (Coutière), aberrant specimens. *a, b*. Anterior region, dorsal and lateral aspects, male; *c*, same, female; *d*, small cheliped, female; *e*, third leg, male; *f*, telson and uropod, male; *g*, telson and uropod, female.

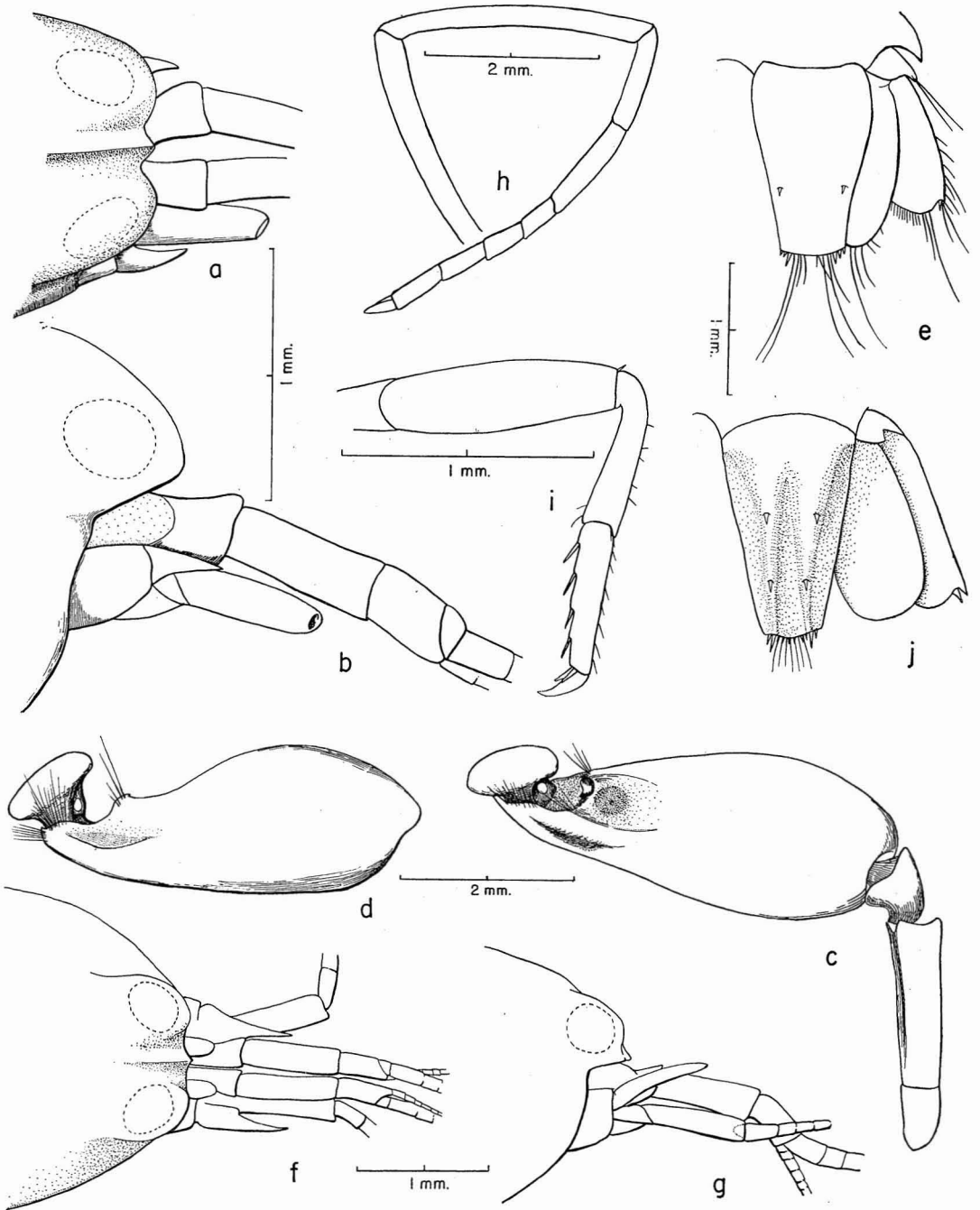


FIG. 23. *Thunor* species 1. *a-e*, Female: *a*, *b*, anterior region, dorsal and lateral aspects; *c*, *d*, large cheliped; *e*, telson and uropod. *f-j*, Male: *f*, *g*, anterior region, dorsal and lateral aspects; *h*, second leg; *i*, third leg; *j*, telson and uropod.

thoracic legs; a 10.4 ovigerous female (carapace length 3.9 mm.) lacking all thoracic legs except the large chela, basal articles of 2nd and 4th legs, and 5th legs. Specimens collected at the same time by A. H. Banner.

**DESCRIPTION:** Body heavy, with cephalothorax markedly heavier than abdomen; thoracic legs long and heavy. (Because of the differences between the male and the female the descriptions will be given separately.)

*Male.* Anterior carapace rounded and depressed in lateral view. Orbital hoods inflated, rounded anteriorly, and higher in lateral view than interorbital area. Rostrum small, triangular, acute, and bearing a low but sharp carina that extends posteriorly to behind orbital hoods. Margin of carapace between anterior orbital hoods and rostrum almost straight.

Antennular peduncle long and slender, with second article 4 times as long as broad and about twice as long as visible portion of first and third articles (third article slightly longer than first). Stylocerite rounded, reaching only 0.5 length of visible portion of first article. Outer flagellum 1.1 times as long as peduncle, inner flagellum slightly longer than outer.

Basicerite unarmed. Scaphocerite reduced, with tip of lateral spine reaching only to middle of second antennular article; blade almost rudimentary, reaching only to end of first antennular article. Carpocerite reaching end of second antennular article. Flagellum long, about 2.5 times as long as outer antennular flagellum.

Carpal articles of second legs with the ratio: 10:12:4.5:5.2:6.0. Chela as long as basal carpal article, with fingers occupying only distal 0.3.

Third legs with ischium unarmed. Merus unarmed, 3.5 times as long as broad. Carpus with superior distal margin projecting as a heavy rounded tooth, inferior margin unarmed; 0.57 as long as merus. Propodus 0.64 length of merus, 4 times as long as broad proximally, and tapering distally; armed with four strong spines on inferior margin and two

distally. Dactylus simple, curved, slightly less than 0.3 the length of propodus.

Pleura of anterior abdominal somites rounded. Uropods of usual form and armature except strong spine of outer uropod brown and outer uropod without trace of distal articulation. Telson 4.0 times as long as posterior margin is broad, 2.5 times as broad anteriorly as posteriorly; lateral margins almost straight, posterior lateral corners rounded, posterior margin slightly arcuate. Anterior pair of spinules 0.4, posterior pair 0.7 of length of telson posterior of articulation; posterior lateral pairs of spinules of moderate development; central tuft of setae of usual form but short, and telson bearing at bases of setae a series of short spinules. Dorsal surface of telson without usual uniform convexity, but bearing two low rounded ridges that merge anteriorly.

*Female.* Orbital hoods similar in form to those of male. Rostrum slightly asymmetrical, rounded; dorsal carina higher and more rounded than in male. Margin of carapace between orbital hoods and rostrum not straight but with rounded and asymmetrical indentations.

Antennular peduncle similar to that of male except stylocerite concealed by carapace in dorsal view. Flagellar lengths about same as in male.

Basicerite unarmed, rounded. Scaphocerite extremely reduced, a simple, heavy, acute triangle, with tip reaching almost to end of first antennular article. Carpocerite reaching only slightly past middle of second antennular article. Flagella broken.

Large chela slightly compressed at base, with rounded margins; 2.7 times as long as greatest width, strongly tapering towards fingers. Dactylus hammer-shaped, with length of "head" about 0.2 length of entire chela. Fixed finger rounded, hardly extending beyond articulation of dactylus, much shorter than dactylus and not meeting in apposition. Palm of large chela with two rounded ridges distally leading towards palmar adhesive plaque; adhesive plaque borne on eminence

that is proximally delimited by deep, rounded concavity that accommodates end of "head" of dactylus when dactylus is flexed. Palm also bearing shallow, triangular depression or groove near dactylar articulation; corresponding area on inner face marked by much less extensive depression. Merus of cheliped 4 times as long as outer face is broad, unarmed.

Outer uropod short, abruptly truncate; spine at termination of outer shoulder poorly developed; ramus with small distal triangle that appears to have resulted from a fracture, not an articulation; tip bearing only few long setae. Inner uropod of usual form but with only occasional long setae. Telson 2.9 times as long as tip is broad, 1.8 times as broad anteriorly as posteriorly; lateral margins anteriorly convex, posteriorly slightly concave, slightly asymmetrical; posterior lateral corners rounded; tip very slightly arcuate; superior surface smooth, armed with but a single pair of spines of feeble development located 0.7 of the length posterior to articulation; on tip three pairs of spines and two pair only of long setae adjacent to spines, three shorter setae on left, two on right, middle of tip devoid of all setae.

Eggs without developing larvae, subspherical, 0.6 mm. diameter.

DISCUSSION: These two fragmentary specimens are perplexing. The question arises as to whether they are of the same species. The general form of the anterior carapace, the antennules, the few appendages that they have in common, are similar, yet there are marked differences in the rostrum, in the scaphocerite and especially in the telson and uropods. Unfortunately, because of the fragmentary condition of the specimens, comparison cannot be made in the thoracic legs. In view of the considerable variation that has been noted in the species of *Thunor* and in related Obesomanus group of the genus *Alpheus*, in view of the general similarities noted, and especially in view of the fact that this pair, male and female, were collected together and may have been therefore a cohabiting pair, I be-

lieve that they represent a single species and their differences are individual variations.

The lack of anal tubercles and the lack of the articulation on the outer uropod place this species in the genus *Thunor*. These two fragmentary specimens can be distinguished from *T. idiocheles* (Coutière) in the proportions of the antennular peduncle, the greater reduction of the scaphocerite and, most important, in the depression on the palm of the large chela behind the dactylar articulation and the pronounced hammer-shape of the dactylus of this appendage. This species can be distinguished from the Caribbean *T. rathbunae* by the presence of a rostrum. Another specimen of this species, more complete, is available in another collection, and with that as the type the species will be described and named in a later paper.

#### REFERENCES

- ARMSTRONG, JOHN C. 1949. New Caridea from the Dominican Republic. *Am. Mus. Novitates* No. 1410: 1-27, fig. 1-9.
- BANNER, ALBERT H. 1953. The Crangonidae, or snapping shrimp, of Hawaii. *Pacific Sci.* 7(1): 1-147.
- BATE, C. SPENCE. 1888. Report on the Crustacea *Macrura* dredged by H.M.S. Challenger during the years 1873-76. In: *The Voyage of H.M.S. Challenger, Zoology* 24. xc + 942 [157 pls. in separate vol.]. Great Britain and Ireland, London, Edinburgh and Dublin.
- BOONE, LEE. 1935. Scientific results of the world cruise of the yacht "Alva" 1931, William K. Vanderbilt, Commanding. Crustacea. . . . *Vanderbilt Mar. Mus., Bul.* 6: 1-264, 96 pls.
- BORRADAILE, L. A. 1898. On Some Crustaceans from the South Pacific. Part III, *Macrura*. *Zool. Soc. London, Proc.* 1898: 1000-1015, pls. 63-65.
- CHACE, FENNER A., JR. 1955. Notes on shrimps from the Marshall Islands. *U. S. Natl. Mus., Proc.* 105(3349): 1-22.

- CLOUD, PRESTON E., JR. 1956 (?). Geology of Saipan. *U. S. Geol. Survey Prof. Paper*. 280 [in press].
- COUTIÈRE, HENRI. 1896. Note sur quelques genres nouveaux ou peu connus d'Alphéidés, formant la sous-famille des Alphéopsidés. *Paris Mus. d'Hist. Nat., Bul.* 2(8): 380-386.
- 1897a. Note sur quelque Alphéidés nouveaux ou peu connus rapportés de Djibouti. *Paris Mus. d'Hist. Nat., Bul.* 3(6): 233-235.
- 1897b. Note sur quelque Alphéés nouveaux. *Paris Mus. d'Hist. Nat., Bul.* 3(7): 303-306.
- 1899. Les "Alpheidae," morphologie externe et interne, formes larvaires, bionomie. Thèses présentées à la Faculté des Sciences de Paris. . . . Sér. A, No. 321 [No. d'Ordre 980]. 599 pp., 409 text figs., 6 pls. Masson et Cie., Paris. [Also in: *Ann. Sci. Nat.* VIII, Zool. 9: 1-560.]
- 1902. Sur quelques espèces nouvelles du genre Automate de Man. *Paris Mus. d'Hist. Nat., Bul.* 8(6): 337-342.
- 1903. Note sur quelques Alpheidae des Maldives et Laquedives. *Soc. Philomath. Paris* IX, 5(2): 72-90.
- 1905. Marine Crustacea, XV. Les Alpheidae. In: *Fauna and Geography of the Maldive and Laccadive Archipelagoes*. [J. Stanley Gardiner, ed.] Vol. 2, pt. 4, pp. 852-921, pls. 70-87, text figs. 127-139. University Press, Cambridge. [Vol. dated 1906.]
- 1909. The American species of snapping shrimp of the genus *Synalpheus*. *U. S. Natl. Mus., Proc.* 36: 1-93, text figs. 1-54.
- DANA, JAMES D. 1852<sup>3</sup>. Crustacea. In: *United States Exploring Expedition, During the Years 1838, 1839, 1840, 1841, 1842, under the Command of Charles Wilkes, U.S.N.* Vol. 13, viii + 685. [Folio Atlas of 96 plates published in 1855.]
- date of publication of Dana's volume on the Crustacea. L. B. Holthius has pointed out to me in a personal communication that this is only the date that the U. S. Printing Office delivered 58 official copies of the work to the Department of State, and that the unofficial copies must have been distributed earlier, for the *American Journal of Science* (Ser. 2, 15: 466, 1853) acknowledges the receipt of this volume in December, 1852. Therefore the generally accepted date of publication, 1852, is the correct one.
- Dr. Holthius also pointed out that the part of volume 6 of the proceedings of the Academy of Natural Sciences, Philadelphia, that carries Dana's "Conspectus Crustaceorum etc.," and which bears the volume date of 1854, must have been published by May, 1852 (*op. cit.* 6(3): 71, 72), so for questions of priority for Dana's species, this earlier date should be used.
- DE MAN, JOHANNES GOVERTUS. 1888. Bericht über die von Herrn Dr. J. Brock im Indischen Archipel gesammelten Decapoden und Stomatopoden. *Arch. f. Naturgesch.* 53(1): 215-600.
- 1897. Bericht über die Herr Schiffscapitän Storm zu Atjeh, an den westlichen Küsten von Malakka, Borneo und Celebes sowie in der Java See gesammelten Decapoden und Stomatopoden. Fünfter theil. *Zool. Jahrb., Abt. f. System., Geog. u. Biol. Tiere* 9: 725-790 [plates, vol. 10, pls. 12-14]
- 1902. Die von Herrn Professor Kükenthal im Indischen Archipel gesammelten Decapoden und Stomatopoden. In: Kükenthal, W., Ergebnisse einer zoologischen Forschungsreise in den Molukken und Borneo. *Senckenb. Naturf. Gesell., Abhandl.* 25: 467-929, pl. 19-27.
- 1909. Note sur quelques espèces du genre *Alpheus* Fabr. appartenant au Group Brevirostris. *Soc. Zool. de France, Mém.* 22: 146-164, pls. 7-8.
- 1910. Diagnoses of new species of macrurous decapod Crustacea from the "Siboga Expedition" V. *Ned. Dierk. Ver., Tijdschr.* II, 11(4): 287-319.
- 1911. The Decapoda of the Siboga Expedition. Part II. Family Alpheidae. In: *Siboga Expeditie* 39a<sup>1</sup> (2): 133-327 [Livre 60]; 1915, Supplement [plates and explanations] 39a<sup>1</sup> (2): 23 pls. [Livre 74].
- FABRICIUS, JOHANN C. 1798. *Supplementum*

<sup>3</sup> In my 1953 paper (p. 1) I noted that Haskell, in his study of the reports of the U. S. Exploring Expedition, considered that February, 1853, was the official

- Entomologia systematica emendata et aucta*. . . . 572 pp. Hafniae [Copenhagen].
- HELLER, CAMIL. 1861. Beiträge zur Crustaceen-Fauna des Rothen Meeres. K. *Acad. Wiss. Wien, Sitzungber.* 44: 241-295, 3 Taf.
- HILGENDORF, FRANZ MARTIN. 1878. Die von Herrn W. Peters in Moçambique gesammelten Crustaceen. K. *Akad. Wiss. Berlin, Monatsber.* 1878: 782-851, 4 Taf.
- INTERNATIONAL COMMISSION OF ZOOLOGICAL NOMENCLATURE. 1955. Opinion 334, Validation, under Plenary Powers, of the generic names Crangon Fabricius 1798, and Alpheus Fabricius 1798 (Class Crustacea, Order Decapoda). *Opinions and Declarations Rendered by the International Commission on Zoological Nomenclature* [Francis Hemming, ed.] 10(1): 1-44.
- MILNE EDWARDS, HENRI. 1837. *Histoire naturelle des crustacés, comprenant l'anatomie, la physiologie et la classification de ces animaux*. Tome II. 532 pp. Roret, Paris.
- RAMADAM, M. M. 1936. Report on a collection of Stomatopoda and Decapoda from Ghardaqa, Red Sea. *Egypt. Univ., Fac. Sci., Bul.* (6): 1-43, pls. 1-2.
- RANDALL, JOHN W. 1839. Catalog of the Crustacea brought by Thomas Nuttall and J. K. Townsend from the west coast of North America and the Sandwich Islands. . . . *Acad. Nat. Sci. Phila., Jour.* 8(1): 106-147.
- SCHMITT, WALDO L. 1924. Report on the Macrura, Anomura and Stomatopoda collected by the Barbados-Antigua Expedition from the University of Iowa in 1918. *Iowa Univ., Studies in Nat. Hist.* 10(4): 65-99, pls. I-V.
- STIMPSON, W. 1861. Prodrômus descriptionis animalium evertibratorum, quae in expeditione ad Oceanum Pacificum Septentrionalem. . . . Pars VIII. Crustacea Macrura. *Acad. Nat. Sci. Phila., Proc.* 12: 22-47. [Proc. for 1860.]
- TATTERSALL, WALTER M. 1921. Report on the Stomatopoda and macrurous Decapoda collected by Mr. Cyril Crossland in the Sudanese Red Sea. *Linn. Soc. London, Jour., Zool.* 34: 345-398, pls. 27, 28.