

## *Bannereus anomalus*, New Genus, New Species, a Deep-Sea Alpheid Shrimp from the Coral Sea<sup>1</sup>

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**ABSTRACT:** An alpheid shrimp, *Bannereus anomalus*, new genus, new species, from the Marian Plateau in the Coral Sea is described here. The shrimps are associates of hexactinellid sponges from depths of about 350 m, an alpheid association not previously recorded. They are unusual, among the Alpheidae, in that they possess mandibles without palps. The genus is named in honor of the late Professor A. H. Banner in recognition of his great contribution to the systematics of the family Alpheidae.

THE FISHERIES DIVISION of the Commonwealth Scientific and Industrial Research Organisation carried out a survey of the benthic resources of the Marian Plateau, off the southern end of the Great Barrier Reef, in the Coral Sea, in November 1985. A single example of an alpheid shrimp was collected in the course of this survey, from a depth of 345–350 m, from inside a hexactinellid sponge.

The family Alpheidae contains species in several genera that are associates of a wide variety of marine invertebrates and also of fish. In the Indo-West Pacific region hosts in these associations include Porifera (*Synalpheus*), Scleractinia (*Racilius*, *Alpheus*, *Synalpheus*), Hydroida (*Synalpheus*), Annelida (*Salmones*), Mollusca (*Alpheus*), Crustacea (*Aretopsis*), Echinoderma (*Athanas*, *Synalpheus*), and Ascidiacea (*Synalpheus*). So far, no alpheid shrimps have been reported in association with a member of the phylum Hexactinellida.

In its general appearance, the shrimp showed a close resemblance to the genus *Batella* Holthuis, a genus known only from Australian and Japanese waters. Originally described by Bate (1888) for *Cheirothrix parvimanus*, *Batella* was designated as a new

genus by Holthuis (1955), since *Cheirothrix* was a preoccupied name. A second species of *Batella*, *B. bifurcata*, was subsequently described by Miya and Miyake (1968). Both species are known only by the holotype specimens.

Detailed examination of the mouthparts showed that the mandible, with well-developed molar and incisor processes, was without a palp, a feature known to occur in only two previously described alpheid genera (*Batella* and *Prionalpheus*). A new genus is now designated for this genus, which raises to 11 the number of alpheid genera now known to occur in Australian seas.

### *Bannereus*, NEW GENUS

**DEFINITION:** A small-sized alpheid shrimp with body subcylindrical, slightly compressed, smooth. Rostrum obsolete; supra-, extra-, and infracorneal spines absent. Cornea of eyes dorsally covered by anterior carapace, orbital hoods feebly developed; pterygostomial angle rounded; cardiac notch distinct. Abdomen with pleura bluntly rounded, posteroventral angle of sixth segment not articulated. Telson with two pairs of small dorsal spines, posterior margin rounded with two pairs of spines laterally; anal tubercles absent.

Antennal peduncles normal, statocyst present, stylocerite well developed, stout; scaphocerite normally developed.

Mandible without palp, molar and incisor processes normal. Maxillula with setose palp,

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upper lacinia broad, lower lacinia slender. Maxilla with short setose palp; basal endite broad, bilobed; coxal endite reduced, simple. Maxillipeds normal, with epipods and exopods, third maxilliped with small arthrobranch.

First pereopods with robust chelae, markedly unequal and dissimilar, major chela with fingers lacking molar process and fossa, but lateral cutting edge of dactyl strongly thickened, fitting into longitudinal groove on fixed finger. Second pereopods feeble and slender, subequal; carpus five-segmented, fingers characteristically setose. Ambulatory pereopods robust, dactyls with accessory teeth. All pereopods without epipods.

Pleopods and uropods normal.

TYPE-SPECIES: *Bannereus anomalus*, new species.

SYSTEMATIC POSITION: *Bannereus* is most closely related to the genus *Batella* Holthuis, 1955, as rediagnosed by Miya and Miyake (1968), as it is without an articulated posteroventral plate on the sixth abdominal segment, lacks a mandibular palp, and is without epipods on any of the pereopods.

*Bannereus* may be readily distinguished from *Batella*, of which two similar species are known, by the absence of an acute rostral process, sharply pointed orbital hoods, and an acutely pointed pterygostomial angle to the carapace. Other features that distinguish *Bannereus* from *Batella* are the presence of a distinctly dentate incisor mandibular process, laterally unarmed basicerite, short, relatively blunt stylocerite, broadened upper lacinia to maxillula, unenlarged palp on first maxilliped, normal epipod on second maxilliped, merus and ischium of first pereopods without ventral carinae, chelae of second pereopod normal, with characteristic setal brushes not as in *Batella*, propods of fifth pereopods without transverse rows of setae distolaterally, exopods of uropod not distally rectangular.

ETYMOLOGY: The genus is named in honor of the late Professor A. H. Banner, in recognition of his contribution to the systematics of the Alpheidae between the years 1953 and 1986.

### *Bannereus anomalus*, NEW SPECIES

Figures 1-6

MATERIAL EXAMINED: (1) 1 ovigerous ♀, Marian Plateau, Coral Sea, 22°35.3'S, 153°46.7'E to 22°36.3'S, 153°50.0'E, 345-350 m, F.V. *Soela* Cr. 0685, Stn. 4, 17 November 1985, coll. A. J. Bruce; (2) 1 damaged ♂, 360 m, F.V. *Craigmin*, Stn. 19, 23°36.35'S, 152°43.2'E, 360 m, 30 September 1980.

DESCRIPTION: A small-sized alpheid shrimp. General body form robust, subcylindrical, with surfaces smooth and glabrous.

Rostrum obsolete, frontal margin broadly rounded in female, slightly angulated in male, with ventromedial thickening. Orbital hoods feebly developed, without corneal or supra-corneal teeth; extracorneal and inferior orbital teeth absent; anterolateral margin of branchiostegite broadly rounded; cardiac notch distinct.

Abdomen with pleura of first five segments broadly rounded, unarmed, larger in female than male. Sixth segment subequal to length of fifth, about 1.0 and 1.5 times longer than deep in male and female respectively; posterolateral angle produced, posteroventral angle feebly produced, nonarticulated. Telson about 1.8 of sixth somite length, about 1.7 times longer than anterior width with lateral borders feebly convex, convergent to truncate posterior border, equal to about 0.27 of anterior width; two pairs of small marginal dorsal spines present at 0.77 and 0.9 of telson length; posterior border with two pairs of spines laterally, outer spines about 0.5 of length of inner spine, inner spine equal to about 0.12 of telson length, central portion feebly convex without median point, setose.

Eyes with corneal region well pigmented, completely covered by anterior carapace in dorsal view.

Antennular peduncle short, robust; proximal segment about 2.0 times longer than distal width, with strong ventromedial tooth; stylocerite robust, short, not reaching distal border of segment; statocyst present, without statolith; intermediate and distal segments short, together subequal to length of proximal segment. Upper flagellum of female short,

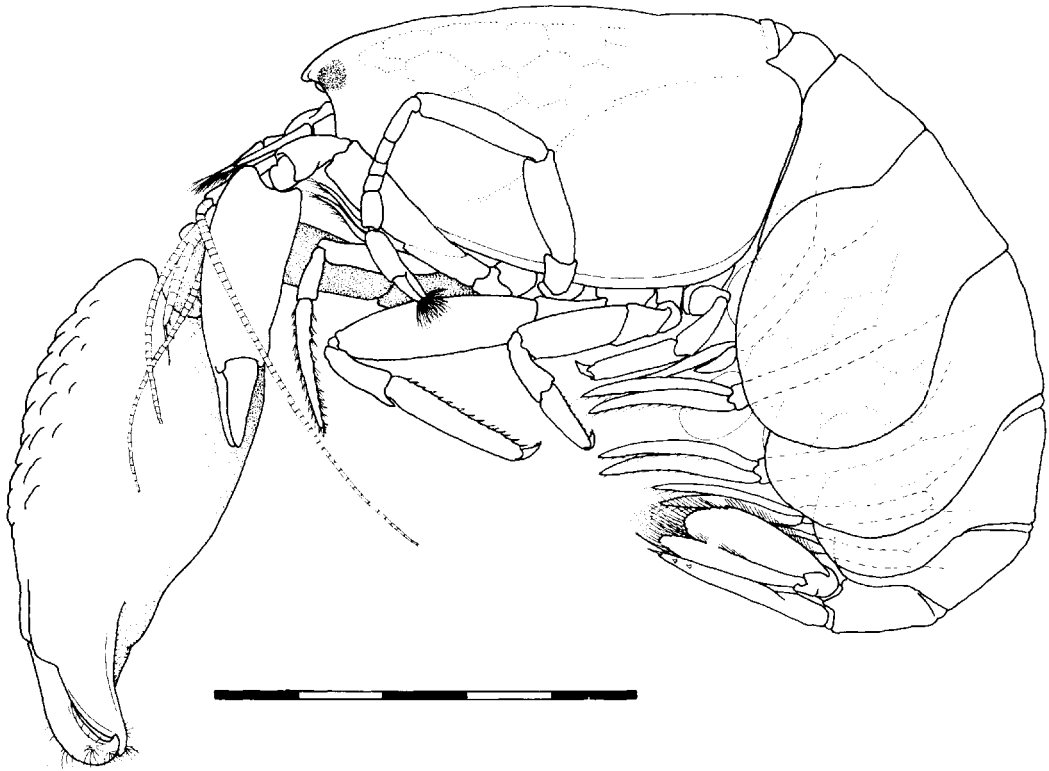


FIGURE 1. *Bannereus anomalus* gen. nov., sp. nov., holotype female, Marian Plateau, Queensland, Australia, 345–350 m. Scale in mm.

biramous, with rami fused for 5 proximal segments, shorter ramus with 6 segments, longer ramus with about 23 segments; lower flagellum slender with about 35 segments. Upper flagellum of male with 4 fused segments and shorter ramus with 3 free segments.

Antenna normal, coxal segment with conspicuous medial process; basicerite unarmed; carpocerite slender, about 9.6 times longer than wide, extending well beyond scaphocerite, flagellum short, slender, subequal to carapace length. Scaphocerite small, about 2.0 times longer than broad, lateral border feebly convex with small, blunt distolateral tooth, lamella reaching to about 0.8 of carpocerite length.

Mouthparts (male): Mandible moderately robust, without palp, molar process obliquely truncate distally with low blunt teeth, fringed with short setae; incisor process broad, distally truncate with seven or eight acute teeth.

Maxilla with slender angulated palp, feebly bilobed, distal lobe with two (three?) short simple setae, proximal lobe with longer setulose seta; upper lacinia broadly expanded with numerous short spines laterally blending with setae medially; lower lacinia slender, with several spinose setae distally. Maxilla with short simple palp with setulose terminal seta and several short setae on medial border; basal endite broad, bilobed, distal lobe larger than proximal, medial borders densely setose; coxal endite reduced, simple, without setae; scaphognathite normal, about 3.0 times longer than broad, posterior lobe half width of anterior. First maxilliped with large, broad, unsegmented palp, with short setae on central medial border; basal endite broad, densely setose medially; coxal endite reduced, sparsely setose; exopod with well-developed flagellum, with small narrow caridean lobe proximally; epipod large, triangular. Second maxilliped

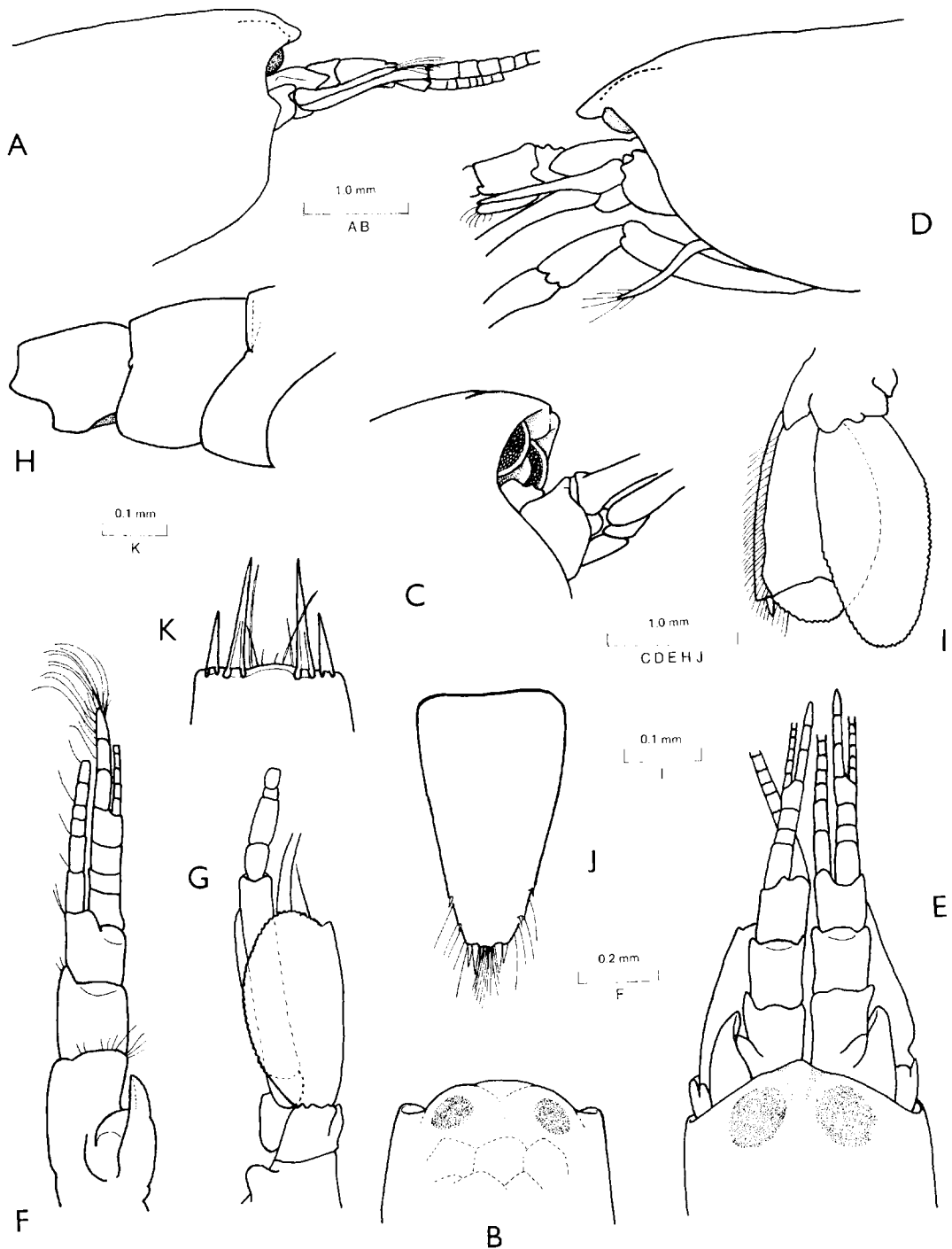


FIGURE 2. *Bannereus anomalus* gen. nov., sp. nov. *A*, anterior carapace and antennae, lateral. *B*, anterior carapace dorsal. *C*, anterior carapace, eyes and basicerite, oblique, ventrolateral. *D*, anterior carapace, bases of antennae and third maxilliped, lateral. *E*, anterior carapace and antennae, dorsal. *F*, antennule. *G*, antenna. *H*, fourth, fifth, and sixth abdominal segments, lateral. *I*, uropod. *J*, telson. *K*, posterior telson spines. *A*–*C*, holotype female; *D*–*K*, male.

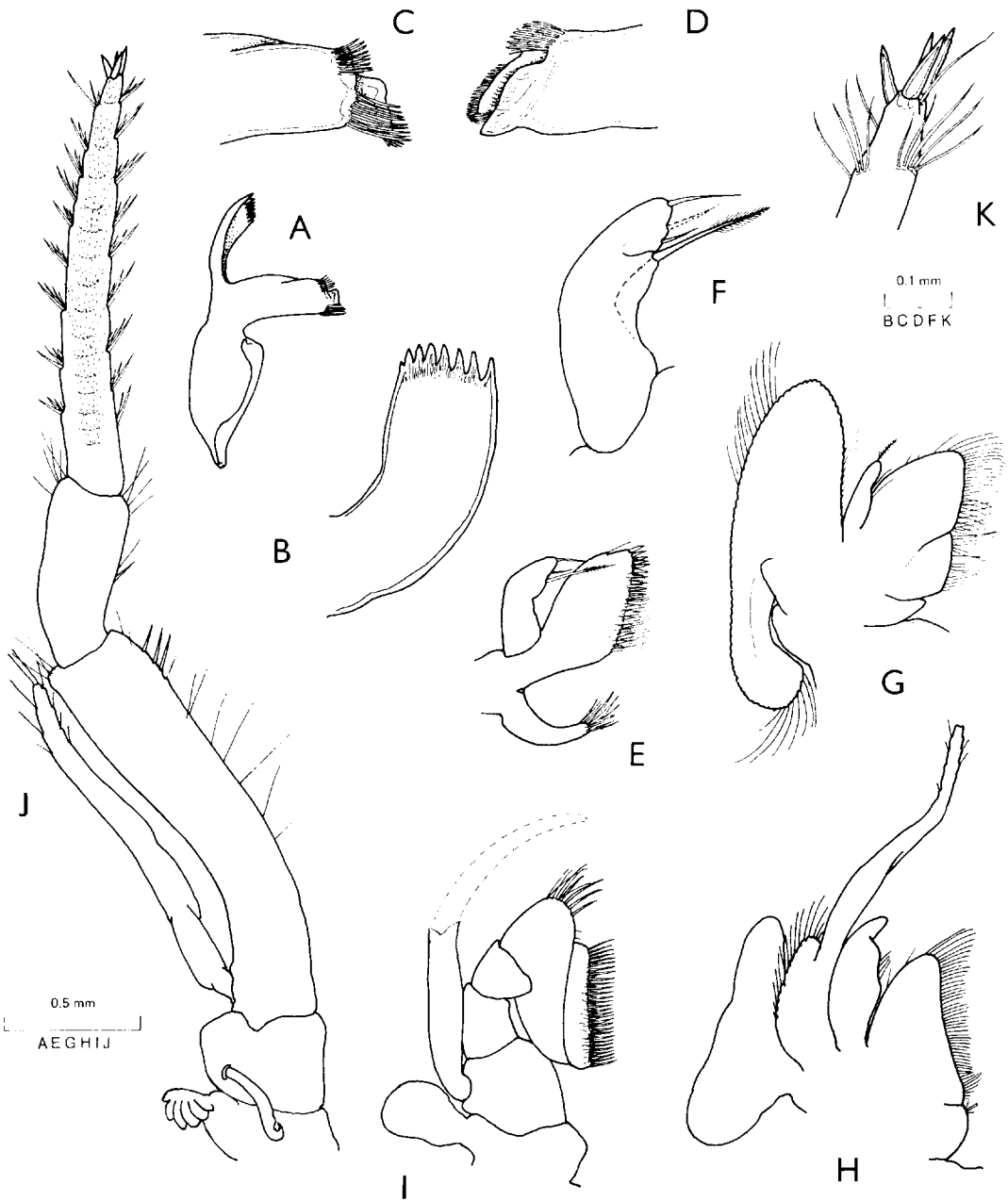


FIGURE 3. *Bannereus anomalus* gen. nov., sp. nov., male. *A*, mandible. *B*, same, incisor process. *C*, *D*, right and left molar processes. *E*, maxillula. *F*, same, palp. *G*, maxilla. *H*, first maxilliped. *I*, second maxilliped. *J*, third maxilliped. *K*, same, tip of terminal segment.

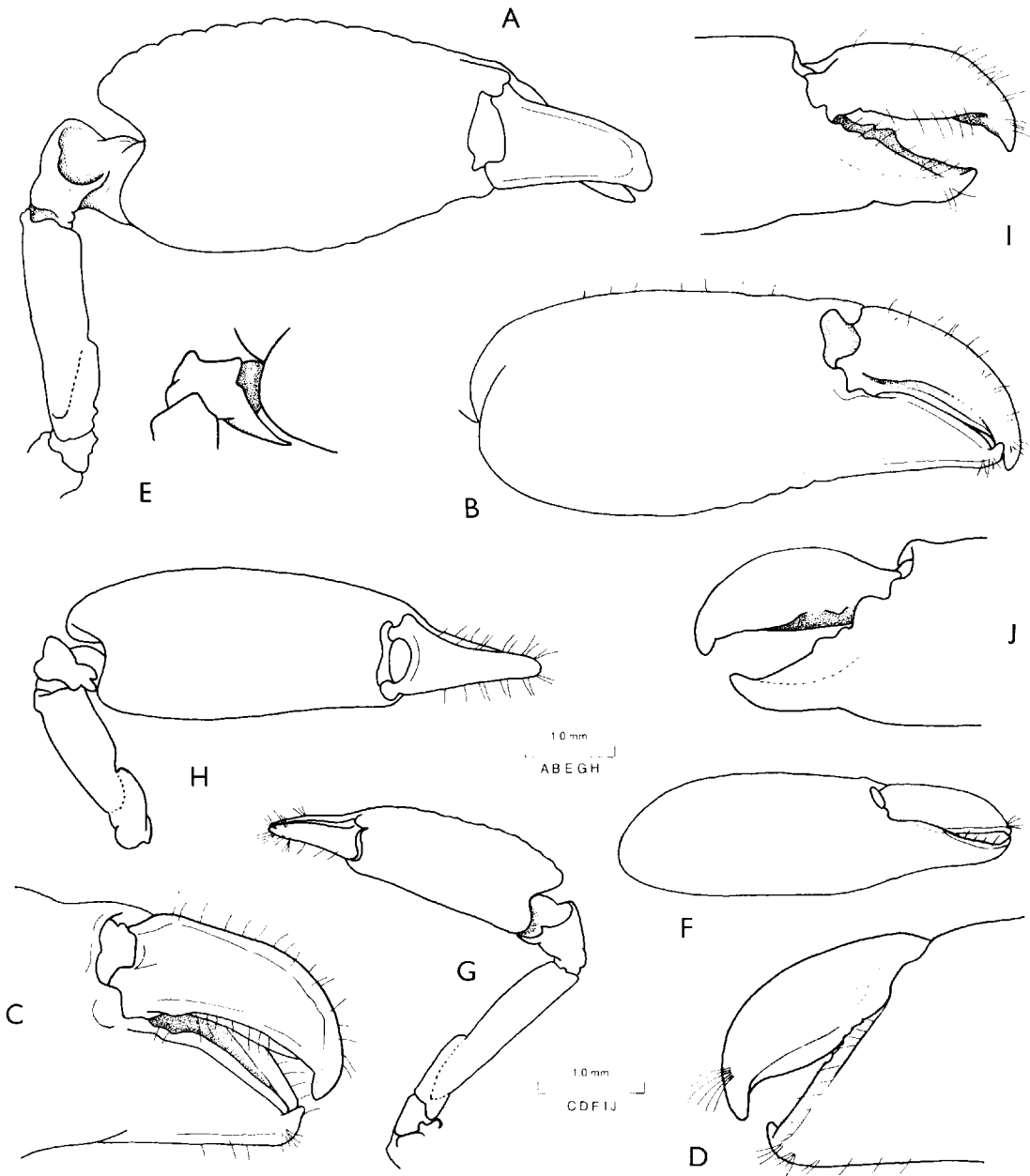


FIGURE 4. *Bannereus anomalus* gen. nov., sp. nov. A, first pereiopod, major. B, same, chela, medial aspect. C, same, fingers, medial. D, same, lateral. E, same, carpus, lateral. F, chela of minor first pereiopod. G, minor second pereiopod. H, same fingers, medial. I, same, lateral. A–F, holotype female; G–I, male.

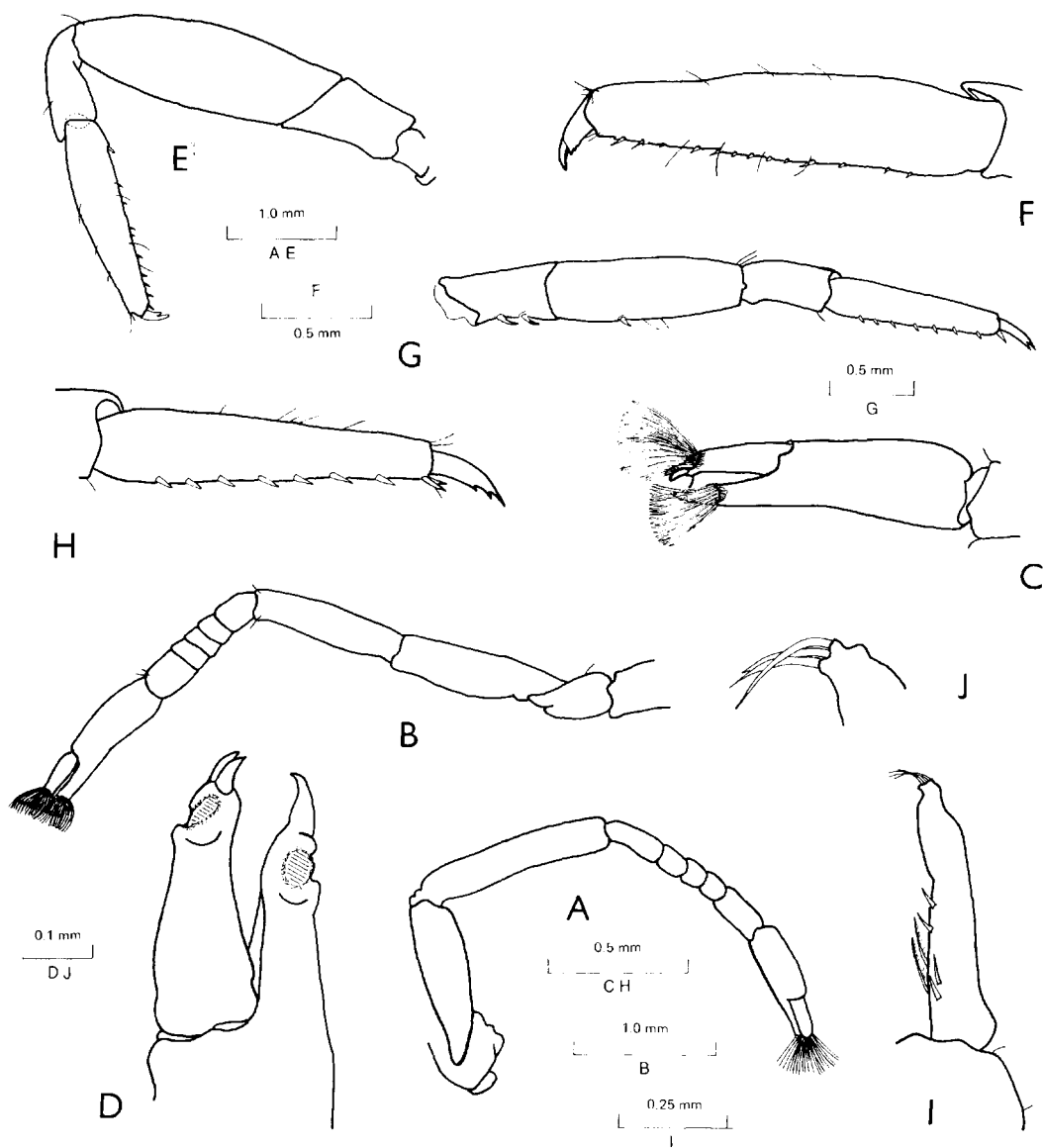


FIGURE 5. *Bannereus anomalus* gen. nov., sp. nov. A, second pereiopod. B, same. C, same, chela. D, same, fingers. E, third pereiopod. F, same, propod and dactyl. G, fifth pereiopod (?). H, same, propod and dactyl. I, first pleopod. J, same, distal end. A, E, F, female holotype; B, D, G, J, male.

normal; distal segment of endopod narrow, strongly spinose medially, ischiomerus short, basis large and broad, exopod flagellum well developed, coxa feebly produced medially, with oval epipod laterally. Third maxilliped with endopod well developed, exceeding basicerite by penultimate and terminal seg-

ments. Antepenultimate segment consisting of fused ischiomerus and basis, bowed, slightly expanded distally, about 4.5 times longer than distal width, medial border sparsely setose with three spines distally; penultimate segment about 2.3 times longer than distal width, sparsely setose, with single spine medi-

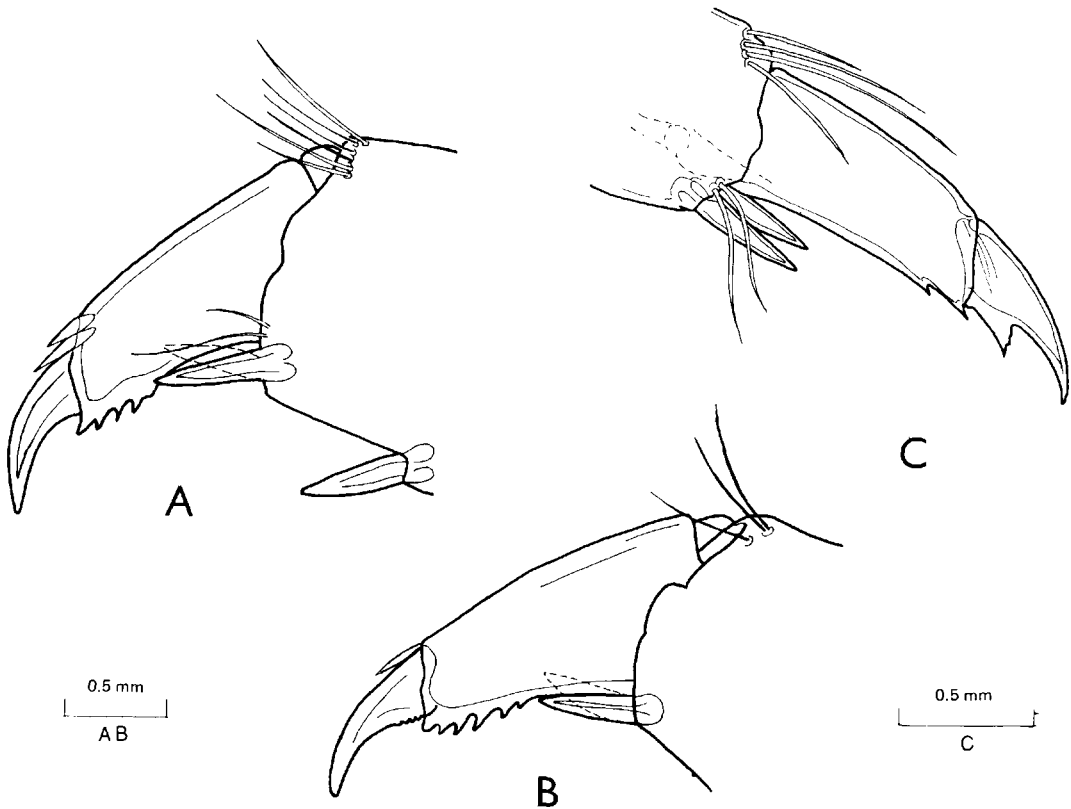


FIGURE 6. *Bannereus anomalus* gen. nov., sp. nov. A, dactyl, third pereopod. B, same, fifth pereopod. C, dactyl of (?) fifth pereopod. A, B, holotype female; C, male.

TABLE I

BRANCHIAL FORMULA FOR *Bannereus anomalus*

BRANCHIAL	MAXILLIPEDS			PEREIOPODS				
	1	2	3	1	2	3	4	5
Pleurobranchs	-	-	-	+	+	+	+	+
Arthrobranchs	-	-	+	-	-	-	-	-
Podobranchs	-	-	-	-	-	-	-	-
Mastigobranchs	-	-	-	-	-	-	-	-
Epipods	+	+	±	-	-	-	-	-
Exopods	+	+	+	-	-	-	-	-

ally; terminal segment subequal to antepenultimate, about 8.0 times longer than proximal width, tapering gradually distally, terminating in group of four stout spines, dorsal, medial, and ventral border with numerous (about 15) transverse groups of serrulate spines, lateral aspect sparsely setose; exopod

flagellum well developed; coxa with small oval lateral plate dorsally and epipod laterally; small arthrobranch present. The branchial formula is given in Table 1.

First pereopods (female) unequal and moderately dissimilar, apparently carried with chelae not flexed beneath body. Major



chela slightly longer than carapace length, with palms swollen, dorsolaterally feebly rugose, posterolaterally produced, about 1.7 times longer than deep; fingers stout, dactylus exceeding fixed finger; dactylus about 3.0 times longer than deep, with stout blunt hooked tip, cutting edge concave, entire, thickened, strongly laterally situated; fixed finger deeper than long, cutting edges laterally situated, deeply cannulate to house cutting edge of dactylus when closed, medial cutting edge entire, continuous with strongly hooked tip, lateral cutting edge minutely tuberculate proximally, otherwise entire, separated by notch from hooked tip. Carpus stout, strongly excavate distally, with lamellar ventral lobe and small dorsal and lateral lobes. Merus robust, about 3.0 times longer than distal width, unarmed distally, with few small irregular tubercles along distal medioventral border, very obliquely articulated and almost fully ankylosed with ischium; ischium robust, about 2.2 times longer than proximal width, unarmed; basis and coxa stout, without special features. Minor second pereiopod with chela about 0.7 of length of major chela, palm subcylindrical, mainly smooth, about 2.2 times longer than central width; fingers subequal, about 0.45 of palm length; dactylus about 2.8 times longer than deep, deepest width centrally, with small hooked tip and entire cutting edge; fixed finger deepest proximally, tapering to small hooked tip distally, about 2.0 times longer than deep, cutting edge distally entire; proximal segments similar to major chela but less robust. First pereiopod (male), only minor chela preserved. Palm subcylindrical, slightly swollen, smooth, about 2.0 times longer than broad; fingers equal to about 0.5 of palm length; dactyl exceeding fixed finger, about 3.0 times longer than central width, with stout feebly hooked tip, with low flange medially and convex entire lateral cutting edge with single low blunt tooth proximally; fixed finger with double cutting edges laterally, each with two low blunt teeth proximally; proximal segments as in female, except merus with about ten spines along medial ventral margin.

Second pereiopods slender, similar, extending beyond carapocerite by the distal third of the carpus; chela small, subcylindrical, taper-

ing slightly distally, about 2.4 times longer than proximal width; fingers subequal, slender, equal to about 0.6 of palm length, distally swollen with transverse band of radiating serrulate setae largely concealing fingertips, single, acute simple in fixed finger, double and articulated in dactylus; carpus five-segmented, lengths in ratio of 2:1:1:1:2 (approximately), subequal to chela length in male, about 1.5 times in female; merus slightly exceeding carpus length, about 5.0 times longer than wide in female, 4.0 times in male; ischium slender, slightly shorter than merus in female, slightly longer in male; basis and coxa without special features.

Ambulatory pereiopods robust, decreasing in development posteriorly. Third pereiopod (female) exceeding carapocerite by dactyl and half propod length; dactyl with corpus strongly compressed, about 1.7 times longer than proximal depth, tapering slightly distally, ventral border with six small teeth distoventrally, two spiniform setae distodorsally, unguis distinct, acute, strongly curved, about 0.7 of corpus length, simple with minute denticles proximoventrally; propod about 5.2 times dactyl length, 4.5 times longer than deep, greatest width proximally, tapering slightly distally, ventral border with 13 stout spines and two distoventral spines; carpus about 0.5 of propod length, robust, unarmed; merus about 1.25 of propod length, robust, unarmed; 3.1 times longer than central width, tapering strongly distally, less proximally, uncovered, obliquely articulated with ischium; ischium about 0.45 of merus length, unarmed; basis and coxa normal. Fourth and fifth pereiopods similar, less robust. Dactyl of fifth pereiopod similar to third, carpus with single distodorsal spine only; propod lacking transverse rows of distal cleaning setae. Fifth pereiopod (?) of male moderately slender, dactyl with carpus about 2.3 times longer than proximal depth, with low acute distoventral denticles only and without distodorsal setae; unguis with strongly accessory tooth and without proximoventral denticles; propod about 4.7 times longer than proximal width, with seven ventral spines and two distoventral spines; carpus unarmed; merus with single ventral spine; ischium with two ventral spines.

Pleopods with basipodite slender, rami also slender. The male, endopod of first pleopod slender, tapering distally, about 4.0 times longer than basal width, slightly expanded laterally, lateral border nonsetose, medial border with six setae on proximal half, distal half nonsetose, apex with three (four?) short, medially curved spines. Second to fifth pleopods missing.

Uropods with protopodite with acute posterolateral process; exopod about 1.6 times longer than broad, lateral border feebly convex, strongly setose ventrolaterally, with short blunt tooth distally, with strong mobile spine medially; diaeresis distinct, nonspinose, distal lamella short; endopod exceeds exopod, about 2.0 times larger than broad.

Ova sparse, about 40, length about 1.0 mm. Dissected ovum containing larva with large yolk and undeveloped pereopods, abdomen lacking pleopods and uropods.

**TYPES:** The holotype female is deposited in the collection of the Northern Territory Museum, catalog number NTM Cr.003495. The male specimen is in the collection of the Queensland Museum, catalog number W10228.

**MEASUREMENTS (MM):** Holotype: carapace length 5.7; total body length about 17; major chela 6.7; minor chela 3.2. Male: carapace length 4.2; minor chela 5.3.

**COLORATION:** The holotype was a uniform pale translucent white when freshly caught. Color of male unknown.

**HOST:** Both specimens were obtained from hexactinellid sponges.

**ETYMOLOGY:** From the Latin *anomalía* (anomaly), referring to the differences between male and female specimens.

**REMARKS:** The male specimen was found in an extensively damaged state, with the thoracic region crushed and almost detached from the abdomen, the latter crushed and lacking most pereopods and pleopods. Only a singly detached ambulatory pereopod and one of the first pereopods was preserved. The holotype female was almost intact, lacking only one of the fifth pereopods. The mouthparts were re-

moved from the right side in the male. The left mandible was also removed, to confirm that the absence of the palp was not due to accidental damage. Similarly, the right mandible was also dissected from the holotype specimen.

#### DISCUSSION

*Bannereus anomalus* is of particular interest as the first alpheid to be found in association with a hexactinellid. These sponges are found abundantly in deeper waters, and numerous species of stenopid shrimps have been found to occur in them (Saint Laurent 1981), although recently a hippolytid shrimp, *Paralepheus zothecculatus*, has also been found similarly associated (Bruce and Chace 1986). Alpheid shrimps are most abundant in shallow tropical waters; relatively few occur in more than 100 m, although a few genera (*Alpheus*, *Alpheopsis*, and *Athanas*) are represented at over 400 m (Banner and Banner 1981). The related species of *Batella*—*B. parvimanus* (Bate) and *B. bifurcata* Miyake & Miya, 1968—occur in shallower depths, the latter at 156 m, in Japan, and the former at only 16 m at Cape York, Australia. The associations of the *Batella* species, if any, have not been recorded, but from their resemblance to *Synalpheus* species, they could well be associated with Hexactinellida or Porifera respectively.

The specific epithet of *B. anomalus* refers to the differences in morphology between the male and female specimens presently referred to this species. These differences appear sufficient to suggest that the male may represent a species distinct from the female, but on account of its damaged and incomplete nature, this cannot be stated with certainty. Certain features suggest that, although congeneric, two species may be involved: the differences in the frontal margin of the carapace; the presence of an epipod on the third maxilliped in the male (absent in the female); the smooth chela and ventrally spinose merus of the second pereopod in the male; the presence of ventral spines on the merus and ischium of the (?) fifth ambulatory pereopod in the male (absent in the female); and the differences in

the dactyls of the ambulatory pereopods. On account of these differences the male specimen is not given the status of paratype.

The major chela of the female is of particular interest and appears to represent an early stage in the evolution of the molar process and fossa so characteristic of *Alpheus* and *Synalpheus* species. The marked thickening of the dactylar cutting edge, throughout its length, closing into a longitudinal channel running the length of the fixed fingers illustrates how the more complex mechanism may have evolved from the condition in the more "primitive" genera of the Alpheidae. The apparent fusion of the merus and ischium of the first pereopods, however, is a feature not paralleled in *Alpheus* or *Synalpheus*. It is also possible that, in view of its size in relation to the carapace length, the single male chela available is the major chela and not the minor one.

#### ACKNOWLEDGMENTS

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