



New Species and Records of Cave Shrimps from the Yucatan Peninsula (Decapoda:  
Agostocarididae and Hippolytidae)

Author(s): Brian Kensley

Source: *Journal of Crustacean Biology*, Vol. 8, No. 4, (Nov., 1988), pp. 688-699

Published by: The Crustacean Society

Stable URL: <http://www.jstor.org/stable/1548704>

Accessed: 25/07/2008 14:22

---

Your use of the JSTOR archive indicates your acceptance of JSTOR's Terms and Conditions of Use, available at <http://www.jstor.org/page/info/about/policies/terms.jsp>. JSTOR's Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at <http://www.jstor.org/action/showPublisher?publisherCode=crustsoc>.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

---

JSTOR is a not-for-profit organization founded in 1995 to build trusted digital archives for scholarship. We work with the scholarly community to preserve their work and the materials they rely upon, and to build a common research platform that promotes the discovery and use of these resources. For more information about JSTOR, please contact [support@jstor.org](mailto:support@jstor.org).

NEW SPECIES AND RECORDS OF CAVE SHRIMPS  
FROM THE YUCATAN PENINSULA  
(DECAPODA: AGOSTOCARIDIDAE AND HIPPOLYTIDAE)

Brian Kensley

ABSTRACT

The second known agostocaridid shrimp, *Agostocaris bozanici*, is described from a cenote on Cozumel Island. The new species is characterized by having a dorsally unarmed rostrum, and 5 pairs of lateral, and 5 pairs of posterior spines on the telson. A new genus and species of hippolytid, *Yagerocaris cozumel*, is described from a different cenote and an anchialine cave on Cozumel. The genus is characterized primarily by the possession of a very strong pterygostomial spine on the carapace, subequal second pereopods in which the carpi have 5 articles, a single arthrobranch of maxilliped 3, and a rectangular posterior lobe on the telson. Both shrimps are true anchialines, having been taken from marine-salinity water in cenotes well away from the coast, and both have reduced eyes. The hippolytid shrimps *Somersiella sterreri* Hart and Manning (previously known only from Bermuda) and *Janicea antiguensis* (Chace) (previously recorded from Antigua, Bermuda, and the Bahamas) are recorded from a cave on Cozumel Island. While these latter 2 species show some differences from the original descriptions, it is felt to be premature to place them in new taxa.

Numerous species of caridean shrimps have been recorded from the fresh-water, anchialine, and marine caves on islands of the Caribbean and the Yucatan Peninsula of Mexico (Hobbs and Hobbs, 1976; Hobbs, *et al.*, 1977; Holthuis, 1986). From the latter area alone, three species of *Typhlatya* are known (one undescribed), in addition to *Creaseria morleyi* (Creaser), while a species of *Procaris* awaits description. With many more caves and cenotes being explored, further shrimp records can be expected, as the present two records demonstrate. (Cenote is the Mayan word for a cave or naturally occurring well containing water.) With each such record, another piece falls into place in the jigsaw puzzle that is the biogeography of anchialine shrimps of the world.

The present material was collected by a team of cave divers who visited some of the cenotes of the Yucatan Peninsula during 1987 and 1988, and was made available to the Smithsonian Institution by Ms. Jill Yager.

Family Agostocarididae Hart and Manning,  
1986

*Agostocaris bozanici*, new species  
Figs. 1-3

*Material*.—Holotype USNM 211443, ♀ CL 7.4 mm, paratypes USNM 211444, 1 ♀ CL 8.0 mm, 3 immature CL 5.9, 4.8, 4.3 mm; Xcan-ha Cenote (Cenote Roja), Cozumel Island, Quintana Roo, Mexico, 80-100 ft (24.4-30.4 m) below surface of water, salinity 34‰;

collected by J. Bozanic 25, 29 September 1987.—Paratype USNM 211465, ♀ CL 5.2 mm; Xcan-ha Cenote, Cozumel Island, Quintana Roo, Mexico; collected by H. Ayala, D. Drago, 18 March 1988.—Paratypes, USNM 211466, ♀ CL 7.2 mm, 2 immature CL 4.0 mm, 4.1 mm; Xcan-ha Cenote, Cozumel Island, Quintana Roo, Mexico, 60-136 ft (18.3-41.5 m) below surface of water, salinity 34‰; collected by J. Bozanic, 6 April 1988.

*Description*.—Integument firm, thin, with sparse scattering of tiny black chromatophores. Rostrum triangular, apically acute, bilaterally compressed, dorsally unarmed, carinate, carina extending onto anterior carapace for distance equal to rostral length, ventrally carinate. Dorsal profile of carapace evenly convex; infraorbital and branchiostegal angles rounded; very faint orbitobranchial sulcus present. Pleuron of abdominal somite 2 broadly ovate; pleura of somites 3-5 posteroventrally rounded; somite 6 dorsally twice length of somite 5, with small posteroventral tooth. Telson about 3 times longer than basal width, tapering slightly, bearing 5 pairs of mobile lateral spines; posterior margin slightly convex, armed with 5 pairs of spines, second pair from lateral margin longest.

Eye not differentiated into cornea and stalk, lacking pigment, conical, directed anterodorsally. Antennule with basal peduncular article subequal in length to articles 2 and 3 combined; stylocerite with proximal two-thirds parallel-sided, apically acute; su-

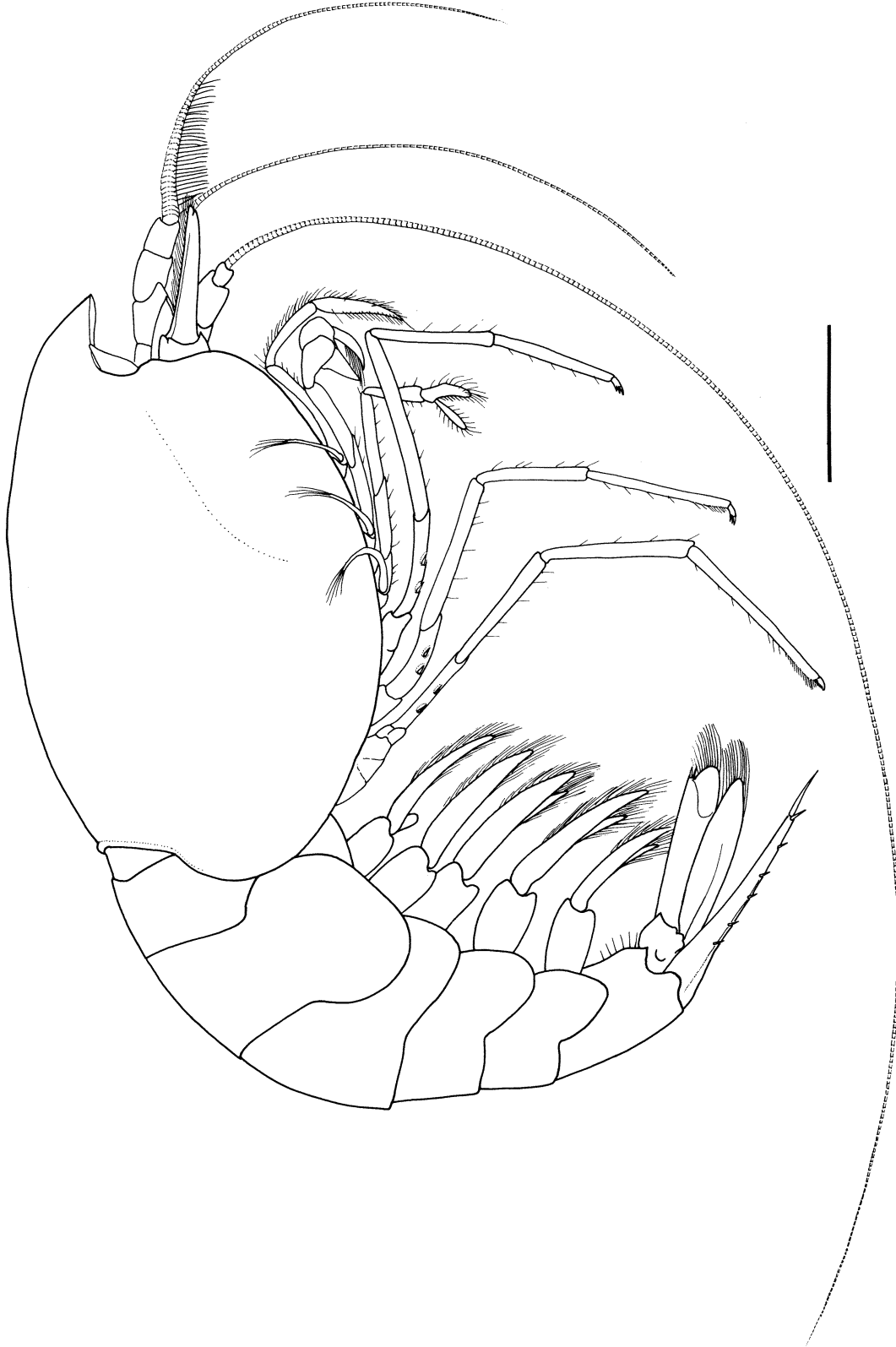


Fig. 1. *Agostocaris bozanici*, new species, lateral view. Scale = 2 mm.

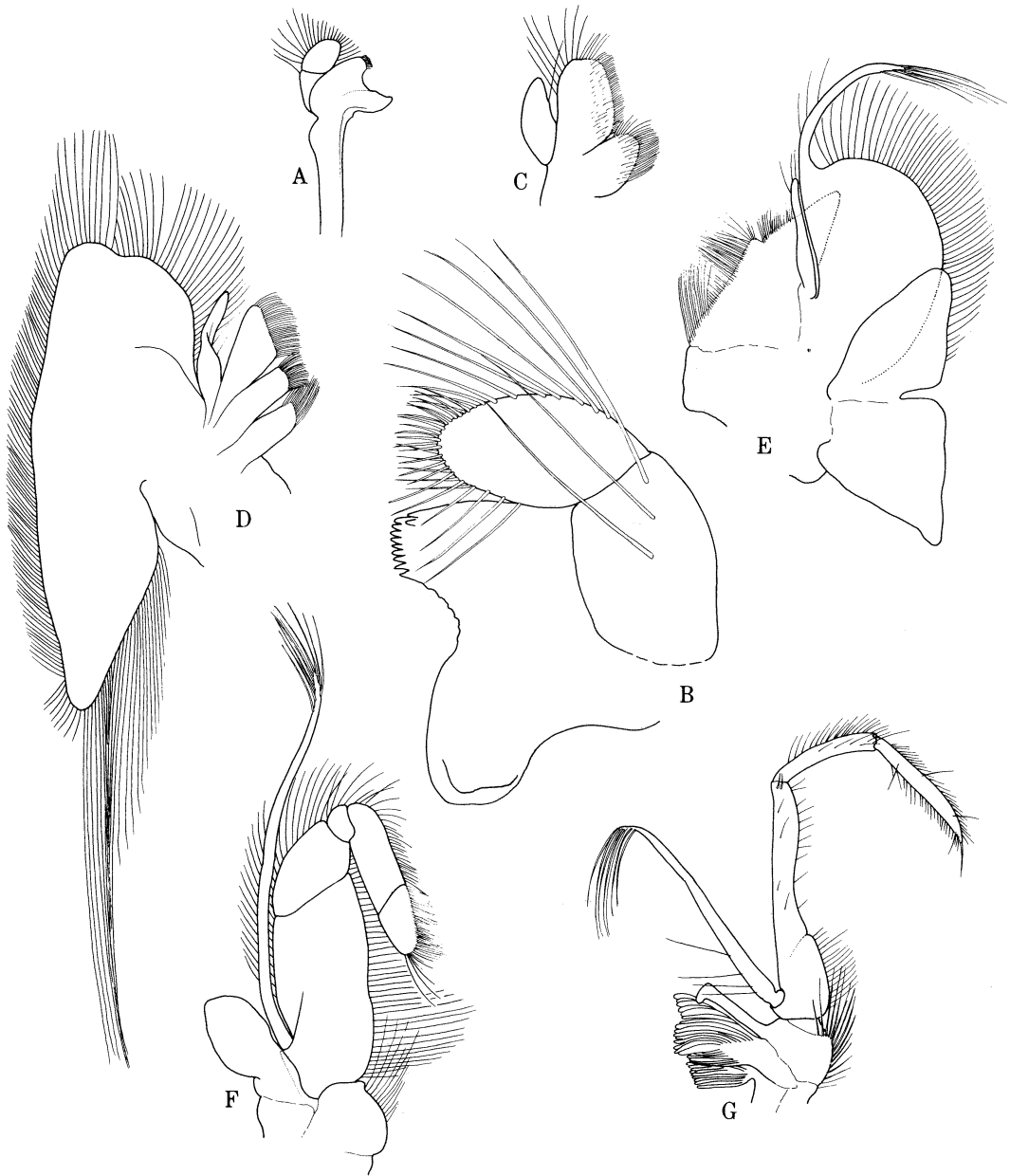


Fig. 2. *Agostocaris bozanici*, new species: A, mandible; B, mandible, further enlarged; C, maxilla 1; D, maxilla 2; E, maxilliped 1; F, maxilliped 2; G, maxilliped 3.

perior flagellum subequal to carapace in length, inferior flagellum slightly longer. Antennal scaphocerite 1.7 times as long as greatest width, small distal tooth on lateral margin not reaching apex of blade; flagellum at least 3 times longer than carapace length. Mandible with palp of 2 broad articles, distal article bearing marginal setae; incisor process having row of 11 small teeth; molar

thin walled, distally blunt. Scaphognathite of maxilla 2 having elongate setae at posterior end reaching well into branchial chamber.

Disposition of branchiae, epipods, and exopods: maxilliped 1, exopod, bilobed epipod; maxilliped 2, exopod, unilobed epipod; maxilliped 3, exopod, straplike epipod, 1 bipartite arthrobranch, 1 pleurobranch;

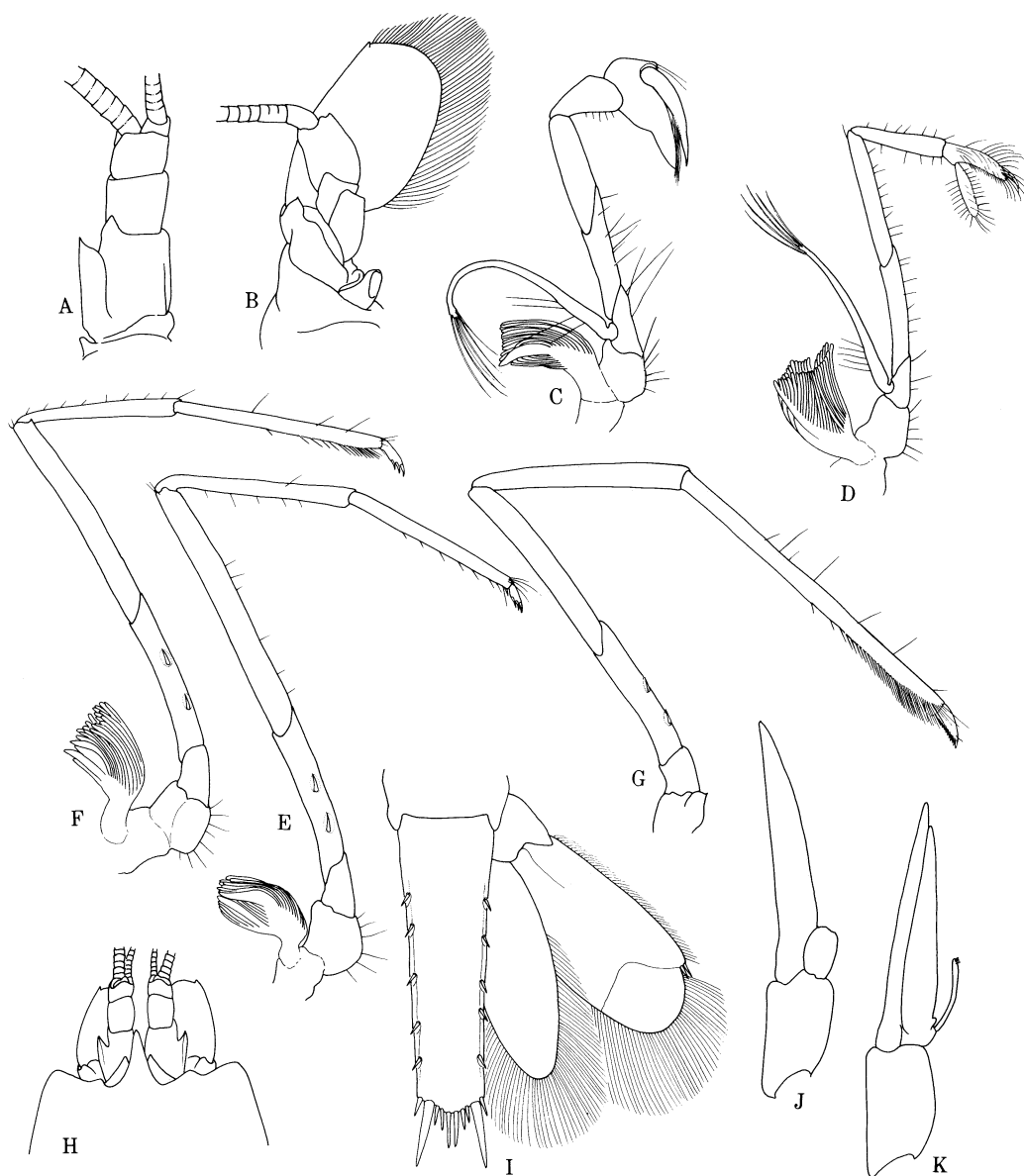


Fig. 3. *Agostocaris bozanici*, new species: A, antennule; B, antenna; C, pereiopod 1; D, pereiopod 2; E, pereiopod 3; F, pereiopod 4; G, pereiopod 5; H, anterior carapace in dorsal view; I, telson and right uropod in dorsal view; J, pleopod 1 ♀; K, pleopod 2 ♀.

pereiopod 1, exopod, 1 arthrobranch, 1 pleurobranch; pereiopod 2, exopod, 1 arthrobranch, 1 pleurobranch; pereiopod 3, 1 arthrobranch, 1 pleurobranch; pereiopod 4, 1 arthrobranch, 1 pleurobranch; pereiopod 5, 1 rudimentary arthrobranch, 1 pleurobranch.

Maxilliped 1 with distally triangular endite, digitiform endopod, exopod distally setose, with broad caridean lobe at base,

epipod broadly bilobed. Maxilliped 2, endopod pediform, ischium and basis fused. Maxilliped 3 of 4 articles, article 2 having incomplete suture indicating fusion of articles. Pereiopod 1 shorter than maxilliped 3 and pereiopod 2, chelate, dactylus more slender than propodal finger, flattened-ovate in cross section, entire cutting edge bearing single row of minute, finely serrate, triangular spines; propodal fixed finger with broad

transparent flange along cutting margin, latter having single row of minute, closely set blunt spines; propodal palm about half length of fingers; carpus distally widened, articulating on posterior surface of propodus. Pereiopod 2 more slender but longer than pereiopod 1, chelate, dactylus lamellate, margins setose; propodal finger heavier than dactylus, faintly curved along outer margin, compressed, with numerous setae. Pereiopod 3, ischium bearing 2 spines on outer surface; dactylus having 3 spines on posterior surface. Pereiopod 4, ischium bearing 2 spines on outer surface; propodus with cluster of serrate grooming setae posterodistally; dactylus having 3 spines on posterior surface. Pereiopod 5, ischium with 2 spines on outer surface; propodus 1.8 times length of propodus of pereiopod 4, bearing dense serrate grooming setae along posterodistal third; dactylus with row of about 8 small spines on posterior margin. Pleopod 1 biramous, exopod elongate, setose; endopod short, ovate, devoid of spines or setae. Pleopods 2–5 biramous, exopod and endopod elongate, setose; endopod bearing slender appendix interna. Outer uropodal ramus bearing 2 spines on outer distal margin, diaeresis in distal third, distal margin broadly rounded; inner uropodal ramus narrower and distally more narrowly rounded than outer ramus.

*Gut Contents.* — The foregut of the dissected 8.0-mm CL female specimen was removed, and found to be packed with the fine filaments of *Oscillatoria corallinae* Gomont, a cyanobacterium thought to be a benthic form (J. Norris, personal communication). The gut contents of a second female (USNM 211465) was examined, in which the anterior foregut contained densely packed filaments of *O. corallinae*, while the posterior part contained a brown mass of fine organic detrital material including what happened to be oval fecal pellets of about 0.06 mm longer diameter.

*Remarks.* — The family Agostocarididae was established for *Agostocaris williamsi* from caves on Grand Bahama Island and the Turks and Caicos Islands by Hart and Manning (1986). Several features easily distinguish *A. williamsi* from the present species. These include the five pairs of lateral telsonic spines (four pairs in *A. williamsi*), and

five pairs of posterior telsonic spines (four pairs in *A. williamsi*), and the presence of a pleurobranch above maxilliped 3 and pereiopod 1 (absent in the earlier species). The rostrum of *A. williamsi* was originally described as dentate; in fact, this is a variable feature. Five paratypes in the Smithsonian Institution were examined, in which the dorsal rostral dentition was found to be 9, 5, 1, 1, and 0. In all five, the anterior rostrum bears fine upright dorsal setae. In *A. bozanici*, both teeth and dorsal setae are absent.

With only two species known in the family, the affinities of the agostocaridids continue to be unclear. A similarity not mentioned by Hart and Manning (1986) in their original description of the family, lies in the form of the first two pairs of pereiopods of members of the Atyidae. In these, the carpus, which is distally widened or even cup-shaped, articulates on the underside of the propodus, while the dactylus articulates proximally on the propodus to form the chela. Given the many differences between these two families in branchial formulae and mouthpart structure, however, this pereiopodal similarity may well be a parallelism.

*Etymology.* — This species is named for veteran cave diver Jeff Bozanic.

#### Family Hippolytidae Dana, 1852

##### *Yagerocaris*, new genus

*Diagnosis.* — Carapace with strong pterygostomian spine. Upper antennular flagellum biramous. Mandibular palp of 2 articles. Exopods on maxillipeds 1–3. Epipods present on maxillipeds 1–3, and pereiopods 1–4. Single arthrobranch present on maxilliped 3 only. Left and right pereiopods 2 subequal; carpus of 5 articles. Telson with posterior margin between inner pair of spines produced into rectangular lobe reaching more than halfway along elongate inner spines.

*Type species.* — *Yagerocaris cozumel*, new species.

*Etymology.* — *Yagerocaris* is a combination of “Yager,” for Ms. Jill Yager, indefatigable cave diver and biologist, and the Greek *karis*, a shrimp. The gender is feminine.

*Remarks.* — The above diagnostic charac-

ters in combination separate the present genus from any earlier-described hippolytid (see key in Holthuis, 1955: 95). Of the more recently described cave and anchialine hippolytids, the present material bears a superficial resemblance to the genus *Calliasmata* Holthuis, 1973, especially in the finely setose carapace. *Calliasmata*, with one species in the Red Sea area and one from the Dominican Republic, possesses second pereopods having multiarticulate carpi and meri, whereas *Yagerocaris* has only a 5-articulate carpus of pereopod 2. Further, the form of the very strongly spiniform pterygostomial area of the carapace and the configuration of the posterior part of the telson find no equivalents among the hippolytid genera.

*Yagerocaris cozumel*, new species

Figs. 4–6

*Material.* — Holotype, USNM 211445, ovigerous specimen, CL 7.0 mm; paratypes, USNM 211446, ovigerous specimen, CL 7.0 mm, postovigerous specimen, CL 7.2 mm, nonovigerous specimen, CL 5.5 mm (dissected); Areolito Cenote, Cozumel, Quintana Roo, Mexico, 40 ft (12.2 m) below surface of water, salinity marine; collected by J. Bozanic, 20 September 1987. — Paratype, USNM 211463, ovigerous specimen, CL 6.0 mm, Cueva de Quebrada, Parque de Chankanaab, Cozumel, Quintana Roo, Mexico, salinity 35‰, collected by D. Williams, 18 September 1984. — Paratypes, USNM 211467, 2 ovigerous specimens CL 6.0 mm, 6.2 mm, 2 nonovigerous specimens CL 5.5 mm, 5.9 mm; Areolita Cenote, Cozumel, Quintana Roo, Mexico, 30 ft (9 m) below surface of water, salinity marine; collected by J. Bozanic, 31 March 1988.

*Description.* — Integument of carapace and terga and pleura of abdomen bearing fairly dense, very short setules. Rostrum broad-based, triangular in dorsal view, ventral margin faintly sinuous in lateral view, reaching to about second antennular peduncle article. Carapace margin slightly convex in antennal region; pterygostomial region produced into strong spine. Anterior margin of pleuron 1 straight; pleuron 2 more broadly rounded posteroventrally than anteroventrally; pleura 3–5 each with distinct posteroventral tooth. Abdominal somite 6 four-fifths middorsal length of somite 5, with acutely triangular posterolateral lobe. Telson with 2 pairs of articulated dorsal spines in posterior half; posterior margin bearing 2 pairs of spines, outer pair one-fourth length of inner pair; margin between inner pair of spines produced into rectangular lobe

reaching more than halfway along elongate inner spines, with 18–20 plumose setae on truncate/rounded posterior margin.

Eyestalks basally fused, anteriorly flattened, small weakly pigmented area flanked by pair of low subacute lobes. Antennule with distally acute stylocerite reaching beyond distal margin of second peduncle article; basal peduncle article subequal in length to 2 distal articles together; dorso-lateral flagellum slightly longer than carapace plus rostrum, fused basal portion of 5 articles, free part of shorter ramus single article bearing 3 clumps of aesthetascs; ventromesial flagellum subequal to dorsolateral flagellum in length. Antennal scaphocerite about two-thirds longer than greatest width; lateral margin nearly straight, ending in strong tooth reaching as far forward as anterior margin of blade; flagellum almost 3 times carapace length.

Mandibular palp of 2 articles, distal article longer than proximal, bearing numerous setae; incisor process having 5 distal sclerotized cusps; molar stout, obliquely truncate. Palp of maxilla 1 faintly bilobed. Maxilla 2 with proximal endite somewhat reduced, bearing elongate setae, distal endite deeply divided, lobes subequal; setae of scaphognathite longest anteriorly.

Disposition of epipods, exopods, and branchiae: maxilliped 1, exopod, obscurely bilobed epipod; maxilliped 2, exopod, unilobed epipod; maxilliped 3, exopod, epipod (mastigobranch), reduced arthrobranch; pereopod 1, epipod (mastigobranch), 1 setobranch, 1 pleurobranch; pereopod 2, epipod (mastigobranch), 1 setobranch, 1 pleurobranch; pereopod 3, epipod (mastigobranch), 1 setobranch, 1 pleurobranch; pereopod 4, epipod (mastigobranch), 1 setobranch, 1 pleurobranch; pereopod 5, 1 setobranch, 1 pleurobranch.

Maxilliped 1 with proximal endite rounded, smaller than distal broad endite; endopod short, digitiform; exopod elongate, slender, with distinct setose caridean lobe at base; epipod obscurely bilobed. Maxilliped 2 endopod pediform, with distal article articulating lengthwise along penultimate article. Maxilliped 3 just overreaching antennal scaphocerite; distal article bearing several spines in distal one-third, several rows of setae in proximal two-thirds; ischiomerus and basis distinct.

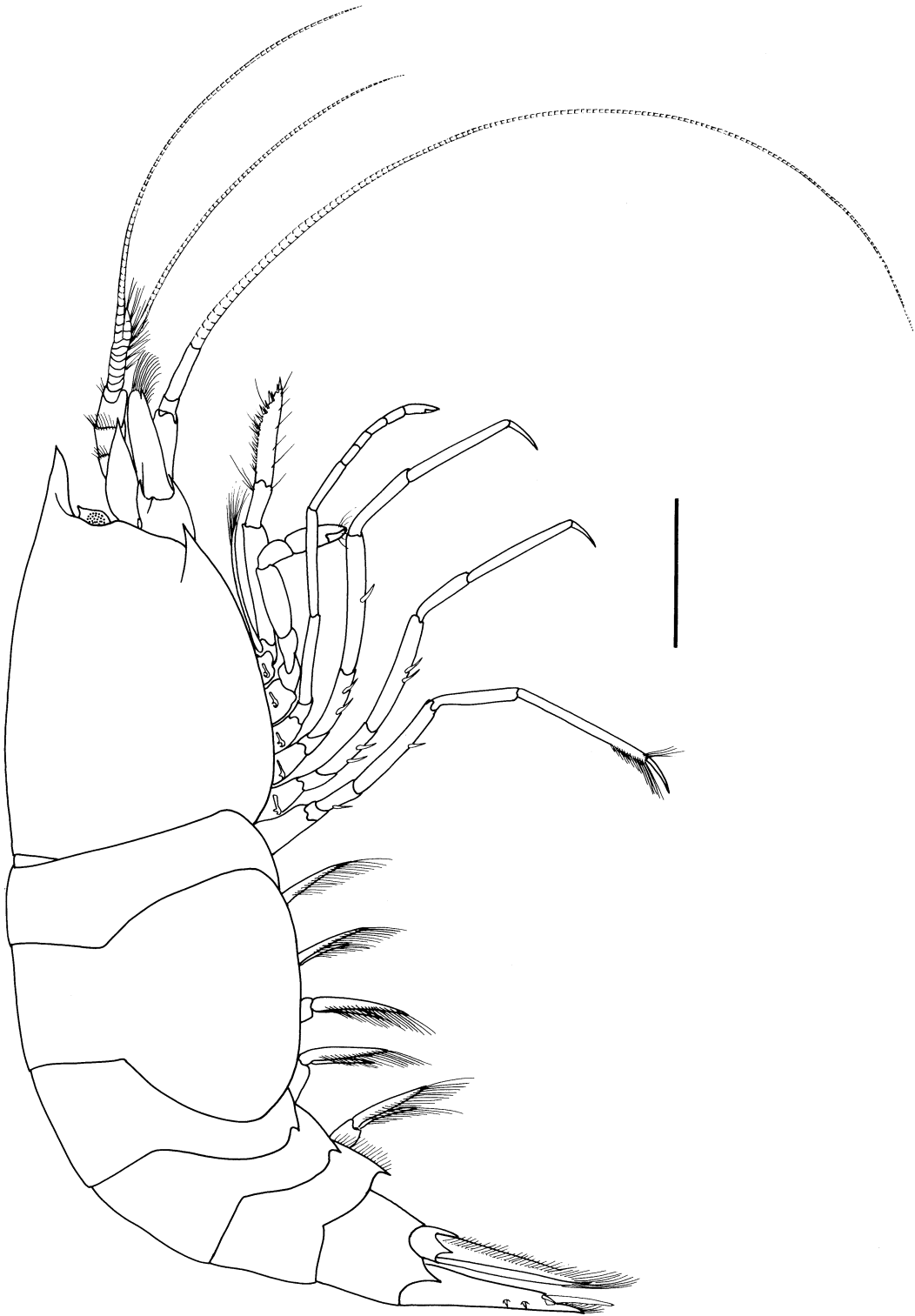


Fig. 4. *Yagerocaris cozumel*, new genus, new species, lateral view. Scale = 4 mm.



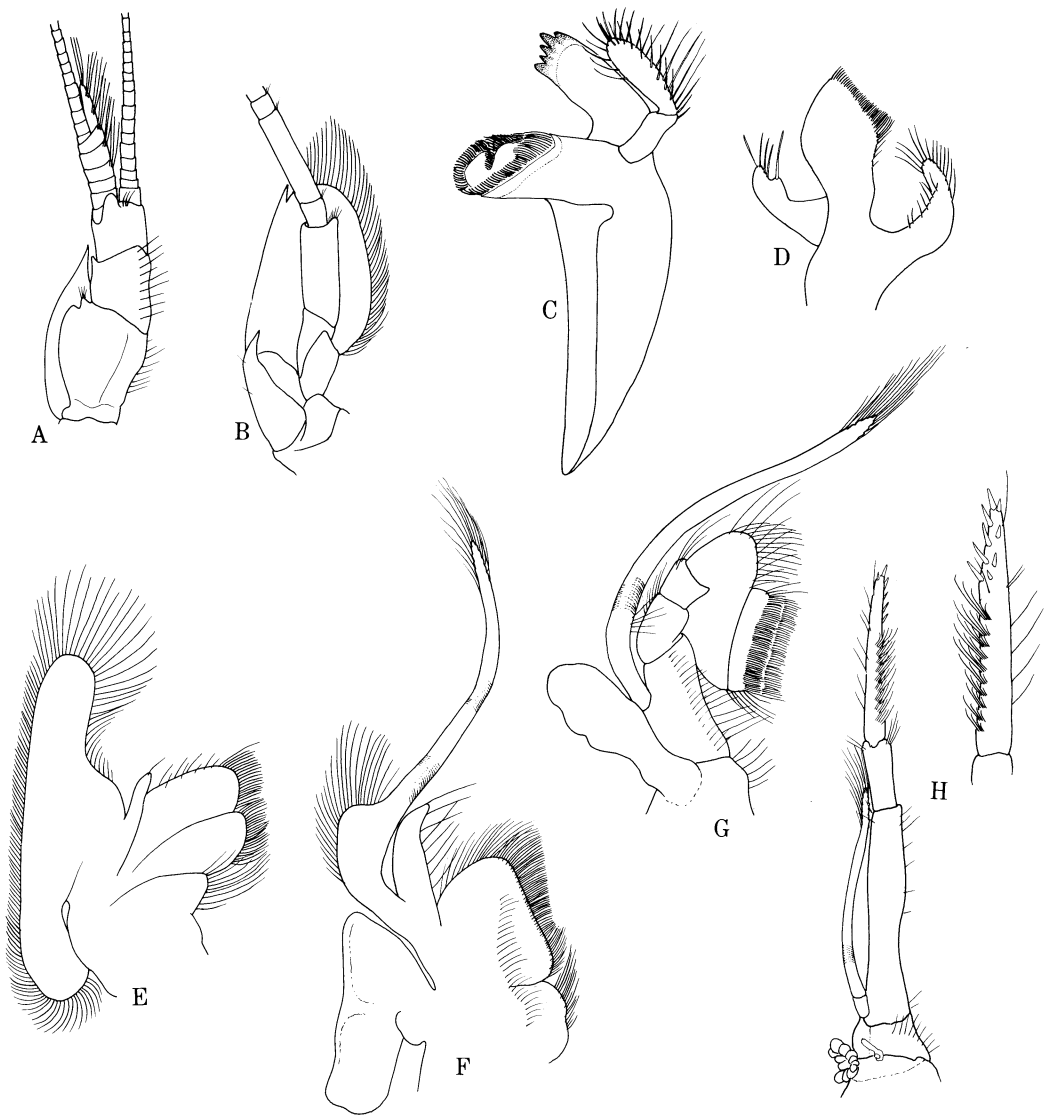


Fig. 5. *Yagerocaris cozumel*, new genus, new species: A, antennule; B, antenna; C, mandible; D, maxilla 1; E, maxilla 2; F, maxilliped 1; G, maxilliped 2; H, maxilliped 3, with distal article further enlarged.

Pereiopod 1 more robust but shorter than following legs, chelate, barely reaching base of antennal scale; dactylus about two-thirds length of propodal palm; cutting edges of fingers entire, straight. Pereiopod 2, both members subequal, overreaching maxilliped 3 by chela and at least distalmost carpal article; carpus consisting of 4 distal subequal articles plus more elongate proximal article. Pereiopod 3, ischium bearing 2 articulating spines on posterior margin; merus with single articulating spine at about mid-

length of posterior margin. Pereiopod 4 subequal to pereiopod 3, ischium with 2 spines on posterior margin, merus with 1 or 2 spines on posterior margin. Pereiopod 5 little longer than pereiopod 4, ischium with 1 spine on posterior margin; merus with 1 spine on posterior margin; propodus with postero-distal series of overlapping transverse rows of elongate grooming setae.

Pleopod 1, endopod about one-fourth length of exopod, with well-spaced marginal setae. Pleopod 2, endopod with appendix

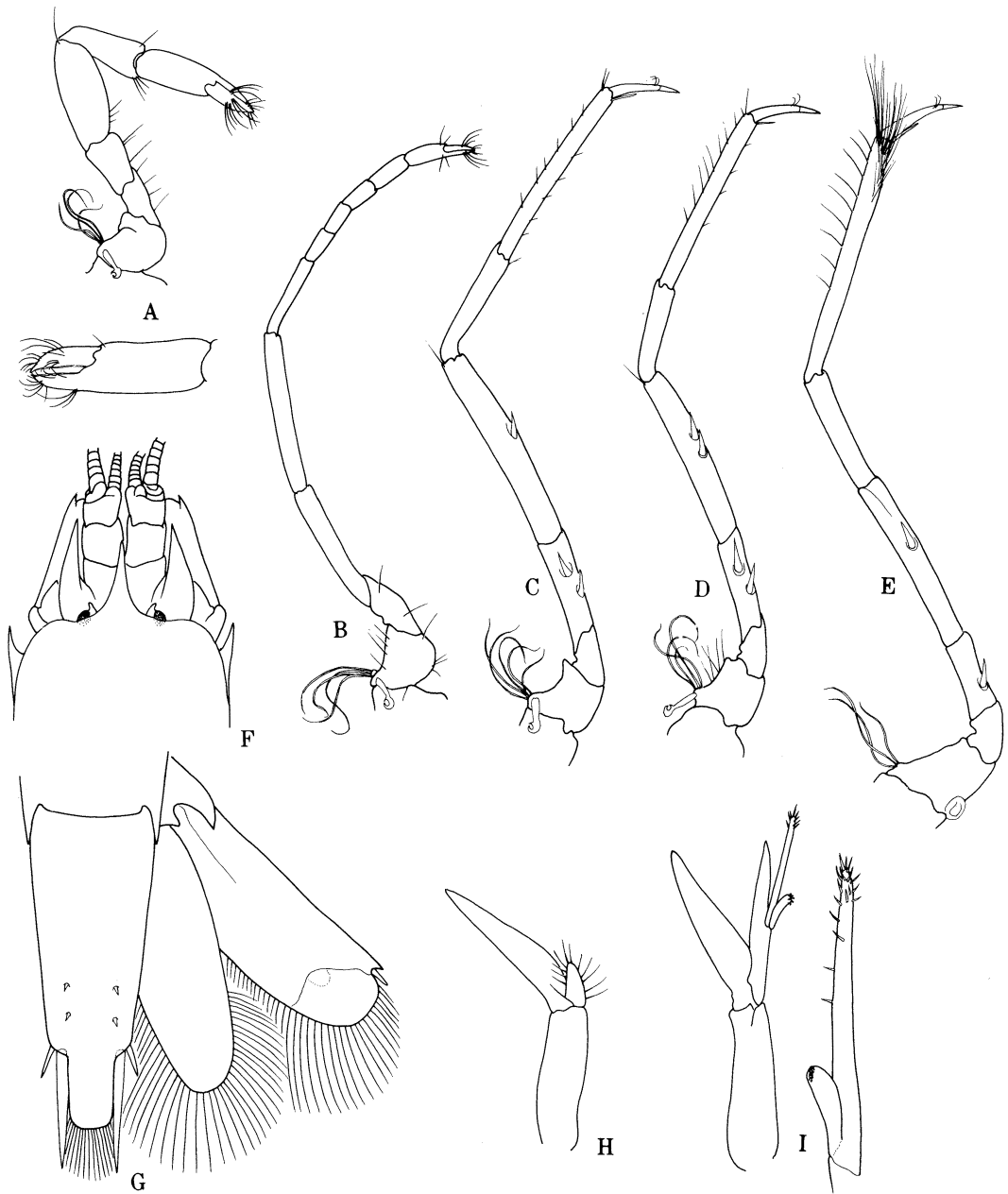


Fig. 6. *Yagerocaris cozumel*, new genus, new species: A, pereiopod 1, with chela in lateral view; B, pereiopod 2; C, pereiopod 3; D, pereiopod 4; E, pereiopod 5; F, anterior carapace in dorsal view; G, telson and right uropod in dorsal view; H, pleopod 1; I, pleopod 2, with appendix masculina and appendix interna further enlarged.

masculina and appendix interna articulating at about midlength of mesial margin; appendix interna one-third length of appendix masculina, latter reaching beyond apex of rami, rodlike, with few distal spines.

Uropodal rami barely overreaching telsonic apex; lateral ramus with articulating spine mesial to tooth on outer margin just overreaching distal margin of blade; diarsis complete.

*Hermaphroditism.*—All nine specimens in hand possess a strong appendix masculina on pleopod 2, and a genital aperture can be seen at the base of the coxa of pereopods 5. The smallest specimen (CL 5.5 mm) had eggs in the ovaries, visible through the carapace, but lacked the elongate setae on the pleopodal protopods, used for the attachment of the eggs. The five ovigerous specimens (CL 6.0, 6.0, 6.2, 7.0, 7.0 mm) had lost some of the eggs, but eight, eight, seven, two, and six eggs, respectively, remained attached to the pleopodal protopod setae. The largest specimen (CL 7.2 mm) lacked eggs on the pleopods, but possessed the protopod setae. Given this combination of male and female characters, I tentatively suggest that this species possibly displays protandrous hermaphroditism, a phenomenon not unknown in the Hippolytidae. *Lysmata seticaudata* (Risso) has been shown to exhibit irreversible protandrous hermaphroditism (Dohrn, 1950), as has *Lysmata nilita* Dohrn and Holthuis, 1950. Other members of the family that exhibit protandry include *Chorismus antarcticus* (Pfeffer) (see Yaldwyn, 1966) and *Hippolyte inermis* Leach (see Veillet *et al.*, 1963). Bauer (1986) has demonstrated a more complex reproductive regime in the hippolytid *Thor manningi* Chace, in which primary males, primary females, and protandric hermaphroditic individuals occur in a given population. Bauer (1986) hypothesized that a proportion of about 50% primary males persists in the population of *T. manningi*, since these individuals are more efficient at fertilizing breeding females than are the protandric individuals. With only eight specimens of *Yagerocaris cozumel* available, it is not possible to establish the type of reproductive pattern followed in this species.

The occurrence of protandrous hermaphroditism in a cave species possibly has a secondary reproductive advantage in addition to the primary advantage correlated with the larger size of breeding females (Policansky, 1982). Given the somewhat restricted gene pool within a cave, there would be a greater chance for gamete exchange if two shrimps that happen to meet are both hermaphroditic and in the appropriate reproductive phase, than if the species were gonochoristic.

*Gut Contents.*—The foregut which was removed from the dissected specimen contained an unidentifiable brown finely macerated mush.

*Etymology.*—The specific epithet is the name of the type locality, the island of Cozumel, used as a noun in apposition.

*Somersiella sterreri* Hart and Manning,  
1981  
Fig. 7

*Somersiella sterreri* Hart and Manning, 1981: 442, figs. 1–28.—Manning and Hart, 1984: 661, fig. 5.

*Material.*—USNM 211468, 1 nonovigerous ♀ CL 16.1 mm, 1 ovigerous ♀ CL 15.3 mm; Cueva Quebrada, Chankanaab Park, Cozumel, Quintana Roo, Mexico, marine water; collected by J. Bozanic 1 April 1988.

*Previous Records.*—Bermuda, anchialine caves.

*Remarks.*—*Somersiella sterreri* was described from Tucker's Town Cave and Chalk Cave, Bermuda (♂ holotype, USNM 184016, CL 12.0 mm, nonovigerous ♀ paratype, USNM 184017, CL 25.1 mm, respectively). Comparison of the Yucatan material with the types reveals differences in the rostrums, antennal spines, and the spination of the posterior three pairs of pereopods. The rostral differences almost certainly represent individual variation. The antennal spines of the types reach beyond the carapace margin, whereas in the two specimens from Cozumel, the spines do not reach the carapace margin. In the two specimens from Cozumel, the ischial spine count of pereopods 3, 4, and 5 is 11, 5, and 4; that of the Bermudan types of 13 and 14, 8 and 11, and 5 and 7. The configuration of the antennal spines and the lower pereopodal spine counts of the Cozumel specimens may be a reflection of a genetically isolated population. Until more material from both localities is available, it would be incautious to designate the Cozumel material as a separate taxon.

The range extension of more than 1,500 miles (2,414 km) represented by this record is considerable. The ovigerous female from Cozumel carries an estimated 2,000 tiny eggs attached to the pleopods. The small size of these eggs would suggest an extended planktonic larval stage, in which case it might be predicted that this species will be recovered from other anchialine habitats in the Carib-

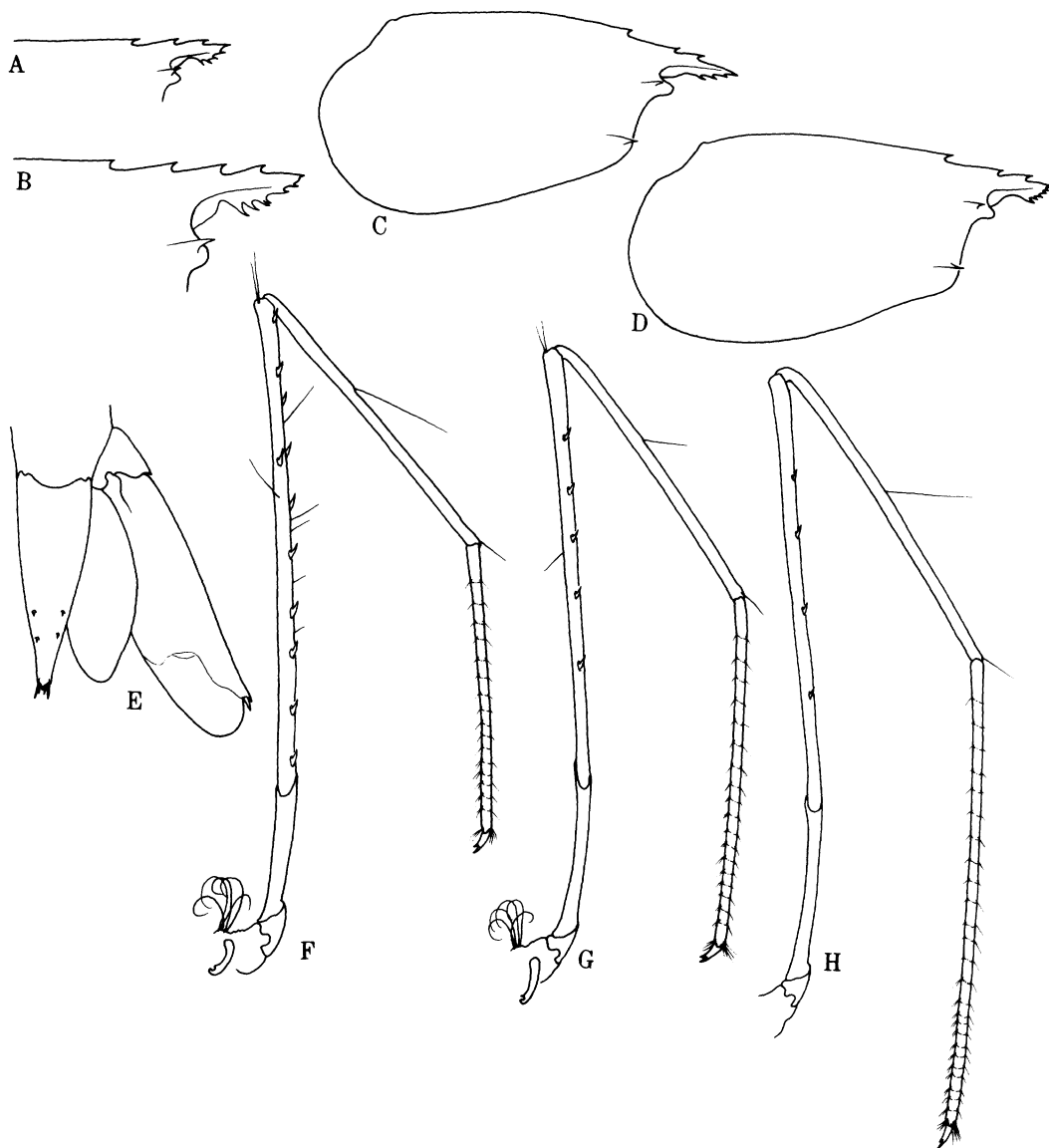


Fig. 7. *Somersiella sterreri* Hart and Manning, 1981: A, anterior carapace and rostrum of holotype; B, anterior carapace and rostrum of paratype; C, carapace of nonovigerous ♀ from Cozumel; D, carapace of ovigerous ♀ from Cozumel; E, telson and right uropod; F, pereiopod 3; G, pereiopod 4; H, pereiopod 5.

bean area, and might also explain the occurrence at Bermuda.

#### *Janicea antiguensis* (Chace, 1972)

*Barbouria antiguensis* Chace, 1972: 107, figs. 40, 41.  
*Janicea antiguensis*: Manning and Hart, 1984: 657, fig. 2.

**Material.**—USNM 211469, 2 ovigerous ♀♀, CL 8.5 mm, 10.0 mm; Cueva Quebrada, Chankanaab Park, Cozumel Island, Quintana Roo, Mexico, marine water; collected by J. Bozanic, 1 April 1988.

**Previous Records.**—Antigua, seawall in dockyard, English Harbour; Bermuda, cave on Cooper's Island; Bahamas, Cemetery Cave, Grand Bahama.

**Remarks.**—The occurrence of this species on the Yucatan Peninsula is not entirely surprising, given the previous widespread records, especially that of the type locality in a relatively open, nonanchialine marine habitat. The numerous, very small eggs would also indicate an extended planktonic larval life, which, as with the previous species, would help to explain this wide distribution.

#### ACKNOWLEDGEMENTS

I am grateful to Mr. Jeff Bozanic, Island Caves Research Center, Key Biscayne, Florida, Mr. Dennis Wil-

liams, and Ms. Jill Yager, Old Dominion University, Norfolk, Virginia, who collected the shrimps described here, and made them available for study. Dr. James N. Norris, Department of Botany, National Museum of Natural History, Smithsonian Institution, identified the cyanobacterium mentioned here.

This paper was read in manuscript by C. W. Hart, Jr., Janice Clark, and Dr. F. A. Chace, Jr., all of the Department of Invertebrate Zoology, Smithsonian Institution; I am grateful for their valuable comments. I also thank Dr. L. B. Holthuis of the Rijksmuseum van Natuurlijke Historie, Leiden, for his helpful suggestions.

This paper is contribution number 5 of the Island Caves Research Center, Key Biscayne, Florida.

#### LITERATURE CITED

- Bauer, R. T. 1986. Sex change and life history pattern in the shrimp *Thor manningi* (Decapoda: Caridea): a novel case of partial protandric hermaphroditism.—*Biological Bulletin* 170: 11–31.
- Chace, F. A., Jr. 1972. The shrimps of the Smithsonian-Bredin Caribbean Expeditions with a summary of the West Indian shallow-water species (Crustacea: Decapoda: Natantia).—*Smithsonian Contributions to Zoology* 98: i–x, 1–179.
- Dohrn, P. F. R. 1950. Studi sulla *Lysmata seticaudata* Risso. (Hyppolitidae) [sic]. I. Le condizione normali della sessualità in natura.—*Pubblicazioni della Stazione Zoologica di Napoli* 22: 257–272.
- , and L. B. Holthuis. 1950. *Lysmata nilita*, a new species of prawn (Crustacea Decapoda) from the Western Mediterranean.—*Pubblicazioni della Stazione Zoologica di Napoli* 22: 339–347.
- Hart, C. W., Jr., and R. B. Manning. 1981. The cavernicolous shrimps of Bermuda (Alpheidae, Hippolytidae, and Atyidae).—*Journal of Crustacean Biology* 1: 441–456.
- , and ———. 1986. Two new shrimps (Procarididae and Agostocarididae, new family) from marine caves of the western North Atlantic.—*Journal of Crustacean Biology* 6: 408–416.
- Hobbs, H. H., III, and H. H. Hobbs, Jr. 1976. On the troglobitic shrimps of the Yucatan Peninsula, Mexico (Decapoda: Atyidae and Palaemonidae).—*Smithsonian Contributions to Zoology* 240: 1–23.
- Hobbs, H. H., Jr., Hobbs, H. H., III, and M. A. Daniel. 1977. A review of the troglobitic decapod crustaceans of the Americas.—*Smithsonian Contributions to Zoology* 244: 1–183.
- Holthuis, L. B. 1955. The Recent genera of the caridean and stenopodidean shrimps (Class Crustacea, Order Decapoda, Supersection Natantia) with keys for their determination.—*Zoologische Verhandlungen* 26: 1–157.
- . 1973. Caridean shrimps found in land-locked saltwater pools at four Indo-West Pacific localities (Sinai Peninsula, Funafuti Atoll, Maui and Hawaii Islands), with the description of one new genus and four new species.—*Zoologische Verhandlungen* 128: 1–48.
- . 1986. Decapoda.—*In*: L. Botosaneanu, ed., *Stygofauna mundi*. A faunistic, distributional, and ecological synthesis of the world fauna inhabiting subterranean waters (including the marine interstitial). Pp. 589–615. E. J. Brill/Dr. W. Backhuys, Leiden.
- Manning, R. B., and C. W. Hart, Jr. 1984. The status of the hippolytid shrimp genera *Barbouria* and *Ligur* (Crustacea: Decapoda): a reevaluation.—*Proceedings of the Biological Society of Washington* 97: 655–665.
- Policansky, D. 1982. Sex change in plants and animals.—*Annual Review of Ecology and Systematics* 13: 471–495.
- Veillet, A., J. Dax, and A.-M. Vouaux. 1963. Inversion sexuelle et parasitisme par *Bopyrina virbii* (Walz) chez la crevette *Hippolyte inermis* (Leach).—*Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences, Paris* 256: 790–791.
- Yaldwyn, J. C. 1966. Protandrous hermaphroditism in decapod prawns of the families Hippolytidae and Campylonotidae.—*Nature, London* 209: 1366.

RECEIVED: 8 February 1988.

ACCEPTED: 4 May 1988.

Address: Department of Invertebrate Zoology (Crustacea), National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560.