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AND SPECIES OF HERMIT CRAB WITH  
A DISTINCTIVE LARVA

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*LITHOPAGURUS YUCATANICUS*, A NEW GENUS  
AND SPECIES OF HERMIT CRAB WITH  
A DISTINCTIVE LARVA<sup>1</sup>

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ABSTRACT

*Lithopagurus yucatanicus* gen. nov., sp. nov., is described from three specimens collected by the R/V JOHN ELLIOTT PILLSBURY in the Yucatan Channel. The species, modified for inhabiting holes in rock or rock-like sponge rather than gastropod shells, is similar to those of five other genera in having 13 pairs of gills, an accessory tooth on the ischium of the third maxilliped, and gonopods in one sex. It differs from them in having a single pair of gonopods on the male abdomen but no unpaired pleopods, while the female abdomen bears only three unpaired pleopods. The female carries a very few large eggs, the larva passing rapidly through abbreviated development. The larva possesses reduced mouthparts, an unusual telson, lacks the posterolateral carapace spines otherwise typical of the family, and is unique among hermit crab larvae in having well-developed spines on the lateral margin of the antennal scale.

INTRODUCTION

On the homeward leg of an oceanographic cruise in 1967, the University of Miami research vessel JOHN ELLIOTT PILLSBURY made a series of bottom hauls in the vicinity of Arrowsmith Bank, off the coast of the Yucatan Peninsula, Mexico. This area proved to be extremely rich in species, and a number of undescribed hermit crabs were among the crustaceans collected. Many specimens were kept alive for observations on color and behavior and to permit hatching of eggs. Some of the new species will be described in later publications, but one of them is sufficiently important to warrant early treatment. The larva of this form is so different from pagurid larvae previously described that, despite the paucity of material, a description of the larva is included herein.

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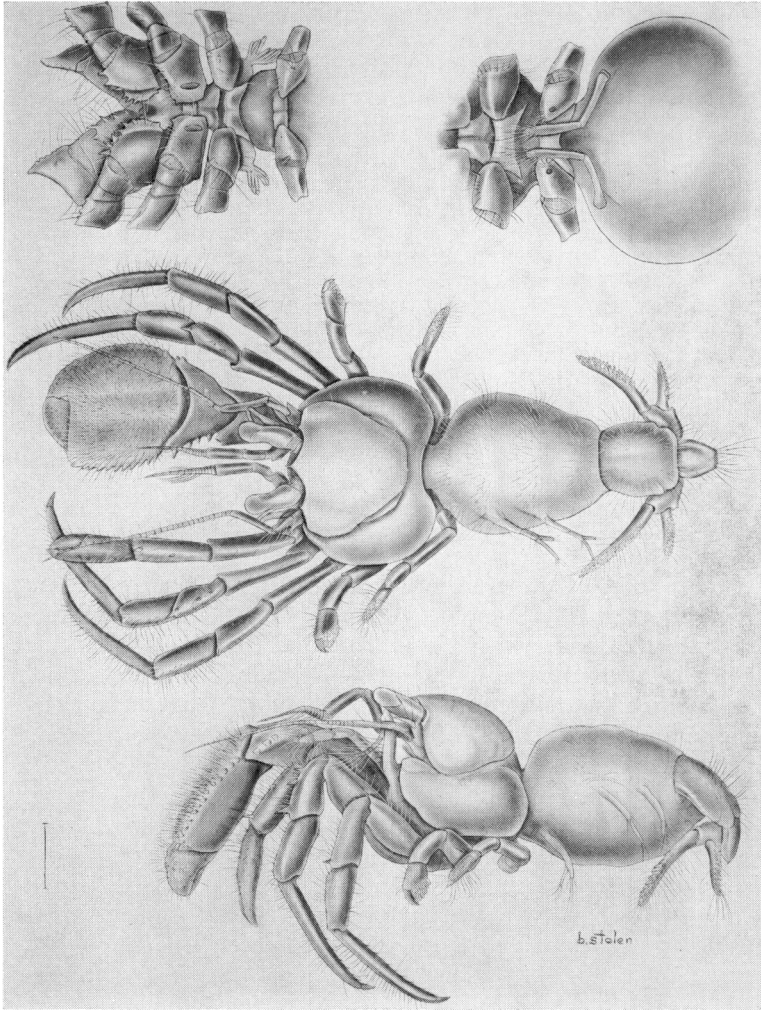


FIGURE 1. *Lithopagurus yucatanicus*, sp. n. Left and center, lateral and dorsal views of paratype female from P-581; upper right, ventral view of same; lower right, ventral view of male holotype, showing gonopods.

The illustrations, without which the manuscript would not have been written, were executed by Miss Barbara Stolen, to whom I am especially grateful. I thank Dr. Michèle de Saint Laurent-Dechancé for helpful criticisms and for permission to quote unpublished information. Mrs. C. Edith Marks has borne the often very heavy burden of feeding and caring for the many adult specimens and larvae upon which my research has depended for the past several years, and I take this opportunity to express my appreciation for her efforts. I owe thanks also to Talbot Murray and Robert Feigenbaum for assistance in the field and laboratory.

The scales in the figures represent 1.0 mm unless otherwise indicated.

#### Family Paguridae

#### **Lithopagurus**, gen. nov.

*Diagnosis*.—A pagurid with 13 pairs of gills consisting of a pair of arthrobranches on the third maxilliped and pairs on pereopods 1-4, with a pleurobranch on the somites of pereopods 2-4; male with one pair of gonopods, on the second abdominal somite, and no unpaired pleopods; female with no gonopods but with three unpaired pleopods; gonopores of female paired; palp of maxillule simple, not reflexed, bearing a single terminal seta; exopodite of all three pairs of maxillipeds flagelliform; an accessory tooth present with the *crista dentata* on the ischium of  $mxp_3$ ; shield of carapace well calcified, convex, rest of carapace not calcified; an acuminate rostrum; ocular acicles acute, narrow, not broad; abdomen short, plump, not coiled; dorsal surface of sixth abdominal somite calcified, convex; telson symmetrical, armed posteriorly only with setae; right cheliped much greater than left, fingers opening horizontally, major manus broad, operculiform, flat dorsal or anterior surface obscured with short setae; minor cheliped slender, finger tips corneous; tips of dactyli of major manus calcareous with minute corneous spines; pereopod 4 subchelate, pereopod 5 minutely so, all pereopods well calcified; uropods elongate, subsymmetrical, bearing long corneous granules forming rasps.

*Type-species*.—*Lithopagurus yucatanicus*, sp. nov.

#### **Lithopagurus yucatanicus**, sp. nov.

Figs. 1-4

*Diagnosis*.—To the above generic diagnosis, add the following:

Shield broader than long; rostrum acute, in advance of front; antennular peduncles exceeding eyes by length of distal peduncular segment; setae of flagellum of antenna only one to two segments long; lateral surface of major manus with low rounded tubercles extending onto ventral surface; coxa of major cheliped and coxae of  $P_2$ ,  $P_3$  with sharp spines on anterior margins;

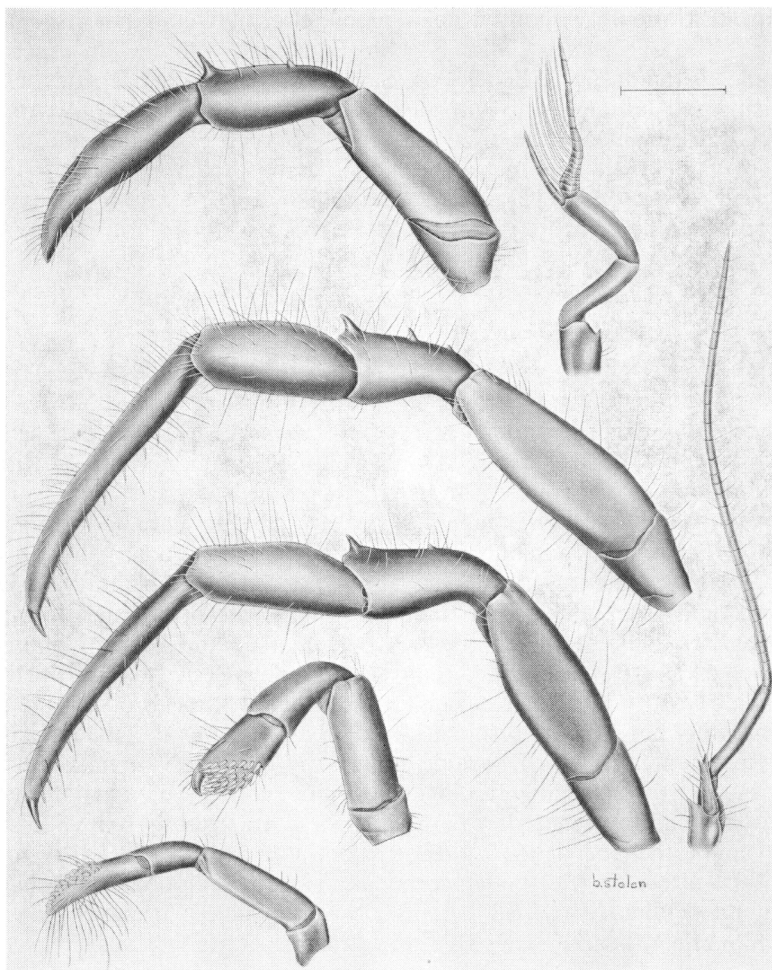


FIGURE 2. *Lithopagurus yucatanicus*, sp. n. Upper right, antennule; lower right, antenna; left, top to bottom, lateral views of pereopods 1-5 from the left side. All appendages of paratype female from P-581.

carpus of  $P_2$  with three large spines dorsally, that of  $P_3$  with one large and one small spine.

*Material*.—**HOLOTYPE**: Male, shield length (SL) = 2.8 mm, carapace length (CL) = 3.2 mm; Pillsbury station P-581, 21°05'N, 86°23'W, 146-265 m, 22 May 1967. U. S. National Museum Catalog No. 122636.

**PARATYPE**: Female, shield length 2.6 mm, collected with holotype. To

be deposited in Museum National d'Histoire naturelle, Paris. (Illustrated specimen.)

PARATYPE: Female, ovigerous at capture, shield length 2.6 mm; Pillsbury station P-584, 21°02'N, 86°24'W, 353-347 m, 23 May 1967. U. S. National Museum Catalog No. 122637. Taken in fragment of lithistid sponge.

*Description.*—Hardparts calcareous, slightly iridescent. Shield strongly convex, distinctly broader than long, with prominent acute rostrum, frontal spines sharp, well behind tip of rostrum. Posterior carapace very short, total carapace length from tip of rostrum to posterior transverse margin equaling shield width.

Abdomen plump, straight not coiled, dorsal tergal plates on somites 2, 3, 4, and 5 poorly developed but with prominent bands of setae. Sixth abdominal plate strongly calcified, convex, also bearing setae.

Telson about equal in length to maximum width, tapering posteriorly but with transverse posterior margin bearing setae.

Abdominal appendages in male consisting of a symmetrical pair of uniramous gonopods arising laterally on second abdominal somite. No other abdominal appendages in male other than uropods. Female without paired gonopods or pleopods, but with unpaired biramous pleopods on three somites, most anterior of these appearing to arise from first abdominal somite, being displaced ventrally and lying far forward of tergum of the second abdominal somite. Pleopods of third and fourth abdominal somites originating at left lateral border of dorsal band of setae. In both sexes subsymmetrical uropods with very long, narrow exopodites and much shorter, narrow endopodites, both rami bearing long and spinelike, rather than low and rounded, corneous granules.

Eyestalks short, constricted in middle, width of well-developed cornea about one-third total eyestalk length. Stalks concave medially, much stouter proximally. Eyescales (ocular acicles) small, acute, unidentate, sometimes extending beyond tip of rostrum.

Antennular peduncles exceeding eyes by at least entire length of distal peduncular segment. Dorsal flagellum reaching only to middle of major manus. Setae of flagellum only one to two segments long. Antennal acicle bifid, reaching cornea.

Mandible with apparently two-segmented palp, not distinctive.

Maxillule with simple, curved, endopodal palp bearing single terminal seta.

Maxilla normal.

Maxillipeds normal, each with flagelliform exopodite. Mxp3 with strong *crista dentata* on ischium, an accessory tooth present on lateral surface of ischium.

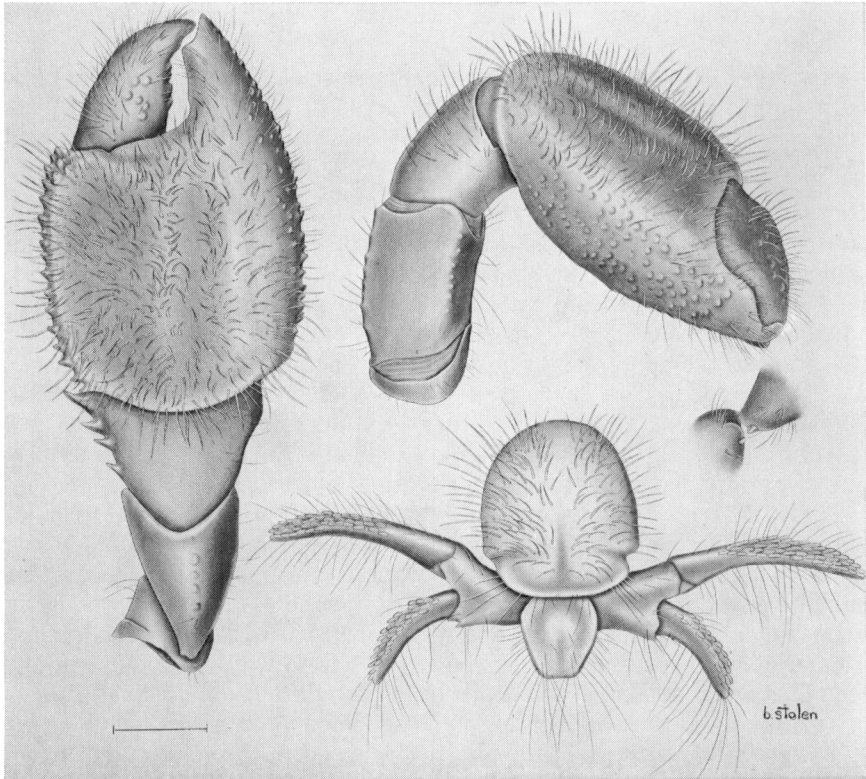


FIGURE 3. *Lithopagurus yucatanicus*, sp. n. Left, dorsal view of major chela; upper right, dorsolateral view of same; center right, detail of tips of dactyli of major manus; lower right, tail fan, including calcified plate of sixth abdominal somite. All from paratype female from P-581.

Major manus suboval, almost flat on dorsal surface but with two longitudinal, slightly raised areas. Dorsal surface covered with numerous stout, golden setae nearly obscuring surface of manus. Medial margin of manus with row of strong but blunt spines. Medial margin of movable dactylus with similar but irregularly arranged spines. Tip of movable dactylus fitting between pair of terminal spines on immovable dactylus. Lateral surface of major manus also covered with low rounded tubercles extending onto ventral surface. Major carpus with three or four spines on lateral and medial margins, smooth on dorsal surface, but with scattered setae. Merus with row of spines on lateral and medial margins. Coxa with sharp spines medially.

Minor cheliped narrow, dactyli corneous, less than one-half length of

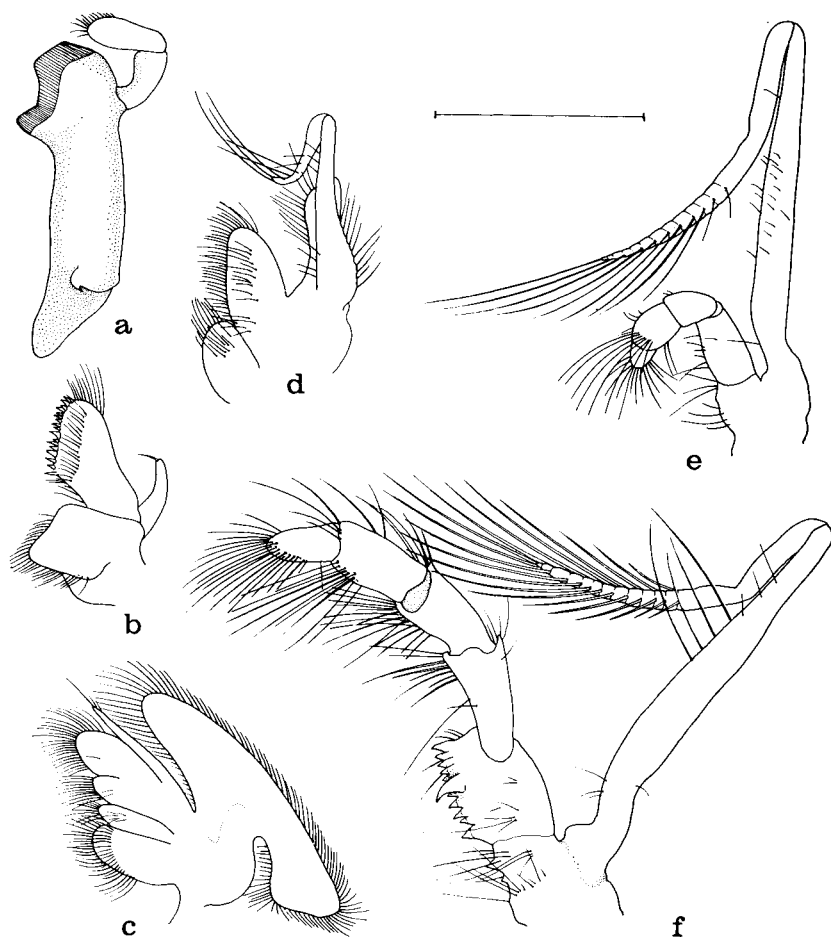


FIGURE 4. *Lithopagurus yucatanicus*, sp. n. a, mandible; b, maxillule; c, maxilla; d-f, first, second, and third maxillipeds, respectively. All from paratype female from P-581.

minor manus; manus unarmed except for long setae. Minor carpus sub-cylindrical, bearing two or three large well-separated spines on dorsal surface in addition to many setae. Merus not distinctly armed. Coxa lying obscured, dorsal to coxa of second pereiopod.

Second pereiopod on each side with narrow, almost straight dactylus, nearly twice length of propodus, dactylus ending in large corneous spine, a row of strong corneous spines ventrally, many setae dorsally. Propodus



with setae only; carpus with three very large sharp calcareous spines dorsally. Coxa with very large spines medially.

Third pereiopods similar to second, but with carpus bearing only a large distal spine dorsally and a very small one more proximally.

Fourth pereiopods with short curved dactylus barely exceeding long corneous granules of the propodal rasp which occupies only distal half of lateral surface of propodus.

Fifth pereiopod chelate, but with dactylus so small as to be extremely difficult to see, in contrast to well-developed, rasp-bearing propodus.

*Type*.—Male, shield length 2.8 mm, U. S. National Museum No. 122636.

*Type Locality*.—Pillsbury Station P-581, 21°05'N, 86°23'W in 146-265 meters.

*Color Notes*.—In life, the specimens appeared white, but practically all body parts bore some scattered red chromatophores.

*Etymology*.—The generic name (masculine) is derived from the Greek words for stone, *lithos*, and hermit crab, *pagourus*, and refers to the use of rocklike shelter, for which the animal is adapted. The trivial name indicates the regionally limited distribution as presently known.

*Range*.—Known only from the vicinity of the type locality, Arrowsmith Bank.

*Ecology*.—The vertical distribution of the species is not well defined, for although the deepest specimen was taken very close to 350 m, the other specimens may have come from as shallow as 146 m, or as deep as 265 m. At P-581, coral and coralline rubble characterized the bottom.

Some indication of temperature tolerance of the species was obtained during the several months that the specimens were maintained in the laboratory. The temperature for the specimens from the shallower station was lowered from 20°C to 15°C on 30 May, 1967, and was returned to 20°C on 19 October, 1967. They had been without natural or artificial shelters since collection, and were maintained in isolation in plastic trays, being fed twice a week with bits of shrimp. On 19 October, at the time the temperature was raised to 20°C, they were given short straight pieces of glass tubing which they used as burrows despite the relatively great weight which prevented them from moving their homes across the smooth bottom of the tray. They remained in these until death. The holotype male died at 20°C on 14 November, 1967, six months after capture. The temperature for one paratype female was raised from 20°C to 24.5°C on 25 October, 1967, and she died the next day.

The other paratype, which had been ovigerous and which inhabited a small piece of lithistid sponge at the time of capture, was allowed to keep

her shelter. Temperature was lowered from 20°C to 15°C on 26 May, 1967, to retard development of the eggs and because it was assumed that this female, collected at greater depth than the other specimens, almost certainly came from a temperature much below 20°C. In fact, as with the other specimens, 15°C appeared satisfactory. At the end of October, she was observed to have a single large egg in the ovary, visible through the dorsal abdominal wall. In an attempt to induce ovulation the specimen was transferred to 20°C, but after several days at that temperature she died on 2 November, 1967.

#### LARVAL DEVELOPMENT

The ovigerous paratype bore an undetermined number of eggs, more than six but probably less than nine. No eggs were measured while viable, but their diameter was estimated to be approximately 2 mm. Following transfer from 20° to 15°C on 26 May, 1967, the female dropped several eggs at intervals. Three of them examined on 6 June contained embryos with beating hearts and partly formed eyes. Despite attempts to maintain these eggs in culture dishes the embryos died prior to hatching. Another egg dropped on 19 June remained alive and began hatching as a prezoa on 7 August, but the larva died the next day. The second larva to hatch emerged on 12 August, but died on 15 August without molting beyond first zoea. A third larva hatched on 16 August, but also died without molting. The fourth, and last, surviving embryo (the seventh observed) also hatched on 16 August at 15°C. Hatching took place between 15:00 and 16:45 hours, and at 18:10 the larva was beginning to shed the very delicate prezoal cuticle. The larva was placed in filtered Gulf Stream water without food and on 17 August molted again, from first zoea to second zoea, the exuvia being removed at 17:00 hours, at which time *Artemia* nauplii were added to the culture vessel. On 18 August at 09:00 the animal had molted again, and the exuvia of the second zoea was recovered. On 20 August the specimen died, as an apparent stage-III zoea about to molt again, probably to glaucothoë.

Throughout the duration of larval life (approximately four days) the specimen apparently subsisted entirely on its very obvious yolk reserves and did not feed, as later examination of mouthparts indicated these appendages were never well developed.

Because of the delicate nature of the exuviae, not all structures of the stages following zoea I could be studied; the limited material was in rather poor condition.

*Zoea I*.—SIZE: CL = 2.05 mm; TL = 4.1 mm. CL is taken from the tip of the rostrum to the posterolateral margin of the carapace, the TL from the tip of the rostrum to the posterior margin of the telson. There was

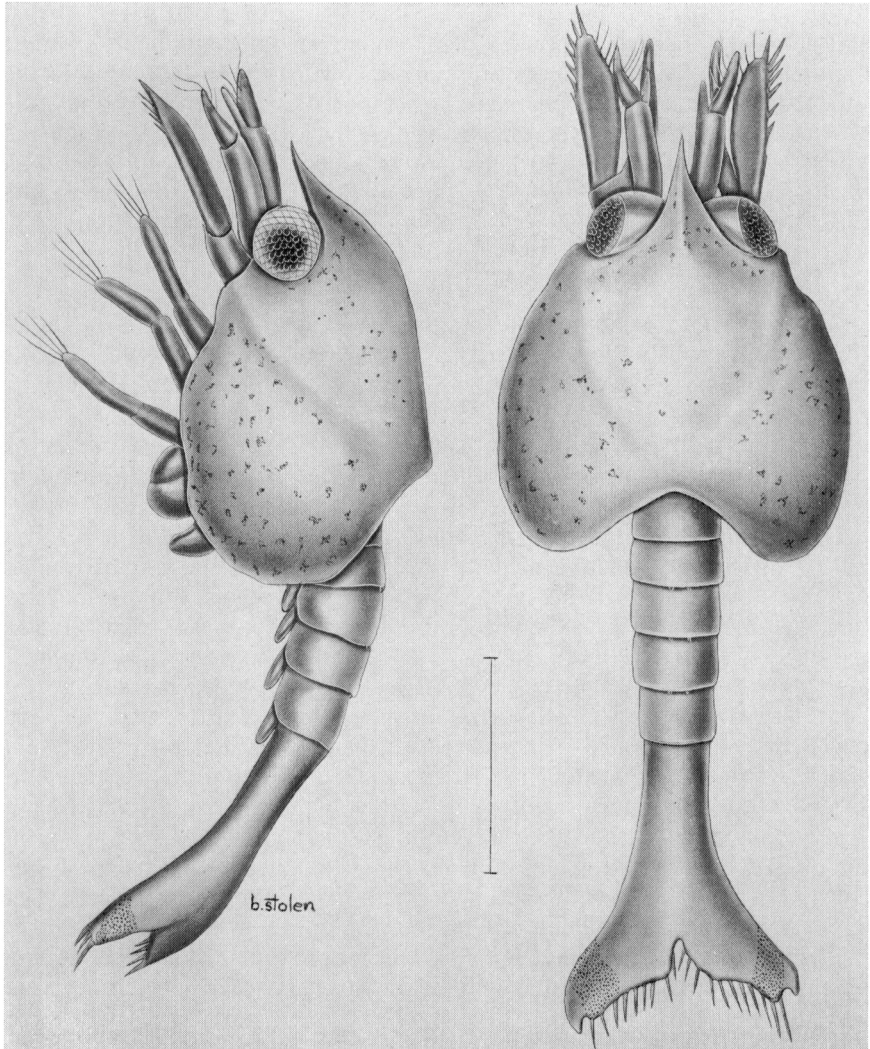


FIGURE 5. *Lithopagurus yucatanicus*, sp. n. Dorsal and lateral views of first zoeal stage. Telson shows some deformation in this specimen and carapace is slightly inflated. The eyes, the broad bands on the telson, and some of the chromatophores on the anterodorsal part of the carapace were orange; the remaining chromatophores were red.