

A NEW CRAWFISH OF THE GENUS *PROCAMBARUS*, SUBGENUS
CAPILLICAMBARUS, FROM TEXAS, WITH NOTES ON THE
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ABSTRACT

A new species is described, on the basis of 43 first form males from Brazoria County, Texas. New distributional records for *Procambarus hinei* and *P. incilis*, the other known members of the subgenus, include ten new county records. The ranges suggest that rivers are significant barriers separating these species from one another.

INTRODUCTION

The species of *Procambarus* described here occurs in the lower Brazos River valley, between the ranges of *P. hinei* (Ortmann, 1905) and *P. incilis* Penn (1962), the other two known members of the subgenus *Capillicambarus* Hobbs (1972). Collected by the author in the spring of 1972, this crawfish also has been found in collections made in 1966 by Joe B. Black of McNeese State University, Lake Charles, Louisiana.

I wish to thank Dr. Black for very generously providing data on all his Texas collections of the subgenus *Capillicambarus*, and for loaning several of them to me. I am also most grateful to Horton H. Hobbs, Jr. of the Smithsonian Institution for his criticism of the manuscript, and to Chester O. Martin for his assistance in the preparation of the figures. This is contribution No. TA10099

of the Texas Agricultural Experiment Station.

Procambarus (Capillicambarus)
brazoriensis new species

Diagnosis.—Body and eyes pigmented. Rostrum usually without marginal spines or tubercles in adults, acumen poorly or not at all delimited basally. Juveniles with acute lateral spines at base of acumen. Areola broad but variable, 2.5 to 4.9 times longer than wide, and 28.3 to 33.6% of entire length of carapace. Single cervical spine present or absent, often so small as to escape notice. Postorbital ridges weakly developed, terminating anteriorly in short spine or ending squarely, with no spine. Antennal scale 2.1 to 2.5 times longer than wide, broadest slightly proximal to midlength. Chela subcylindrical and non-tuberculate. Ischia of third and fourth pereopods with simple hooks. Venter of cephalothorax covered with dense mat of long hairs arising from mesial faces of pereopods and third maxillipeds. First pleopods (Fig. 1-A, B) symmetrical, extending forward just beyond caudal margin of coxae of third pereopods when abdomen is flexed. Apical third of pleopod bent caudad at about 35° angle to shaft, expanding distally as seen in mesial view, not tapering toward apex, terminating abruptly in three small elements. Apical elements twisted (sinistrally on left appendage) as

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TABLE 1. Measurements (mm) of *Procambarus brazoriensis*.

	Holo-type	Morpho-type	Allo-type
Carapace:			
Length	15.2	14.2	17.3
Greatest height	8.3	7.8	9.3
Greatest width	7.6	7.1	9.1
Areola:			
Length	5.1	4.4	5.7
Least width	1.2	1.2	1.4
Rostrum:			
Length	4.1	3.9	5.0
Width at base	2.5	2.4	3.1
Antennal scale:			
Length of lateral margin	4.2	4.0	4.2
Greatest width	1.9	1.7	2.0
Chela:			
Length of outer margin	13.6	9.6	7.3
Length of inner margin of palm	8.4	5.4	3.1
Greatest width of palm	3.0	2.3	2.7
Greatest thickness of palm	2.6	1.8	1.8
Length of dactyl	4.6	3.8	3.6

in other members of subgenus (Penn, 1953, 1962), but twisting slight so that elements best observed in mesial or lateral view. Mesial process non-corneous, spiculiform, extending laterodistad; cephalic process somewhat corneous, lying closely mesiocephalic to mesial process, strongly compressed laterally, tapering gently in mesial view from wide base to blunt or truncate tip; central projection corneous, acute, compressed along longitudinal axis, with fusion line of component elements visible. Caudal process absent. Apical half of pleopod with dense covering of long hairs on mesial surface; cephalomesial shoulder weak.

Holotypic male, Form I.—Cephalothorax (Fig. 1-C, D) subovate. Abdomen narrower and slightly longer than cephalothorax. Greatest width of cephalothorax subequal to height at same level. Aerola 4.2 times longer than wide. Rostrum without lateral spines, widest at base, with margins converging as nearly straight lines; no median carina. Suborbital angle slightly greater than right angle. Branchiostegal spine small, acute. Cervical groove interrupted by small lateral spine on each side. Epistome (Fig. 1-H) broader than long, with small spine on anterior margin. Cephalic portion of telson with two spines at each caudolateral angle, more lateral one nearly twice length of other. Antennules of usual form, with basal segment bearing large spine on distal margin of ventral surface. Antennae reaching just beyond telson. Antennal scale (Fig. 1-I) extending well beyond tip of rostrum, broadest slightly proximal to midlength; lateral margin straight, terminating in acute spine.

Chela (Fig. 1-E) very finely pubescent. Palm inflated; both fingers terminating in corneous tips. Opposable margins of fingers flattened, covered with rows of minute rounded denticles, with about four rows distally to about ten proximally. Fingers short; length of dactyl 34% that of outer margin of chela. Carpus subcylindrical, non-tuberculate.

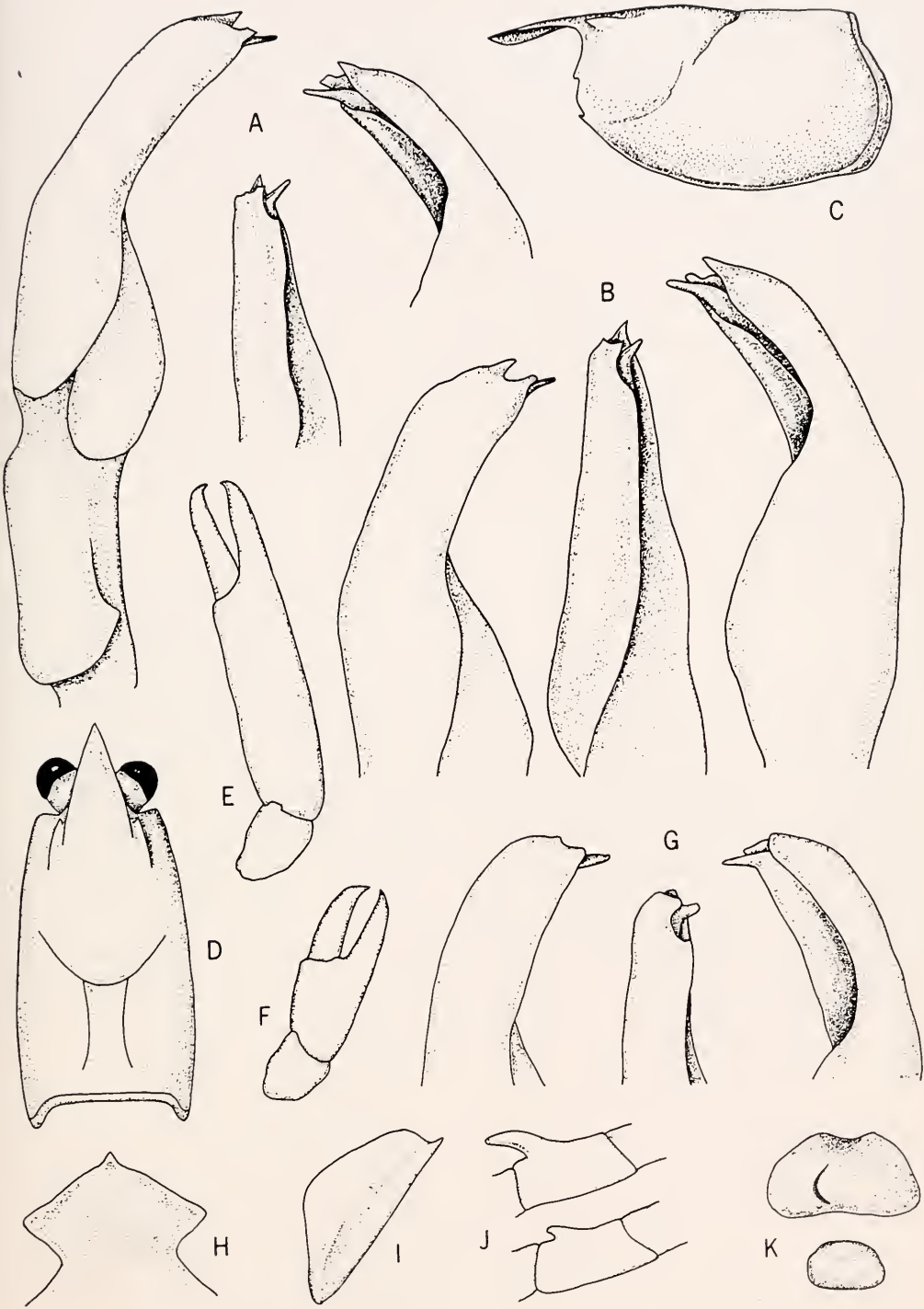
Hooks on ischia of fourth pereopods about one-third as long as those on third pereopods (Fig. 1-J). Hook on latter extending proximally beyond distal margin of corresponding basis; that on fourth pereopod not reaching proximal margin of ischium.

Hairs on venter of cephalothorax especially thick and conspicuous on mesial faces of third maxillipeds and first three pereopods.

First pleopods as described in diagnosis. Measurements are given in Table 1.

Morphotypic male, Form II.—Similar to

Figure 1. *Procambarus (Capillicambarus) brazoriensis* new species. A, mesial, caudal, and lateral views (left to right) of first pleopod of paratype male, Form I; B, similar views of first pleopod of another paratype male, Form I; C, D, lateral and dorsal views of carapace of holotype; E, chela and carpus of holotype; F, chela and carpus of allotype; G, mesial, caudal, and lateral views of first pleopod of paratype male, Form II; H, I, epistome and antennal scale of paratype male, Form I; J, ischia of third and fourth pereopods of holotype; K, annulus ventralis of paratype female. Pubescence removed from all structures illustrated.



holotype in general appearance. Chelae reduced but with ratio of finger length to total length of chela as in holotype. Hooks on ischia of third and fourth pereopods greatly reduced; those on third pereopods extending proximally barely to margin of ischium, and those on fourth pereopods appearing only as low prominences. Venter of cephalothorax only sparsely clothed with long hairs. Apical processes of first pleopods (Fig. 1-G) reduced, non-corneous.

Allotypic female.—Similar to holotype in shape and structure of cephalothorax, but differing markedly in proportions of chela (Fig. 1-F), in which length of inner margin of palm and of dactyl subequal. Annulus ventralis (Fig. 1-K) freely movable; width nearly twice as great as length. Annulus in caudal view tapering steeply to truncate apex. Anterior face with deep furrow from base to summit. Sinus originating at summit, running posterodextrad and gently recurving posteroinistrad nearly to base of posterior face. Sternal plate immediately caudal to annulus with acute apex directed cephaloventrad.

Color pattern.—The following notes are based on live and freshly killed specimens. A pair of brown to dark olivaceous dorsal stripes, each slightly wider than the areola, originate behind the eyes and run posteriorly along either side of the areola and onto the abdomen. On the abdomen, these stripes converge slightly, become narrower, and terminate on the base of the telson. The mid-dorsal region, from rostrum to base of telson, is light tan, appearing as a light stripe narrower than the darker stripes bordering it. Another dark stripe, generally brown and narrower than the first, begins on the mid-lateral surface of the carapace and extends to the base of the uropod. The space between this stripe and the edge of the abdominal tergites is about as wide as the stripe. The latter areas, and the broader regions between dorsal and lateral dark stripes, are light tan to pale olive, as are the telson, uropods, and chelae.

Size.—The largest specimen collected is a female, 19.4 mm in carapace length. The largest and smallest Form I males have corresponding lengths of 18.0 and 12.0 mm.

Type locality.—Ditch beside County Road 400, 0.1 mile SE of Missouri Pacific railroad and 0.25 mile SW of Brazos River, at S

edge of Brazoria, Brazoria County, Texas. Specimens were netted from the ditch, which lies between the gravel road and a grazed live oak woodland with lush undergrowth. A portion of the ditch over a hundred meters long and about one meter wide commonly contains water up to 0.3 m deep, but dries completely during extended periods without rain. *Procambarus acutus* (Girard, 1852), *P. clarki* (Girard, 1852), and *Cambarellus puer* Hobbs (1945) were collected at the same locality.

Types.—The holotypic male, Form I, allotypic female, and morphotypic male, Form II (Nos. 133916, 133917, 133918, respectively) are deposited together with 50 paratypes (15 ♂ I, 12 ♂ II, 10 ♀, 6 juv. ♂, 7 juv. ♀) in the National Museum of Natural History, Smithsonian Institution. The remaining paratypes (27 ♂ I, 33 ♂ II, 56 ♀, 81 juv. ♂, 88 juv. ♀) are in the collection of the author.

Range.—*Procambarus brazoriensis* has been found only in Brazoria County, Texas, in an area between the San Bernard River and Oyster Creek (both sides of the Brazos River), extending inland from the Gulf only about 20 miles (Fig. 2). It has been collected by the author or by J. B. Black at the following localities: S edge of Brazoria (DWA T14-1), 1 mi. NE Brazoria (JBB 144, 145; DWA 415), 4.3 mi. NE Brazoria (DWA 408), 5 mi. NE Brazoria (JBB 143), 2.5 mi. S Brazoria (DWA T14-5), and 1.5 mi. N Jones Creek (DWA T14-2).

Variation.—The range of variation in the first pleopods of the 43 Form I males examined is represented in Fig. 1-A, B. Non-secondary sexual characters vary as indicated in the diagnosis. In about 20% of females the annulus ventralis appears as a mirror image of that of the allotype.

Relationships.—*Procambarus brazoriensis* has its closest affinities with *P. binei*. In comparison with *P. incilis*, both *P. binei* and *P. brazoriensis* have a more slender mesial process, a much better developed cephalic process, and a more acute central projection. The hooks on the ischia of the fourth pereopods of *P. brazoriensis* are similar to those of *P. binei*, and are much better developed than those of *P. incilis*. These similarities and differences indicate that *P. brazoriensis* is not an intergrade between

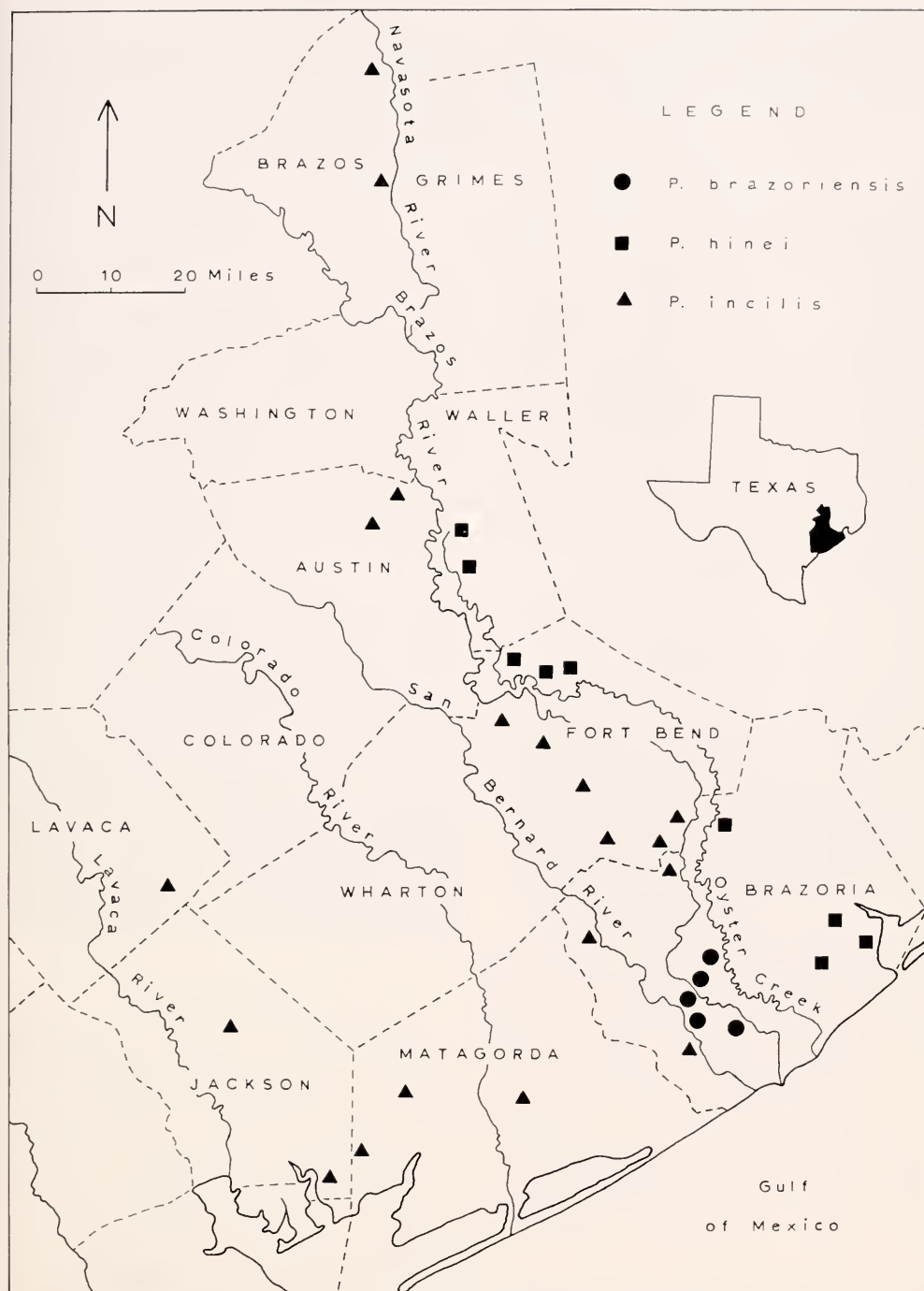


Figure 2. New distributional records for *Procambarus*, subgenus *Capillicambarus*, in Texas (eastern localities for *P. hinei* not included).

P. binei and *P. incilis*, as might be suggested by its occurrence between the ranges of the latter two species. The annuli ventrales of females of the three species are virtually indistinguishable. Statements that *P. binei* and *P. incilis* have immovable annuli ventrales (Penn, 1953, 1962) are erroneous.

Procambarus brazoriensis differs from *P. binei* in having the apical third of the pleopod expanding distally in mesial view and ending abruptly, not tapering to its apex as in *P. binei*. The cephalic process is wider than that of *P. binei* both at the base and at its truncate tip, and lies in a more nearly longitudinal plane (with respect to the axis of the animal). The cephalic process of *P. binei* is nearly transverse in orientation.

Life history notes.—Form I males have been present in every month for which collections are available: March, June, July, August, and September. Large numbers of small young were present in June. Females had sperm plugs in March and August.

DISTRIBUTION OF *PROCAMBARUS HINEI* (ORTMANN)

This species has a spotty distribution throughout most of Louisiana west of the Mississippi River, and in the southeastern corner of Texas. Penn (1956) recorded it from 12 parishes in Louisiana. Previous Texas records are from Harris, Liberty, and Jefferson Counties (Penn and Hobbs, 1958). I have collected it at 16 localities in Texas, as far west as the Brazos River (Fig. 2).

Collection Localities: Brazoria County—2.3 mi. W Rosharon (DWA T12-5), 5 mi. S Danbury (DWA 438), 6.5 mi. SE Danbury (DWA T13-5), 11 mi. SE Danbury (DWA 362); Fort Bend County—2 mi. NW Fulshear (DWA T9-1), 1.6 mi. E Fulshear (DWA T9-7), 5.3 mi. E Fulshear (DWA 432); Jasper County—6 mi. S Evadale (DWA 398); Liberty County—4.8 mi. NW Moss Hill (DWA 403), 0.7 mi. W Moss Hill (DWA 402), 2 mi. E Liberty (DWA 404), 3.3 mi. N Hull (DWA 401); Newton County—15 mi. N Deweyville (DWA 396), 7.8 mi. N Deweyville (DWA 395); and Waller County—9 mi. SSE Hempstead (DWA T7-2), 11 mi. NNW Brookshire (DWA T7-3, T7-4, T7-6).

One of J. B. Black's collections (JBB 145, 1 mi. NE Brazoria, Brazoria County) from the range of *P. brazoriensis* contains a single first form male *P. binei* in addition to several *P. brazoriensis*. Sympatric occur-

rence of the two species would be quite significant. However, subsequent collecting at that locality has produced only *P. brazoriensis*, and I am reluctant to accept a record based on one specimen, fearing the possibility of error.

DISTRIBUTION OF *PROCAMBARUS INCILIS* PENN

Previously recorded from Jackson, Matagorda, and Wharton Counties, Texas (Penn, 1962). These localities, and more recent additional collecting, suggest that its range (Fig. 2) is bounded on the southwest by the Lavaca River and Bay. To the east, it appears to be separated from *P. brazoriensis* by the lower San Bernard River, and from *P. binei* by the Brazos River north almost to its confluence with the Navasota River. *P. incilis* has been collected by the author or by J. B. Black at 19 localities.

Collection Localities: Austin County—3.8 mi. NE Belleville (DWA T8-1), 7.8 mi. NE Belleville (DWA T8-4); Brazoria County—1.7 mi. E Danciger (DWA 418), 7 mi. E Damon (DWA 410), 7 mi. S Brazoria (DWA T14-3); Brazos County—7 mi. NE Kurten (DWA 383), 8 mi. E College Station (DWA T4-2, T4-4); Fort Bend County—10.5 mi. W Rosenberg (DWA T10-5), 4.5 mi. W Rosenberg (DWA T10-2), 7 mi. S Rosenberg (DWA 431), 6.3 mi. E Needville (DWA T11-1), 13.5 mi. ESE Needville (DWA T11-5), 15.5 mi. E Needville (DWA T11-2); Jackson County—5 mi. NE Edna (JBB 421), 8.5 mi. W Palacios (JBB 153); Lavaca County—4 mi. N Speaks (DWA 437); and Matagorda County—8 mi. NW Palacios (DWA T16-6), 1.5 mi. E Blessing (DWA T16-5), 3 mi. N Wadsworth (DWA T15-7).

ZOOGEOGRAPHY

The range of *Procambarus brazoriensis* appears to be separated from that of *P. incilis* to the southwest by the San Bernard River, and from that of *P. binei* to the northeast by Oyster Creek (Fig. 2). Extensive collecting around the periphery of the range has failed to disclose intergrades, or to close the gap between *P. brazoriensis* and its relatives to the north and northwest. The single record of *P. binei* occurring together with *P. brazoriensis* may be indicative of a sparse population of *P. binei* existing sympatrically with *P. brazoriensis*, attesting their specific status relative to one another.

The present delimitation of the range

largely by rivers might suggest that these streams isolated a segment of the parental stock, which diverged to become *P. brazoriensis*. However, the geological events leading to the present situation are much too recent for such an explanation to be tenable. This area lies on the Brazos-Colorado alluvial plain, which is of Recent origin. Development of the Oyster Creek course, formerly occupied by the Brazos River, and establishment of the modern lower Brazos have occurred in the last 2,000-4,000 years (Bernard, LeBlanc, and Major, 1962). Late in the Pleistocene the lower Brazos lay west of its present course.

Major rivers may have been important in the derivation of *P. brazoriensis*, but probably it formerly occupied a larger range. Later changes in stream courses may have divided its range, with isolated populations subsequently becoming extinct. A possible explanation for the loss of such populations is the disappearance of barriers separating them from their close relatives, with which they were unable to compete or into the populations of which they were assimilated (if capable of interbreeding). Perhaps survival of members of the subgenus continues to depend, to a degree, on the partial isolation from one another afforded by the rivers separating their ranges.

Further evidence that *P. brazoriensis* was derived from *P. hinei* (or vice versa) rather than from *P. incillis* can be seen in the distribution of the small crawfish, *Cambarellus puer*. *C. puer* occurs together with *P. bra-*

zoriensis and *P. hinei* throughout their ranges, but is not found in the range of *P. incillis* (with two known exceptions in Brazoria County, both localities probably recently colonized).

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A NEW TROGLOBITIC CRAYFISH OF THE GENUS *PROCAMBARUS*
FROM FLORIDA (DECAPODA: ASTACIDAE)

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ABSTRACT

A new troglobitic crayfish of the genus *Procambarus* is described from northern Florida. The new crayfish is most closely related to *P. lucifugus lucifugus* and *P. lucifugus alaciuua*. The Florida troglobitic crayfishes are illustrated, and a key to them is presented.

Only a year ago, the description of a new troglobitic crayfish, *Procambarus milleri* Hobbs (1971), from Dade County Florida, appeared. Suspecting that it was probably the last undescribed troglobitic crayfish occurring in the State, Hobbs presented a key to the seven species and subspecies that were known at that time and illustrated certain of their diagnostic features. After that manuscript had been accepted for publication, adult specimens of the crayfish from Leon and Wakulla counties that he had tentatively identified (loc. cit., p. 123) as *Procambarus pallidus* (Hobbs, 1940), were obtained by D. Bruce Means, and specimens of another troglobite were collected in Jefferson County by Michael N. Horst. Both proved to be distinct and were described by Hobbs and Means (1972).

In the meantime, Frank Redmon had discovered the sinkhole that is here designated the type-locality of the new species described below, and in November, 1971, Frank Hurt collected the first specimens of this species, one of which is being maintained alive in the Jacksonville Children's Museum. Additional specimens, including the holotypic male, were collected by him and Barry W. Mansell on November 23, 1971. Except for the holotype, all of the specimens on which

the following description is based were obtained in January and February 1972 by the authors.

In order to provide a comparable series of illustrations of all of the Floridian troglobitic crayfishes, Figures 2-4 are included to complement those of the seven species and subspecies figured in Hobbs, 1971. A revised key to these troglobites is also presented.

We extend our appreciation to Frank Hurt and Barry W. Mansell who first collected the crayfish described herein and who have permitted us to prepare this account of it. We are deeply indebted to Dr. Horton H. Hobbs, Jr., Smithsonian Institution, who actually prepared the bulk of the description of the new species and the Figures, and who has kindly allowed publication in this paper of his revised key to the troglobitic crayfishes. This contribution to science is as much his as ours.

Procambarus (Ortmannicus) erythrops,
new species

Diagnosis: Integument white to pale tan; eyes moderately small, lacking facets, but with conspicuous red pigment spot. Rostrum with marginal spines. Arcola 8.3 to 14.5 times longer than wide and comprising 35.3% to 38.7% of entire length of carapace (45.3% to 48.1% of postorbital length). Single pair of cervical spines present. Suborbital angle absent. Postorbital ridges terminating cephalically in a spine and several tubercles at caudal base. Hepatic area of carapace with crowded tubercles, some spiniform. Antennal scale approximately 1.7

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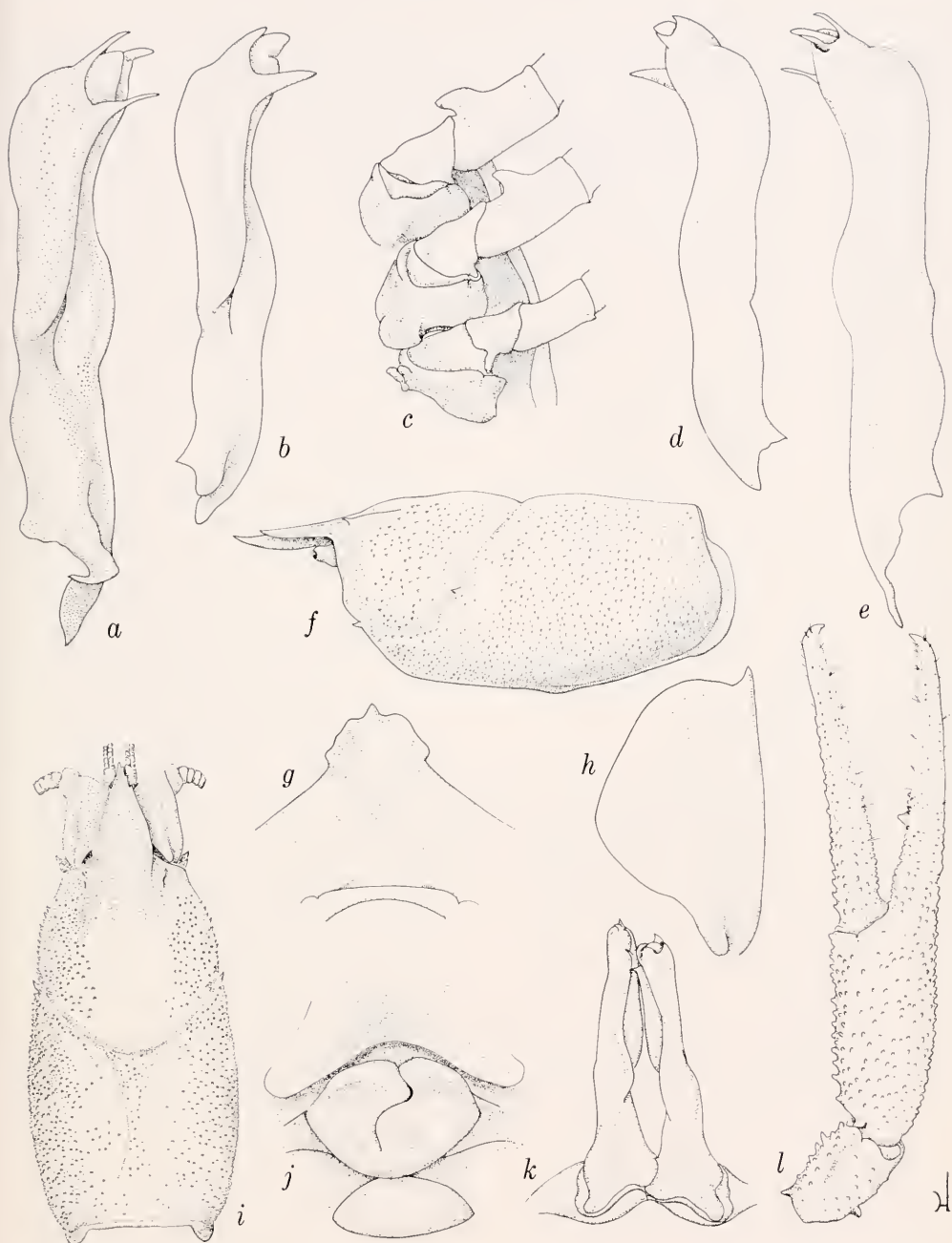


Figure 1. *Procambarus erythropus*, new species. *a*, Mesial view of first pleopod of holotype; *b*, Mesial view of first pleopod of paratypic male, form II; *c*, Basal podomeres of third, fourth, and fifth pereiopods of holotype; *d*, Lateral view of first pleopod of paratypic male, form II; *e*, Lateral view of first pleopod of holotype; *f*, Lateral view of carapace of holotype; *g*, Epistome of holotype; *h*, Antennal scale of holotype; *i*, Dorsal view of carapace of holotype; *j*, Annulus ventralis of allotype; *k*, Caudal view of first pleopods of holotype; *l*, Dorsal view of distal podomeres of cheliped of holotype.

times longer than wide, widest proximal to midlength. Ischia of third and fourth pereopods with hooks, that on third overreaching basioischial articulation. First pleopods asymmetrical, with distinct rounded hump on cephalic surface, subapical setae, and reaching cephalically to coxae of third pereopods; distal extremity bearing (1) subspiciform mesial process directed caudodistally and slightly laterally; (2) prominent, slender, acute cephalic process cephalic to and partially hooding central projection, directed caudodistally; (3) corneous, long central projection extending caudodistally at 75° to 80° to main shaft of appendage and almost as far caudally as mesial process, and (4) caudal element consisting of prominent crestlike adventitious ridge (process) situated mesial to central projection; caudal knob and caudal process absent. Annulus ventralis with cephalolateral margins elevated (ventrally) and with raised caudomedian prominence; sinus originating on cephalic margin, and, following sinuous contour, ending on caudomedian prominence. Sternum immediately cephalic to annulus entire, lacking caudally projecting prominences and tubercles.

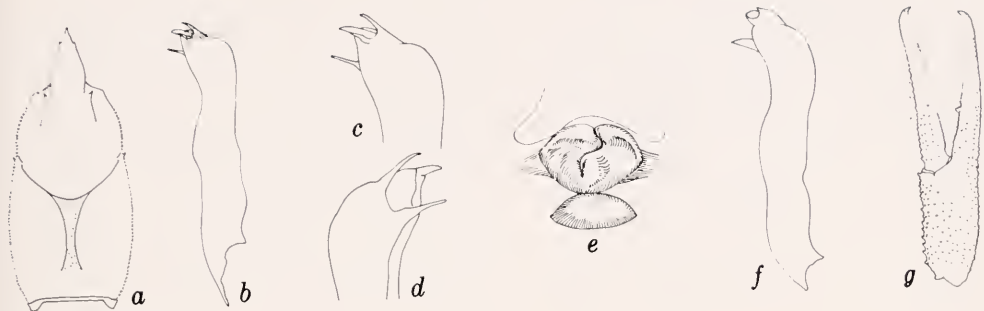
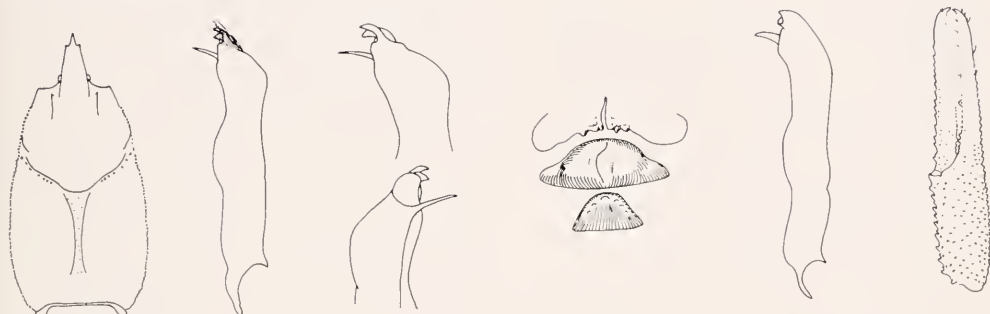
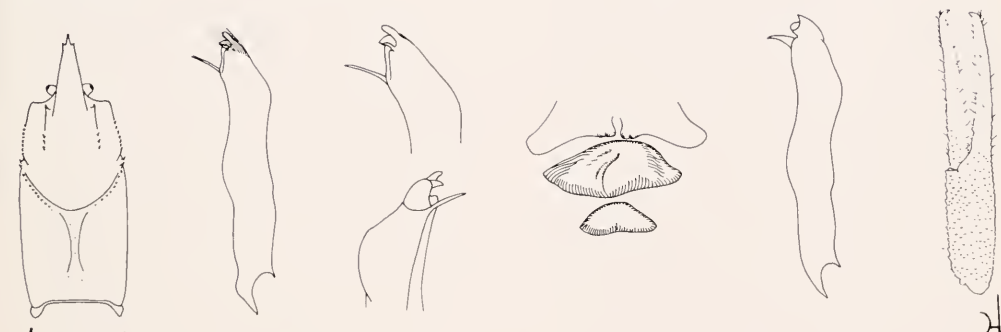
Holotypic Male, Form I: Body (Fig. 1*f,i*) subcylindrical. Eye reduced in size, lacking facets but provided with small red pigment spot. Abdomen narrower than thorax (16.0 and 21.1 mm, respectively). Width of carapace greater than height at caudodorsal margin of cervical groove (21.3 and 18.0 mm). Areola 10.0 times longer than wide with one or two punctations across narrowest part. Cephalic section of carapace about 1.7 times longer than areola; length of areola 37.3% of entire length of carapace (47.1% of postorbital length). Rostrum excavate dorsally with unthickened, convex margins interrupted by paired marginal spines at base of acumen, latter reaching level of distal end of peduncle of antennule and bearing two accessory spines on dextral margin and two smaller ones on sinistral margin; setiferous punctations arranged in submarginal row and few scattered over remainder of surface of rostrum, most abundant at level of orbit. Subrostral ridges rather weak, not evident in dorsal aspect except in caudalmost portion of orbit. Postorbital ridges clearly defined, with acute,

curved spines cephalically and few small tubercles caudally; dorsolateral groove shallow, inconspicuous. Suborbital angle absent. Branchiostegal spine prominent, acute. Dorsomedian portion of carapace sparsely punctate; hepatic region tuberculate except cephalically, some tubercles acute or spiniform; branchiostegites thickly studded with tubercles, especially cephaloventrally; only one cervical spine present on each side although part of a series of small acute tubercles along caudal flank of cervical groove.

Abdomen shorter than carapace (44.0 and 45.6 mm). Cephalic section of telson with three spines in each caudolateral corner, mesial two movable. Cephalic lobe of epistome (Fig. 1*g*) with convergent, somewhat thickened, ventrally elevated, undulating cephalolateral margins; subtruncate cephalic margin bearing acute median projection; basal portion with median longitudinal depression, lacking distinct fovea. Antennules of usual form with prominent distally directed spine near midlength of ventral surface of basal article of peduncle. Antennae exceeding caudal margin of telson by length slightly greater than that of carapace. Antennal scale (Fig. 1*h*) 1.7 times longer than broad with greatest width distinctly proximal to midlength, lamellar area about 2.5 times broader than thickened lateral part, latter terminating in strong, short spine.

Third maxillipeds extending anteriorly to level of tip of rostrum; opposable margin of ischium with teeth, its lateral surface serrate distally; ventral surface almost naked, but mesioventral surface with several sublinear series of stiff, long setae.

Right chela (Fig. 1*l*) slender, subovate in cross section, not strongly depressed. Mesial surface of palm with tubercles not distinctly arranged in linear series but with 10 or 11 in relatively straight line and additional ones above and below; lateral margin of palm with serrations extending to distal end of proximal third of fixed finger; dorsal and ventral surfaces of both fingers with submedian longitudinal ridges flanked proximally by conspicuous tubercles, distally by setiferous punctations. Fixed finger with row of 15 tubercles along proximal two-fifths; with distinctly larger, corneous-tipped tubercle on lower level (between twelfth

2. *P. erythropus*3. *P. horsti*4. *P. orcinus*

Figures 2-4. Floridian troglobitic crayfishes. *a*, Dorsal view of carapace; *b*, Lateral view of left first pleopod of first form male; *c*, Mesial view of distal portion of same; *d*, Lateral view of distal portion of same; *e*, Annulus ventralis; *f*, Lateral view of left first pleopod of second form male; *g*, Dorsal view of chela of first form male.

and thirteenth tubercle from base) followed immediately distally by two additional progressively smaller tubercles; band of crowded minute denticles beginning between rows at level of large tubercle, broadening distally, extending almost to corneous tip of finger. Opposable margin of dactyl with row of 12 tubercles extending from base almost to level of major tubercle on fixed finger, with row of seven tubercles beginning dorsal to,

and between, two distalmost tubercles in latter row, ending at level immediately proximal to distalmost tubercle of row on fixed finger; tubercles of both rows decreasing in size distally, band of crowded minute denticles as on fixed finger; mesial surface of dactyl with tubercles extending from proximal portion to base of distal one-fourth of finger.

Carpus of right cheliped longer than broad

TABLE 1. Measurements (mm) of *Procambarus* (*Ortmannicus*) *erythrops*.

	Holo-type	Allo-type	Morpho-type
Carapace:			
Height	18.0	14.3	18.0
Width	21.1	16.1	20.0
Length	45.6	34.8	42.7
Areola:			
Width	1.7	1.5	1.3
Length	17.0	12.9	16.0
Rostrum:			
Width	5.9	4.5	5.5
Length	11.9	8.3	10.6
Right Chela:			
Length of mesial margin of palm	15.0	10.5	14.9
Width of palm	8.9	6.0	8.2
Length of lateral margin of chela	41.5	28.6	42.1
Length of dactyl	25.1	17.4	25.3

(10.3 and 6.0 mm), with all surfaces tuberculate; dorsal surface with distinct oblique furrow; dorsomesial surface with row of three tubercles, distalmost distinctly larger than others nearby; largest tubercle on podomere situated on distal ventromesial border; additional strong tubercle on ventrodistal condyle.

Merus of right cheliped tuberculate except for proximal portion of mesial and lateral surfaces; dorsal surface with crowded tubercles, more numerous distally, largest subspiniform and situated subapically; ventral surface with sublinear series of 20 tubercles mesially, less well defined row of 14 laterally; additional tubercles between and flanking both rows; distal ventrolateral angle with strong, spiniform tubercle. Ischium with tubercles dorsally and ventrally, five larger ones linearly arranged along ventromesial margin. Basis with single tubercle in position corresponding to ventromesial row of tubercles on ischium (two on left cheliped).

Hooks on ischia of third and fourth pereiopods (Fig. 1*c*) simple, that on third overreaching basioischial articulation, that on fourth not reaching corresponding articulation, not opposed by tubercle on basis. Coxa of fourth pereiopod with prominent,

swollen caudomesial boss, that of fifth with small tuberculiform prominence extending caudomesially and somewhat ventrally from caudomesial angle.

Sternum between second, third, and fourth pereiopods rather deep, ventrolateral margins bordered with long setae.

First pleopods (Fig. 1*a,e,k*) as described in diagnosis. In addition, subterminal setae arising around base of cephalic process and along lateral base of central projection, completely obscuring both processes in lateral aspect.

Uropod with distally directed spine on each basal lobe; median spine on mesial ramus not nearly reaching distal margin of ramus.

Allotypic Female: Differing from holotype in following respects: acumen without accessory spines; punctations on dorsal surface of rostrum at level of orbit few, most lacking setae; cephalic section of telson with only two spines in each caudolateral corner; cephalic margin of cephalic lobe of epistome more deeply emarginate on each side of median projection; tubercles on mesial margin of palm of chela more nearly linearly arranged, mesialmost row consisting of 11 or 12; opposable margin of both fingers of chela with row of 12 tubercles, fixed finger with usual additional large tubercle on lower level, but with additional two on holotype lacking; carpus of cheliped with three large spines on distal margin, two ventral ones as described in holotype, and one mesial to dorsal articular knob; merus with several distinctly spiniform tubercles on dorsodistal surface, ventral surface with one or two more tubercles in each of two poorly defined rows; ischium with tubercle on ventromesial margin virtually obsolete.

Annulus ventralis (Fig. 1*j*) not deeply embedded in sternum, subovate, broader than long with cephalic margin elevated ventrally, bearing median emargination marking origin of sinus; latter extending caudally in form of tilted, reversed "S," ending sinistral to median line on submedian elevation near caudal margin of annulus. Sternum immediately cephalic to annulus without caudally projecting prominences or tubercles. Postannular plate much broader than long, only little narrower than width of annulus, its

width, however, greater than greatest length of annulus.

Morphotypic Male, Form II.—Differing from holotype in following respects: acumen of rostrum lacking accessory spines; lateral surface of fixed finger of cheliped with serrations extending to midlength of finger; opposable margin of dactyl with row of 18 tubercles in single row; irregular row of 15 or 16 tubercles on ventrolateral surface of merus; ventromesial surface of ischium with row of six tubercles on left cheliped, corresponding basis lacking tubercle; basis of right cheliped with one tubercle mesially. Hooks on ischia of third and fourth pereopods distinctly reduced, neither reaching basioischial articulation; prominences on coxae of fourth and fifth pereopods not conspicuously smaller than those in holotype.

First pleopods strongly asymmetrical with few subapical setae, as depicted in Fig. 1*b,d*. Mesial and cephalic processes and central projection much more robust than in holotype; caudal element represented by tumescence at caudomesial base of central projection.

Type-locality: Sim's Sink, 1 mi west of the junction of U.S. Hwys. 27 and 129, and 0.1 mi south of Hwy. 27, Suwannee County, Florida (Sec. 24, T. 6S, R. 14E). The shallow, funnel-shaped sink reaches ground water at a depth of approximately 12 feet. The original owners have partially covered it with boards upon which there is an accumulation of detritus, mosses, and ferns, but broken portions of the roof and spaces between boards allow detritus to filter into the sinkhole. The pool of water is elliptical, measuring approximately 8 by 12 feet, and is bounded by a nearly vertical shaft of limestone for half of its circumference to a depth of about 30 feet (bottom of pool). There are small ledges and crevices in the limestone wall. Opposite the vertical wall, the pool opens to a cave of unknown extent, and during periods of lower water levels, the surface area of the pool is greater since part of the ceiling of the cave is then above the water. *Procambarus erythropus* occurs throughout the sink and explored cave area.

Types: The holotypic male, form I, allotypic female, and morphotypic male, form II (Nos. 133471, 133472, and 133473 re-

spectively) are deposited together with paratypes (4♂ I, 3♂ II, 8♀, 6 juv.♂, 1 juv.♀) in the National Museum of Natural History, Smithsonian Institution. An additional series of paratypes (1♂ I, 1♂ II, 1♀) are in the Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands.

Range: *Procambarus erythropus* is known to occur in only two localities in Suwannee County, Florida. The location of the type-locality is cited above, and the other is an unnamed sink situated only 0.2 mi south of it.

Variations: The more conspicuous variations noted probably have resulted from regenerations of lost parts. For example, the multiple spines on the acumen of the holotype is unique among available specimens, and there is evidence that the acumen was injured in an earlier instar. The usual minor differences in the arrangement of spines and tubercles obtain, and, while not mentioned in the above descriptions, the opposable margins of the coxae of the chelipeds may bear zero to three spiniform tubercles that may or may not be symmetrically balanced or arranged. The range of variations in certain body proportions are cited in the Diagnosis, and certain secondary sexual differences are shown in Table 1. In addition, the setose ventrolateral margins of the sternum in the first form males contrast markedly with the sparse, short setae on the corresponding areas of the females and second form males.

Life History Notes: With the exception of the holotype, which was obtained on November 23, 1971, all specimens included in the type-series were collected on January 23 and February 25, 1972. First form males were obtained on all three dates. No ovigerous females or ones carrying young have been observed. Seven juveniles with carapace lengths ranging from 8.9 to 20.0 mm were among the two 1972 lots. Another troglobitic crayfish, *Troglocambarus mac-lanei*, is a coinhabitant of the type locality.

Size: The largest specimen available is the holotype that has a carapace length of 45.6 mm (postorbital length 36.1 mm). The smallest first form male has corresponding lengths of 36.8 and 29.3 mm, respectively.

Relationships: *Procambarus erythropus* is more closely allied to *P. lucifugus lucifugus*

(Hobbs, 1940) and *P. lucifugus alachua* (Hobbs, 1940) than to any other crayfishes, sharing with them not only albinistic qualities, but also a strongly tuberculate carapace and chelipeds, the latter slender and long. In the males, all of the secondary sexual characters are markedly similar, and in the females, not only are the annuli ventrales nearly identical but also the sternum immediately cephalic to the annulus is without tubercles or caudally projecting prominences. This crayfish may be distinguished from *P. l. lucifugus* most readily by the red eye spot and an areola less than 15 times longer than broad and usually constituting less than 38% of the total length of the carapace. It differs from *P. l. alachua* in having red instead of black pigment in the eye, convex rostral margins, and a stronger curvature of the distal portion of the first pleopod of the male. More distantly, it is related to *P. horsti*, *P. orcinus*, and *P. pallidus* from which the male can be distinguished by the hook on the ischium of the fourth pereopod that does not overreach the basioischial articulation and which is not opposed by a tubercle on the basis; also, the terminal portion of the first pleopod is distinctly different having a longer central projection, and the cephalic process is never situated lateral to the central projection. The females of the latter three species all have tubercles on the caudal margin of the sternum immediately cephalic to the annulus ventralis, whereas, in *P. erythropros* this portion of the sternum lacks tubercles.

Procambarus erythropros resembles the two subspecies of *P. lucifugus* so closely that it could be designated a third subspecies of the complex. There are two reasons for considering it a full species: (1) we have no evidence of intergradation; and (2) *P. erythropros* shares much more in common with the nominate species than with *P. l. alachua*, its geographically closer relative. Only in possessing pigment in the eye does it resemble *P. l. alachua* more closely; even in this similarity, however, the pigment of *P. erythropros* is distinctly red whereas that of *P. l. alachua* is black. To our knowledge, only one other crayfish, *P. orcinus*, has red pigment in its eyes, but in no other respect does it approach *P. erythropros* as closely as do the two subspecies of *P. lucifugus*.

Etymology: Erythros (G., red) + Ops (G., eye); alluding to the red pigment spot in the eye of this crayfish.

KEY TO THE TROGLOBITIC CRAYFISHES OF FLORIDA

By Horton H. Hobbs, Jr.

(Modified from Hobbs, 1971.

The subgeneric designations are those treated by Hobbs 1969, 1972)

- 1 Third maxillipeds lacking teeth on opposable border of ischium *Troglocambarus maclanei* Hobbs, 1942. (Caves from Citrus and Hernando to Suwannee Counties)
- 1' Third maxillipeds with teeth on opposable border of ischium 2
- 2 Male with hooks on ischia of third pereopods only; first pleopod with two terminal elements bent at right angles to main shaft of appendage. Female with annulus ventralis fused to sternum immediately cephalic to it ... *Cambarus (Jugicambarus) cryptodytes* Hobbs, 1941. (Caves and well in Jackson County, Florida and Decatur County, Georgia)
- 2' Male with hooks on ischia of third and fourth pereopods; first pleopod with more than two terminal elements and never with all bent at right angles to main shaft of appendage. Female with distinct flexible membrane separating annulus ventralis from sternum immediately cephalic to it, or membrane obscured by multituberculate processes projecting caudally from sternum 3
- 3 Eye with pigment spot 4
- 3' Eye without pigment 7
- 4 Pigmented area of eye with facets; rostrum without marginal spines or tubercles. Male with first pleopod bearing distally directed mesial process. Female unknown *Procambarus (Leconticambarus) milleri* Hobbs, 1971. (Well in Dade County)
- 4' Pigmented area of eye without facets; rostrum with marginal spines or tubercles. Male with first pleopod

- bearing caudally or caudodistally directed mesial process 5
- 5 Pigment spot in eye black. Areola more than 20 times longer than broad
Procambarus (Ortmannicus) lucifugus alachua (Hobbs, 1940).
 (Caves and sinkholes in Alachua and Gilchrist counties)
- 5' Pigment spot in eye red. Areola less than 20 times longer than broad 6
- 6 Male with hook on ischium of fourth pereopod reaching basioischial articulation and opposed by tubercle on basis; cephalic process of first pleopod situated lateral to central projection. Female with caudally directed tuberculiform prominences on caudal margin of sternum immediately cephalic to annulus ventralis
Procambarus (Ortmannicus) orcinus (Hobbs and Means, 1972).
 (Springs and sinkholes in Leon and Wakulla counties)
- 6' Male with hook on ischium of fourth pereopod not reaching basioischial articulation and not opposed by tubercle on basis; cephalic process of first pleopod situated cephalic to central projection. Female without caudally directed tuberculiform prominences on caudal margin of sternum immediately cephalic to annulus ventralis *Procambarus (Ortmannicus) erythrops*, new species
 (Sinkholes in western Suwannee County)
- 7 Male with hooks on ischia of third and fourth pereopods bituberculate; first pleopod lacking subapical setae, and cephalic and mesial processes directed distally. Female with annulus ventralis at least as long as broad
Procambarus (Lonnbergius) acherontis (Lönnerberg, 1895).
 (Spring and well in Seminole County)
- 7' Male with hooks on ischia of third and fourth pereopods simple; first pleopod with subapical setae, and cephalic and mesial processes directed caudally or caudodistally
- Female with annulus ventralis shorter than broad 8
- 8 Rostrum narrower at base than along orbit. Male with central projection of first pleopod narrow and elongate; hook on ischium of fourth pereopod not reaching basioischial articulation. Female without caudally directed tubercles on caudal margin of sternum immediately cephalic to annulus ventralis
Procambarus (Ortmannicus) lucifugus lucifugus (Hobbs, 1940).
 (Caves from Citrus and Hernando counties northward to Marion County where it intergrades with *P. l. alachua*)
- 8' Rostrum tapering from base. Male with central projection of first pleopod beaklike; hook on ischium of fourth pereopod overreaching basioischial articulation. Female with caudally directed tubercles on caudal margin of sternum immediately cephalic to annulus ventralis 9
- 9 Postorbital ridges with caudally situated spines or tubercles; areola less than 20 times longer than broad. Male with cephalic process of first pleopod situated lateral to central projection
Procambarus (Ortmannicus) horsti Hobbs and Means, 1972.
 (Well and spring in Jefferson and Leon counties)
- 9' Postorbital ridges without caudally situated spines or tubercles; areola more than 20 times longer than broad. Male with cephalic process of first pleopod situated cephalic to and partially hooding central projection *Procambarus (Ortmannicus) pallidus* (Hobbs, 1940).
 (Caves and sinkholes in Alachua, Columbia, and Suwannee counties)

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