

PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON

TWO NEW SPECIES OF THE CRAYFISH GENUS
PROCAMBARUS (DECAPODA, ASTACIDAE) WITH KEYS
TO THE MEMBERS OF THE SPICULIFER GROUP

BY HORTON H. HOBBS, JR.
Smithsonian Institution, Washington, D.C.

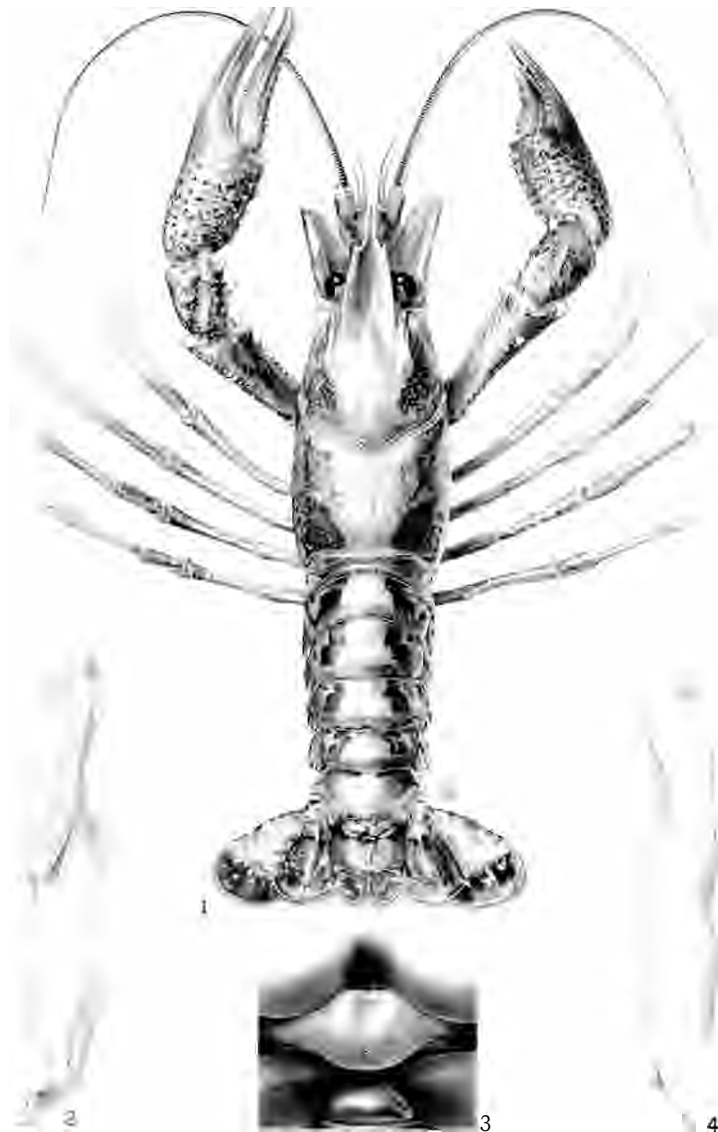
The two species described here have limited ranges in Louisiana and Georgia. That from Louisiana has been found in a few localities in the Ouachita drainage system in Claiborne, Ouachita, and Union parishes, and that from Georgia in the Flint River System in Crawford, Lee, Schley, and Sumter counties.

Keys to the species of the Spiculifer Group, one based on first form males and the other on females, are provided and include summaries of the ranges of each.

Procambarus elegans new species

(Figures 1-11, 24, 25)

Diagnosis: Body pigmented, eyes well-developed. Rostrum with gently convergent margins bearing pair of marginal spines; acumen long and slender. Amok 5.19 to 5.9 times longer than wide and constituting 28.8 to 28.8 percent of entire length of carapace. Carapace with two cervical spines on each side. Suborbital angle small and rounded. Postorbital ridges terminating in spines. Antennal scale approximately 2.5 times longer than wide, broadest proximal to midlength. Mesial margin of palm of chela with seven or eight tubercles, and both fingers provided with moderately well defined longitudinal ridges. Ischiopodites of third and fourth pairs of pereopods with hooks, that of fourth weakly bituberculate; coxae of fourth and fifth pereopods with prominences. First pleopods asymmetrical, without shoulder on cephalic surface, reaching cephalad to coxae of third pair of pereopods, and provided with subterminal setae; distal extremity bearing (1) slender acute mesial process directed mesiodistally and slightly caudally, (2) short spinelike cephalic process arising from cephalic surface of appendage and extending cephalodistally, (3) caudal element consisting of truncate caudal knob bearing minute, acute, toothlike caudal process directed cephalodistally, and (4) short, comeous central projection, situated immediately caudal to cephalic

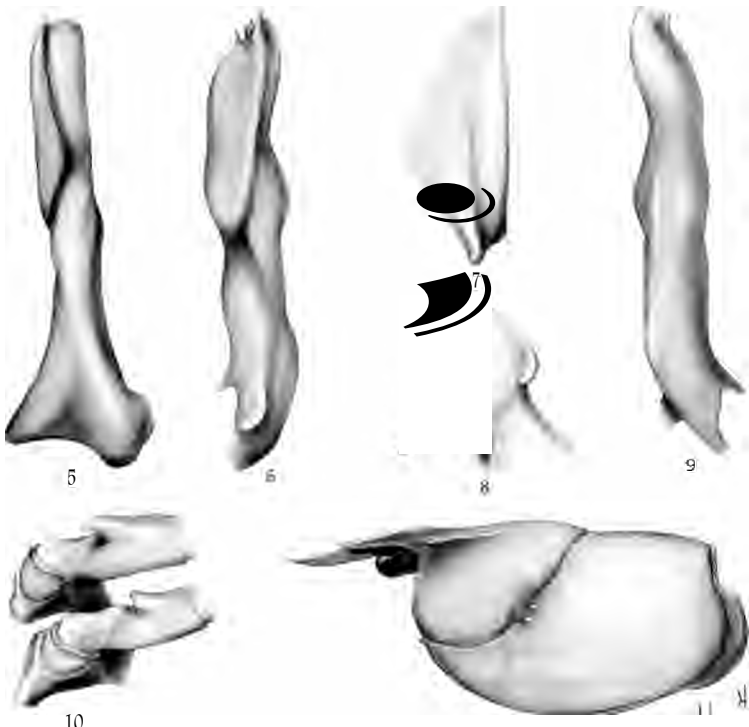


FIGS. 1-4. *Procambarus elegans* new species. 1, Dorsal view of holotype. 2, Mesial view of first left pleopod of holotype. 3, Annulus ventralis of allotype. 4, Lateral view of first left pleopod of holotype.

process, extending subparallel to it, and reaching distally to approximately same level; neither cephalic process nor central projection visible in caudal aspect of appendage.

Holotypic Male, Form I: Body subovate, appearing slightly compressed. Abdomen narrower than thorax (18.3 and 23 mm). Width of carapace slightly greater than height at caudodorsal margin of cervical groove (23.0 and 22.2 mm). Areola 5.9 times longer than wide with four or five punctations across narrowest part. Cephalic section of carapace 2.3 times as long as areola (length 28.2 percent of entire length of carapace). Rostrum excavate dorsally with unthickened margins parallel at base and convergent distally; upper surface of rostrum with usual submarginal setiferous punctations and others scattered between; well-developed marginal spines present at base of acumen; acumen long and spiniform, constituting approximately 42 percent of entire length of rostrum. Subrostral ridges weak and visible in dorsal aspect only near base of rostrum. Post-orbital ridges moderately prominent, grooved dorsally and terminating cephalically in prominent spines. Suborbital angle weak, almost obsolete. Branchiostegal spine acute and prominent. Carapace punctate dorsally, tuberculate cephalolaterally and granulate ventrolaterally; row of tubercles along ventral margin of cephalic portion of cervical groove. Two cervical spines present on each side of carapace, more ventral ones larger. Abdomen subequal in length to carapace. Cephalic section of telson with three spines in each caudolateral corner. Epistome (Fig. 8) subequal in length and breadth; margin slightly elevated and converging to subacute apex. Antennules of usual form with prominent spine on ventral surface of basal segment near midlength. Antennae extending caudad to fourth abdominal tergum. Antennal scale (Fig. 7) about 2.7 times longer than broad, broadest proximal to midlength with widest lamellar area about 1.6 times width of thickened lateral portion, latter terminating in strong acute spine.

Right chela (Fig. 1) depressed with palm somewhat inflated; lateral margin with row of tubercles extending to base of costate distal third of fixed finger; upper and lower surfaces of palm tuberculate with mesial row of eight tubercles subtended dorsolaterally by irregular row of seven; lower surface of palm with prominent tubercle lateral to articular condyle at base of dactyl. Fixed finger with moderately well-defined submedian ridges flanked dorsally by squamous tubercles basally and setiferous punctations distally; opposable margin with row of 17 tubercles (sixth from base largest) along basal three-fourths with yet larger tubercle below former row at base of distal third, and crowded minute denticles present along almost entire length below upper row of tubercles; lower surface with poorly defined submedian ridge flanked along most of its length by setiferous punctations and proximally by few scattered tubercles; ventromesial surface with row of six tubercles along proximal half of finger. Dactyl broken and partially regenerated but in paratypic first form male bearing weak submedian ridge dorsally and ventrally, both



FIGS. 5-11. *Procambarus elegans* new species (pubescence removed from all structures illustrated). 5, Caudal view of first left pleopod of holotype. 6, Mesial view of first left pleopod of holotype. 7, Antennal scale of paratypic male, form I. 8, Epistome of paratype. 9, Lateral view of first left pleopod of holotype. 10, Basal portions of third and fourth pereiopods of paratypic male, form I. 11, Lateral view of carapace of holotype.

flanked by tubercles proximally and setiferous punctations distally; lateral surface subserrate with row of tubercles extending almost to apex; opposable margin convex laterally with greatest height of convexity just proximal to midlength, with upper row of 13 small rounded tubercles along proximal two-thirds and row of four distinctly larger ones along antipenultimate fourth; most proximal one in latter row so large as to give impression of excision on margin immediately proximal to it; crowded minute denticles present between and distal to tubercles and between rows.

Carpus of right cheliped longer than broad (14.1 and 8.9 mm), with mesial portion tuberculate and area lateral to dorsal diagonal excavation

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

	Holotype	Allotype	Morphotype
Carapace:			
Height	22.2	13.2	14.6
Width	23.0	13.9	15.0
Length	53.2	31.6	37.5
Areola:			
Width	2.6	1.6	1.8
Length	15.2	8.3	10.2
Rostrum:			
Width	8.8	5.0	5.7
Length	17.8	11.3	12.9
Chela:			
Length of inner margin of palm	16.6	4.9	6.6
Width of palm	14.7	4.5	6.0
Length of outer margin of chela	46.4	14.6	20.5
Length of dactyl	broken	8.3	12.9

with setiferous punctations; distal dorsomesial surface with prominent spine; mesial surface with one spiniform tubercle near midlength and several smaller ones proximal to it; lower surface with two distal spines, lateral one on ventral articular condyle and other more mesially situated; six small tubercles situated proximomesial to mesial spine.

Merus of right cheliped tuberculate dorsally, distomesially, and ventrally, otherwise punctate; upper distal surface with two prominent spines; ventral surface with irregular lateral row of seven tubercles, some small, others spikelike, and more regular lateral row of 12, generally larger distally; small tubercles present between two rows, and row of three connecting two rows distally. Ischium with mesial row of three tubercles.

Hooks on ischia of third and fourth pereopods (Fig. 10); that on third simple that on fourth weakly bituberculate. Coxa of fourth pereopod with prominent rounded boss caudomesially; that of fifth with small slender projection lateral to penis papilla.

Sternum between second, third, and fourth pereopods moderately deep and bearing prominent fringe of setae on ventrolateral margins.

First pleopods (Figs. 2, 4-6, 9) as described in diagnosis.

Allotypic Female: A juvenile female which differs in no important respects, other than secondary sexual characters, from holotype. Chela conspicuously shorter and smaller with minute denticles between fingers reduced to single rows. Annulus ventralis (Fig. 3) movable, with shallow median trough cephalically; sinus originating along median line almost at midlength of annulus, making C-shaped turn sinistrally, returning to

median line and extending caudally almost to caudal margin. Sternum cephalic to annulus devoid of tubercles or caudally projecting lobes.

Morphotypic Male, Form II: Differs from holotype in only few minor details: Cephalic section of telson with three spines in one caudolateral corner and two in other; mesial margin of palm of chela with only seven tubercles; fixed finger of chela with row of 10 tubercles, third from base largest; dactyl of chela with upper row of three tubercles, and lower of five, proximal tubercle in lower row largest; merus of cheliped with lower lateral row of only five tubercles and inner one of 11; ischia of chelipeds with two tubercles on one and four on other; hooks on ischia of third and fourth pereopods much reduced in size and with no indication of bitubercular condition on that of fourth; prominences on caudomesial surface of coxa of fourth pereopod lower and more rounded.

First pleopod (Figs. 24, 25) with all terminals inflated, but mesial and cephalic processes heavier, and central projection and caudal process much less distinctly delimited, than in holotype.

Color Notes: Dorsum of carapace straw brown with pair of irregular dark brown longitudinal stripes extending from below postorbital ridges to caudal margin of carapace where broadened mesially to form two lobes (remnants of bar, see Hobbs 1958, p. 74, figs. 1 and 2) reaching dorsally to level of branchiocardiac grooves. Branchiostegites ventral to longitudinal stripes pinkish tan fading ventrally to cream cephalically and lavender along most of ventral border; pinkish tan area flecked with irregular dark brown blotches. Rostral and postorbital ridges light tan. Abdomen with pale straw median longitudinal stripe subtended in each somite by pair of dark brown oblique (cephalomesial to caudolateral) stripes which together form irregular stripe flanking median light stripe; areas ventral to dark stripes pinkish tan with irregular dark brown blotches. Telson bordered in dark brown with pale tan central area marked by irregular dark brown lines and blotches; lateral ramus of uropod with irregular dark brown lateral and mesial borders, and dark brown distal segment surrounding cream tan central area; mesial ramus dark brown except proximomesially where cream tan with irregular dark brown spots. Sternum of cephalothoracic and abdominal regions pinkish cream. Dorsal surface of cheliped distal to ischium pale tan with black tubercles and dark brown blotches; distal spines on merus and mesial spines and tubercles on carpus, propodus and dactyl with white tips. Base of fixed finger reddish brown, that of dactyl tan; both fingers with broad blackish band preceding orange-colored tips; lower surface pinkish cream except for encircling blackish bands on fingers. Remaining pereopods, from ischium distally, with tan lateral surfaces bearing darker brown mottlings—otherwise pinkish cream.

Type-locality: Spillway from Corney Lake, an impounded tributary of the Ouachita River, Claiborne Parish, Louisiana. There the "coffee-tinted" water flows with a sluggish to moderately swift current through multiple channels in an eroded clay substrate which supports scattered

groups of aquatic plants including *Myriophyllum*, Potomageton, and Ludwigia. The confluence of the channels forms a moderately flowing stream some 40 feet wide and more than five feet in depth.

Disposition of *types*: The holotypic male, allotypic female, and morphotypic male, together with a single paratypic first form male, are deposited in the Smithsonian Institution, nos. 129892, 129893, 115838, 129894, respectively.

Size: Only two first form males are available, and the carapace of one of them is crushed; the holotype has a carapace length of 53.2 mm, larger than that of any other specimen available.

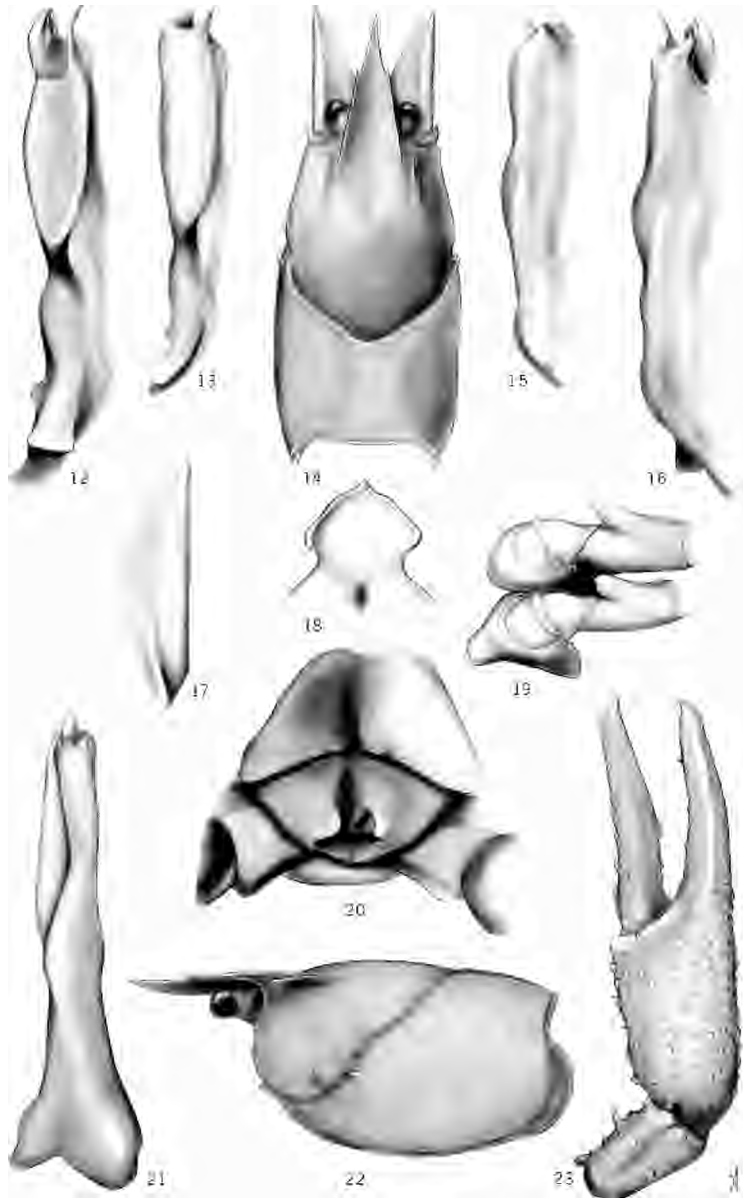
Range, Specimens Examined, and Crayfish Associates: *Procambarus elegans* is known from only five localities in the Ouachita River, system in Louisiana: CLAIBORNE PARISH—Type-locality, 26 May 1952 (1 ♂ I) T. H. Nickerson coll.; 24 April 1965 (1 ♂ I, 1 juv. ♀) W. J. Harman and Horton H. Hobbs, Jr. coll., with *P. a. acutus* (Girard, 1852: 91), *P. clarkii* (Girard, 1852: 91), *P. vioscai* Penn, 1946: 27, *Cambarellus puer* Hobbs, 1945: 469, *Fallicambarus hedgpethi* (Hobbs, 1948: 224), and *Faxonella clypeata* (Hay, 1899: 122). OUACHITA PARISH—Choudrant Bayou, 8 December 1964 (1 ♂ II) N. H. Douglas, coll. with *P. vioscai* and *O. palmeri longimanus* (Faxon, 1898: 655).

UNION PARISH—Mill Creek, Sec. 36—T 19N—R 1E, 18 June 1965 (1 juv. ♂) NHD, coll. with *P. vioscai* and *Orconectes palmeri longimantis*. Meridian Creek, 1 mi. E of Conway, Sec. 7—T 22N—R 1E, 21 May 1956 (1 juv. ♀) W. R. Taylor and L. W. Lowe, coll. Meridian Creek, Sec. 21—T 22N—R 1E, 5 June 1965 (1 juv. ♂, 1 juv. ♀) NHD, coll. with *P. vioscai* and *P. darkii*.

Relationships.: *Procambarus elegans* resembles those members of the Spiculifer Group which have retained the cephalic process on the first pleopod (see Key to First Form Males) and probably has its closest affinities with *P. natchitochae* Penn, 1953, and *P. ablusus* Penn, 1963. It differs from *P. natchitochae* in possessing a much shorter central projection and a truncate caudal knob on the first pleopod, and its areola is much narrower and longer. It differs from *P. ablusus* in that the truncate caudal knob of the first pleopod obscures the caudal process and central projection in caudal aspect, the cephalic process and central projection do not reach so far distally, and the latter is not recurved.

Etymology: The name *elegans* (L.), choice or select, was chosen because of the coloration and apparent rarity of this crayfish.

Remarks: The first specimen (the paratypic male) that I saw was donated to me by Lt. T. H. Nickerson who indicated that it had been caught on a fishing line at the spillway of Corney Lake in swift water four to five feet deep on 26 May 1952. Not until 1965 did I have an opportunity to visit the locality. Dr. Walter J. Harman accompanied me there, and both of us spent some four hours attempting to secure additional specimens by the usual seining and dip-netting techniques. Although at least 100 crayfishes were caught (47 retained), only two of



them were *P. elegans*. Perhaps this species is more abundant in the deeper waters of the spillway but it was our impression that it was exceedingly rare in the area immediately below the dam. The holotype was secluded under a large log that had become lodged against the bank of one of the larger channels.

***Procambarus gibbus* new species**

(Figures 12–23)

Procambarus spiculifer.—Hobbs, 1953b: 416 [map of distribution of *P. spiculifer*, in part].

Diagnosis: Body pigmented, eyes well-developed. Rostrum with gently convergent margins bearing pair of marginal spines; acumen long and slender. Areola 2.8 to 3.5 times longer than wide and constituting 23.8 to 27.2 percent of entire length of carapace. Carapace with two cervical spines on each side. Suborbital angle small and rounded. Postorbital ridges terminating in spines. Antennal scale broadest proximal to mid-length. Mesial margin of palm of chela with five or six tubercles, and both fingers provided with moderately to poorly defined longitudinal ridges. Ischiopodites of third and fourth pairs of pereopods with hooks, that of fourth weakly bituberculate; coxae of fourth and fifth pereopods with prominences. First pleopods asymmetrical, without shoulder on cephalic surface, reaching cephalad to coxae of third pair of pereopods and provided with subterminal setae; distal extremity lacking cephalic process but bearing (1) slender, acute, slightly curved mesial process directed caudolaterally and reaching scarcely beyond level of tip of central projection, (2) caudal element consisting of simple, small bladelike corneous process closely applied to caudal margin of central projection, mesial adventitious ridge, and caudal knob poorly delimited from much swollen caudolateral end of shaft but somewhat fingerlike at lateral base of caudal process, and (3) central projection corneous, very conspicuous, beaklike but extending almost directly distally even though cephalic margin convex. Annulus ventralis with median longitudinal groove between elevated lateral walls and with flat, subtriangular midcaudal depressed area

FIGS. 12–23. *Procambarus gibbus* new species (pubescence removed from structures illustrated). 12, Mesial view of first left pleopod of holotype. 13, Mesial view of first left pleopod of morphotype. 14, Dorsal view of carapace of holotype. 15, Lateral view of first left pleopod of morphotype. 16, Lateral view of first left pleopod of holotype. 17, Antennal scale of paratypic male, form I. 18, Epistome of holotype. 19, Basal portions of third and fourth pereopods of holotype. 20, Annulus ventralis of allotype. 21, Caudal view of first left pleopod of holotype. 22, Lateral view of carapace of holotype. 23, Dorsal view of distal podomeres of cheliped of holotype.

crossed by straight or obliquely directed sinus. Sternum of female immediately cephalic to annulus with pair of very small lobes extending caudally, otherwise unadorned.

Holotypic Male, Form 1; Body subovate, compressed. Abdomen narrower than thorax (14.8 and 16.2 mm). Width of carapace slightly less than height at caudodorsal margin of cervical groove (16.2 and 17.0 mm). Areola 3.2 times longer than wide with seven or eight punctations across narrowest part. Cephalic section of carapace 3.0 times as long as areola (length 24.9 percent of entire length of carapace). Rostrum excavate dorsally with unthickened margins parallel at base and convergent distally; upper surface with usual submarginal setiferous punctations and others scattered between; well-developed marginal spines present at base of acumen; acumen long and spiculiform, constituting approximately 40 percent of entire length of rostrum. Subrostral ridges weak and not visible in dorsal aspect. Postorbital ridges prominent, grooved dorsolaterally, and terminating cephalically in prominent spines. Suborbital angle weak, obtuse, and almost obsolete. Branchiostegal spine acute and moderately prominent. Carapace punctate dorsally, granulate laterally, and tuberculate ventrolaterally with row of tubercles along ventral margin of cephalic portion of cervical groove. Two strong cervical spines present on each side of carapace, more ventral one slightly heavier. Abdomen subequal in length to carapace. Cephalic section of telson with two spines in each caudolateral corner. Epistome (Fig. 18) about 1.5 times broader than long with margins slightly elevated, undulating, and converging to acute apex. Antennules of usual form with prominent spine on ventral surface of basal segment slightly distal to midlength. Antennae extending caudad slightly beyond caudal margin of telson. Antennal scale (Fig. 17) about three times longer than broad, broadest proximal to midlength with widest lamellar area about 1.8 times width of thickened lateral portion, latter terminating in strong acute spine.

Right chela (Fig. 23) somewhat depressed with palm slightly inflated; lateral margin with tubercles extending to midlength of fixed finger with those distal to base of finger low and not visible in position in which chela figured, margin not costate; upper and lower surfaces of palm tuberculate with mesial row of six tubercles, lower surface with prominent tubercle distolateral to articular condyle at base of dactyl. Fixed finger with moderately developed dorsal submedian longitudinal ridge flanked by squamous tubercles proximally and setiferous punctations distally; opposable margin with row of 20 tubercles (fifth from base largest) along proximal five-sixths, distal eight tubercles quite small; three tubercles below former row at base of distal fourth of finger, middle of three larger than other tubercles on opposable margin; minute denticles present along almost entire length between and below upper row of tubercles, lower surface without submedian ridge but with tubercles and punctation arranged much like those on upper surface, Dactyl with very low dorsal and ventral submedian longitudinal ridges flanked proximally by tuber-

des and distally by punctations; lateral surface subserrate with row of tubercles extending almost to apex; opposable margin convex with greatest height of convexity slightly proximal to midlength and bearing single, slightly irregular, row of 19 tubercles ending at base of distal one-eighth of finger, eighth tubercle from base largest, minute denticles present between proximal tubercles, below more distal ones, and continuing almost to base of corneous tip of finger.

Carpus of right cheliped longer than broad (10.2 and 6.5 mm), with mesial and dorsomesial surfaces tuberculate and dorsolateral, lateral, and ventral surfaces mostly punctate; dorsolateral and mesioventral surfaces also with few tubercles; distal dorsomesial surface with prominent spine; mesial surface with one spiniform tubercle near midlength, several smaller ones proximal to it, and one slightly distal to base of large tubercle; lower distal margin with two spines, lateral one on ventrolateral articular condyle and other more mesially situated with group of seven smaller tubercles proximomesial to it.

Merus of right cheliped tuberculate dorsally, distomesially and ventrally, otherwise punctate; upper distal surface with two prominent spines; ventral surface with irregular lateral row of 11 tubercles, three of which spikelike, and more regular lateral row of 15 tubercles, generally larger distally; additional small tubercles flanking rows; rows joined distally by oblique row of three tubercles. Row of four tubercles on ischium corresponding to mesial row on merus.

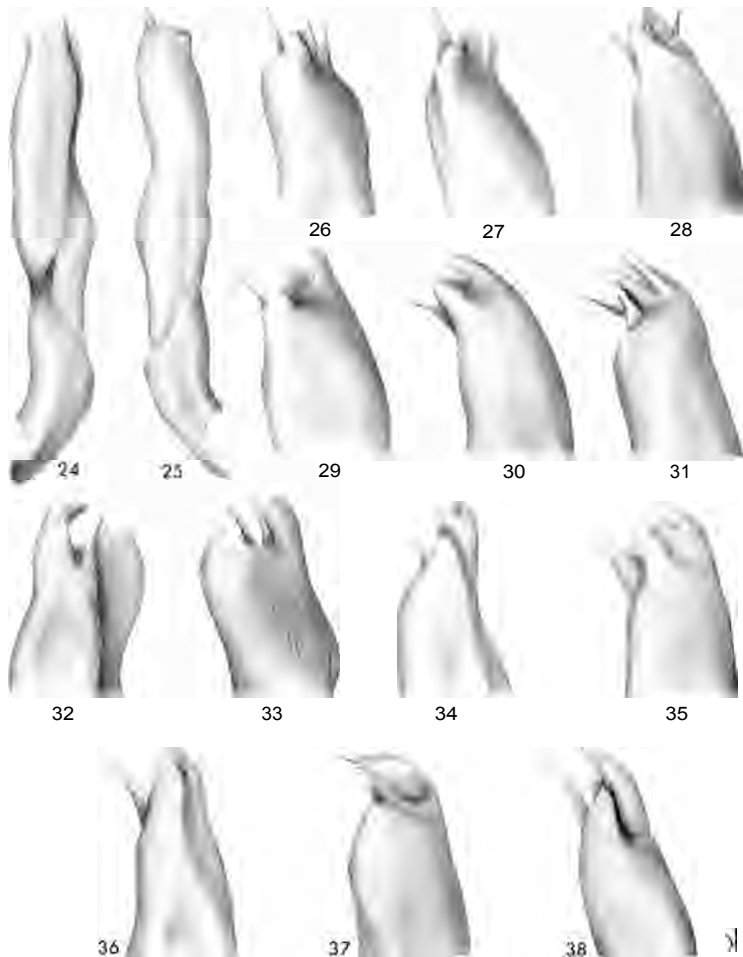
Hooks on ischia of third and fourth pereopods (Fig. 19); that on third simple, that on fourth weakly bituberculate. Coxa of fourth pereopod with prominent, vertically disposed, rounded boss caudomesially; that of fifth with prominent slender projection caudomesially.

Sternum between second, third, and fourth pereopods deep and bearing moderate fringe of setae on ventrolateral margins.

First pleopods (Figs. 12, 16, 21) as described in diagnosis.

Allotypic Female: Except in secondary sexual characteristics, differing only in minor details from holotype: areola with nine or 10 punctations across narrowest part; epistome with more prominent and acute cephalo-median projection; opposable margin of fixed finger of chela with 11 tubercles in upper row (fourth from base largest) and two below with minute denticles arranged in single row; opposable margin of dactyl of chela with row of 13 tubercles (fourth from base largest) along proximal two-thirds of finger; ventral surface of merus of chela with lateral row of eight tubercles and mesial one of 11 (See measurements).

Annulus ventralis (Fig. 20) shallowly situated in sternum, broader than long, with conspicuous median longitudinal trough extending between elevated (ventrally) lateral walls. Sinus arising on median line just cephalic to midlength making C-shaped curve sinistrally around fossa, continuing dextrally across median line before traversing flat, triangular caudal shelf to midcaudal margin of annulus. Sternum cephalic to annulus not tuberculate but with pair of small caudally projecting lobes.



Figs. 24-38. First sinistral pleopods of members of Spiculifer Group (pubescence not indicated): Figs. 24 and 32, mesial views; Figs. 25-31 and 33-38, lateral views. 24 and 25, Morphotype of *P. elegans*. 26, *P. ablusus*. 27, *P. natchitochae*. 28, *P. penni*. 29, *P. vioscai*. 30, *P. dupratzi*. 31, *P. echinatus*. 32 and 33, *P. suttkusi*. 34, *P. versutus*. 35, *P. ouachitae*. 36, *P. lagniappe*. 37, *P. raneyi*. 38, *P. spiculifer*.

TABLE 2. Measurements (mm) of *Procambarus gibbus*.

	Holotype	Allotype	Morphotype
Carapace:			
Height	17.0	18.9	16.7
Width	16.2	17.9	15.7
Length	37.0	41.4	38.0
Areola:			
Width	2.9	3.4	3.0
Length	9.2	10.0	9.2
Rostrum:			
Width	5.9	6.5	6.2
Length	12.9	15.2	13.9
Chela:			
Length of inner margin of palm	13.0	8.4	7.9
Width of palm	10.1	7.4	5.6
Length of outer margin of chela	34.7	23.7	21.0
Length of dactyl	19.0	14.2	12.1

Morphotypic Male, Form II: Like allotype, other than in secondary sexual characteristics, differs only in minor details from holotype: fixed finger of chela with upper row of nine tubercles (fourth from base largest) and single large one below row; dactyl of chela with row of 13 tubercles (fifth from base largest); ventral surface of merus of chela with lateral row of 11 tubercles and mesial one of 13; ischium of right chela with one spine and one tubercle; hooks on ischia of third and fourth pereopods simple and much reduced in size; coxal boss on fourth pereopod and projection on coxa of fifth distinctly less prominent.

First pleopod (Figs. 13, 15) without corneous terminal elements, and all more bulbous and less distinctly defined than in holotype.

Color Notes: Dorsum of carapace pale tan with margins of rostrum and postorbital ridges dark brown. Cephalodorsal areas dark brown changing to reddish brown in caudal hepatic and gastric areas; ventral hepatic region with pair of dark brown oblique bars on cream tan background. Branchiostegites with usual saddle; horns and caudoventral portion of saddle almost black, bar very narrow dorsally connecting broader dorsolateral portions by thin line on extreme caudodorsal margin; area below horns pale tan fading to cream. Abdominal terga tan to olive green with caudal margins black and each with pair of transverse dorsolateral black bars; each of first five abdominal pleura with longitudinal black stripe at base and narrow border along margins and each with scarlet spot above stripe with cream area between stripe and margin. Sixth tergum with caudally emarginate scarlet band cephalically and entire band caudally. Telson bearing pair of black spots in cephalolateral

corners of caudal section, otherwise tan to dark brown. Outer ramus of uropod blackish brown mesially and distally; inner ramus mostly blackish brown but with light spot mesially proximal to midlength. Antennules and antennae dark brown. Chela brownish black with white to cream-tipped tubercles; tips of finger scarlet; carpus and distal portion of merus blackish tan dorsally, latter fading proximally through greenish tan to cream tan with ischium and coxa mostly cream. Remaining pereopods greenish with brownish markings above, paler below, fading proximally to cream tan.

Type-locality: Tributary to Muckalee Creek (Flint River drainage), 3.2 miles north of Americus on U.S. Hwy. 19, Sumter County, Georgia. This comparatively clear stream, some 10 to 15 feet wide and about two feet deep, flows with a moderate current over a sandy and organic bed supporting a luxuriant stand of *Vallisneria* sp. in the unshaded area near the bridge. Among the shoreline plants are *Salix nigra*, *Liriodendron tulipifera*, *Acer* sp., *Quercus* sp., and *Magnolia* sp. No other crayfishes were collected with *P. gibbus* in the locality.

Disposition of types. The holotypic male, form I, the allotypic female, and the morphotypic male, form II, are deposited in the Smithsonian Institution nos. 129804, 129803, and 129805, respectively, as are the paratypes consisting of 4 ♂, form I; 7 ♀, form II; 16 ♂; 33 juvenile ♂; and 41 juvenile ♀.

Size: The largest first form male has a carapace length of 42.2 mm, and the smallest, 29.8 mm. The largest specimen available is a second form male, the carapace length of which is 46.9 mm.

Range and Specimens Examined: *Procambarus gibbus* is known to occur in seven localities in the middle Flint River drainage, chiefly in the Muckalee Creek watershed, in Georgia.

CRAWFORD COUNTY—Tributary to Flint River, 1.5 mi. E of Crawford-Taylor county line, 17 April 1968, Horton H. Hobbs, Jr., coll. (9 ♂ II, 13 ♀, 1 juv. ♂, 6 juv. ♀). LEE COUNTY—Tributary to Muckalee Creek about 7 mi. E of Leesburg, 11 August 1932, E. B. Williamson, coll. (2 ♂ I, 3 ♂ II, 2 ♀, 4 juv. ♂, 1 juv. ♀); Tributary to Muckalee Creek about 7 mi. S of Leesburg, 11 August 1932, E. B. Williamson, coll. (1 ♂ I, 1 ♂ II, 4 ♀, 4 juv. ♂, 1 juv. ♀) Only data "Lee County," 15 August 1932, E. B. Williamson, coll. (1 ♂ I, 1 ♀); Muckaloochee Creek at Smithville, 14 April 1968, Horton H. Hobbs, Jr., coll. (1 ♂ II, 2 ♀, 12 juv. ♂, 14 juv. ♀) Muckalee Creek, 6 mi. SW of Lee-Sumter County line, 15 April 1968, Horton H. Hobbs, Jr., coll. (1 ♀). SCHLEY COUNTY—Tributary to Muckalee Creek, 3.8 mi. SW of Ellaville on State Rte. 153, 15 April 1968, Horton H. Hobbs, Jr., coll. (1 ♂ II, 2 ♀, 2 juv. ♂) - SUMTER COUNTY—Type-locality, 15 April 1968, Horton H. Hobbs, Jr., coll. (1 ♂ I, 2 ♂ II, 4 ♀, 11 juv. ♂, 25 juv. ♀).

Variations: Among the few variations noted, none of which are associated with a restricted portion of the range, are occasional cephalo-

lateral tubercles on the epistome, telson with one or two spines in caudolateral corner of cephalic section, inner margin of palm of chela with five or six tubercles, upper distal surface of merus of cheliped with two or three spines, ischium of cheliped with two to four spines, and hooks on ischia of fourth pereopods in first form male simple or weakly bituberculate. (See diagnosis for variations in proportions.)

Relationships. *Procambarus gibbus* has its closest relationship with *P. spiculifer* (LeConte, 1856), the range of which completely surrounds that of this new species. It shares many features in common with LeConte's species but may be readily distinguished from it by the broad, distal, subtruncate, caudolateral portion of the first pleopod of the male. In *P. spiculifer* the caudadistal margin of the appendage tapers sharply toward the base of the caudal process.

Life History Notes: First form males have been collected in April and August; no females carrying eggs or young have been found.

Crayfish Associates: Collected with *Procambarus gibbus* in one or more localities were *P. paeninsulanus* (Faxon, 1914: 369), *Faxonella clypeata* (Hay, 1899: 122), *Cambarus d. diogenes* Girard, 1852: 88, and *C. latimanus* (Le Conte, 1856: 402).

Etymology: The name *gibbus* (L.) meaning protuberant, refers to the swollen caudadistal portion of the first pleopod of the male.

KEY TO THE SPECIES OF THE SPICULIFER GROUP

The members of the Spiculifer Group of the crayfish genus *Procambarus* may be recognized readily, for they are the only members of the genus occurring the United States which possess two or more cervical spines on each side of the carapace.

First Form Males (Based on first pleopods)

- | | | |
|-------|---|--------|
| | Cephalic process well-developed (Figs. 9, 26-34) | ---- 2 |
| 1' | Cephalic process absent or rudimentary (Figs. 16, 35-38) | 1 2 |
| 2(1) | Cephalic process entirely mesial to central projection and completely obscured by latter in lateral aspect (Figs. 32, 33) ----- <i>P. suttkusi</i> Hobbs, 1953a: 173 (Choctawhatchee drainage system in Alabama and Florida.) | |
| 2' | Cephalic process cephalic, lateral, or cephalomesial to central projection, never entirely obscured by latter in lateral aspect (Fig. 9, 26-31, 34) | -- 3 |
| 3(2') | Cephalic process situated cephalomesial to central projection (Figs. 28, 35 occasionally) | -- 4 |
| 3' | Cephalic process situated cephalic or lateral to central projection (Figs. 9, 26, 27, 29-31, 34) ----- | 5 |

344 *Proceedings* of the Biological Society of Washington

- 4(3) Central projection directed distally (Fig. 28)
P. penni Hobbs, 1951: 273
(Pascagoula and Pearl drainage systems in Mississippi and Louisiana).
- 4' Central projection directed strongly caudodistally (Fig. 35)
P. ouachitae Penn, 1956: 109
(Arkansas and Ouachita drainage systems in Arkansas).
- 5(39) Cephalic process situated lateral to central projection (Fig. 31) *P. echinatus* Hobbs, 1956: 117
(Edisto and Salkehatchie drainage systems in South Carolina).
- 5' Cephalic process situated cephalic to central projection (Figs. 9, 26, 27, 29, 30, 34) 6
- 6(5') Cephalic process almost straight, directed distally or cephalodistally (Figs. 9, 26-28) 7
- 6' Cephalic process recurved, often hooding central projection (Figs. 29, 30, 34) 10
- 7(6) Mesial process not extending distally beyond tip of central projection (Fig. 28) *P. penni* [see couplet 4]
- 7' Mesial process extending distally beyond tip of central projection (Figs. 9, 26, 27) 8
- 8(7') Caudal knob truncate in caudal aspect, obscuring caudal process (Figs. 5, 9) ----- *P. elegans*, new species (Tributaries of the Ouachita River in northern Louisiana).
- 8' Caudal knob irregular in caudal aspect with caudal process evident (Figs. 26, 27) 9
- 9(8') Central projection recurved, accessory process small (Fig. 26) *P. ablusus* Penn 1963: 121
(Hatchie drainage systems in Mississippi and Tennessee).
- 9' Central projection almost straight, accessory process conspicuous (Fig. 27) *P. natchitochae* Penn, 1953: 5
(Bayou Teche, Red, and Calcasieu drainage systems in Arkansas, Louisiana, and Texas).
- 10(8') Caudal knob distinct from caudal process and knoblike (Fig. 29) *P. vioscai* Penn, 1946: 27
(From the Red drainage systems in Arkansas and Louisiana eastward to, but not in, the Pearl River system in Mississippi).
- 10' Caudal knob not clearly distinct from caudal process and subacute (Figs. 30, 34) 11
- 11(10') Distal portion of pleopod tapering conspicuously in lateral aspect, mesial process directed caudodistally (Fig. 34) *P. versutus* (Hagen, 1870: 51)

- 11' Distal portion of pleopod tapering only slightly in lateral aspect, mesial process directed caudally at angle greater than 45° to shaft of appendage (Fig. 30)
P. dupratzi Penn, 1953: 1
 (Trinity, Red, Neches, Sabine, and Calcasieu drainage systems in Arkansas, Texas, and Louisiana).
- 12(1') Central projection arising from level distinctly proximal to base of caudal process (Figs. 16, 38) ----- 13
- 12' Central projection not arising from level distinctly proximal to base of caudal process (Figs. 35-37) 14
- 13(12) Caudodistal portion of shaft subtruncate with caudal element and central projection situated on cephalic half of tip (Fig. 16) *P. gibbus* new species
 (Tributaries to the Flint River in southwestern Georgia).
- 13' Caudodistal portion of shaft tapering with caudal element and central projection constituting almost entire tip (Fig. 38) *P. spiculifer* (LeConte, 1856): 401
 (From the Alabama drainage system eastward to the Savannah system but not south of the Suwannee drainage in Florida).
- 14(12') Distolateral surface of shaft with longitudinal excavation extending proximally from central projection (Fig. 36) *P. lagniappe* Black, 1968: 5
 (Sucarnooche Creek drainage—to Tombigbee River—in Kemper County, Mississippi and Sumter County, Alabama).
- 14' Distolateral surface of shaft without longitudinal excavation (Figs. 35, 37) 15
- 15(14') Caudal knob conspicuous and caudal process large (Fig. 35) *P. ouachitae* Penn [see couplet 4]
- 15' Caudal knob vestigial and caudal process not large (Fig. 37) *P. raneyi* Hobbs, 1953b: 412
 (Upper Savannah River drainage in Georgia and South Carolina and headwaters of the Ocmulgee River in DeKalb County, Georgia).

Females

(For bibliographic citations and ranges, see Key to Males)

- 1 Cephalic portion of annulus ventralis obscured by prominent multituberculate lobes of sternum immediately cephalic to it ----- 2
- 1' Cephalic portion of annulus ventralis not obscured by prominent multituberculate lobes of sternum immediately cephalic to it although single tubercles may project slightly over its margin -- 7

- 2(1) Sternum cephalic to annulus ventralis with at least one subdigitiform tubercle extending caudomesially beyond transverse ridge of annulus ----- *P. suttkusi* Hobbs
- 2' Sternum cephalic to annulus ventralis without digitiform tubercles -- 3
- 3(2') Annulus without or with very shallow median longitudinal furrow cephalically *P. lagunappe* Black
Annulus ventralis with conspicuous median longitudinal furrow cephalically 4
- 4(3') Median longitudinal furrow of annulus flanked by oblique ridges -- 5
- 4' Median longitudinal furrow of annulus flanked by transverse ridges -- 6
- 5(4) Sinus of annulus with at least one acute angular bend ----- *P. dupratzi* Penn
- 5' Sinus of annulus with no acute bends --- *P. ouachitae* Penn
- 6(4') Tubercular lobes extending caudally from sternum cephalic to annulus almost contiguous from base to end; carapace usually with more than two cervical spines ----- *P. echinatus* Hobbs
- 6' Tubercular lobes extending caudally from sternum cephalic to annulus each forming broad convex arc from median line; carapace with only two cervical spines ----- *P. raneyi* Hobbs
- 7(1') Sternum cephalic to annulus devoid of tubercles or lobes 8
- 7' - Sternum cephalic to annulus always with tubercles or small lobes ---9
- 8(7) Areola at least five times longer than broad ----- *P. elegans* new species
- 8' Areola less than five times longer than broad ----- *P. ablusus* Penn
- 9(T) Cephalolateral portions of annulus with pair of narrow ridges paralleling cephalolateral margins *P. vioscai* Penn
- 9' Cephalolateral portions of annulus never with pair of narrow ridges paralleling cephalolateral margins ----- 10
- 10(9') Caudal margin of annulus transverse ----- *P. penni* Hobbs
- 10' Caudal margin of annulus subtriangular, or with caudomedian prominence ----- 11
- 11(10') Caudal margin of annulus forming gentle arc ----- *P. natchitochae* Penn
- 11' Caudal margin of annulus broadly subtriangular or with distinct caudomedian prominence ----- 12
- 11(10') Median longitudinal furrow of annulus deep cephalically and with very high lateral walls --- *P. gibbus*, new species
- 11' Median longitudinal furrow of annulus shallow cephalically and with walls not conspicuously high *P. spiculifer* LeConte

Discussion: This group, comprising 14 species of stream-dwellers, occupies a range in the Coastal Plain and Piedmont provinces extending from the Trinity River, Texas, eastward to the Edisto River, South Carolina, and Suwannee River, Florida. Although occasionally encountered in areas of streams where there is no obvious current, they are not known to invade lentic habitats.

The ranges of five species of the group—*P. ablusus*, *P. echinatus*, *P. lagniappe*, *P. ouachitae* and *P. penni*,—appear to be allopatric; whereas, those of the remaining species overlap that of one or more members of the group. The range of *P. vioscai* is partially shared by *P. dupratzi*, *P. natchitochae*, and *P. elegans*; while that of *P. spiculifer* includes parts of, or surrounds, that of *P. gibbus*, *P. raneyi*, *P. suttkusi*, and *P. versutus*. Despite the overlapping ranges, only two combinations of these species have been collected in a single locality—*P. elegans* and *P. vioscai* in Louisiana, and *P. spiculifer* and *P. versutus* in Alabama and Florida.

Acknowledgments: I wish to thank Lt. T. H. Nickerson for presenting me with the first specimen of *Procambarus elegans* I had seen, and I am indebted to Drs. N. H. Douglas, W. J. Hamman, L. W. Lowe, and W. R. Taylor, for assistance in obtaining additional representatives of this species. I also wish to thank Drs. Fenner A. Chace and J. F. Fitzpatrick for a number of valuable suggestions and criticisms. For the exceptionally fine illustrations of this species (Figs. 1-4), I extend my genuine appreciation to Mrs. Carolyn B. Gast.

LITERATURE CITED

- BLACK, JOE B. 1968. A new crawfish of the genus *Procambarus* from Mississippi (Decapoda, Astacidae). *Tulane Studies in Zool. and Botany*, 15(1): 5-9, 12 figs.
- FAXON, WALTER. 1898. Observations on the Astacidae in the United States National Museum and in the Museum of Comparative Zoology, with descriptions of new species. *Proc. U.S. Nat. Mus.*, 20 (1136): 643-694, pls. LXII-LXX.
- ██████████ 1914. Notes on the crayfishes in the United States National Museum and the Museum of Comparative Zoology with descriptions of new species and subspecies to which is appended a catalogue of the known species and subspecies. *Mem. Mus. Comp. Zool., Harvard Coll.*, 40(8): 351-427, 13 pls.
- GIRARD, CHARLES. 1852. A revision of the North American Astaci, with observations on their habits and geographical distribution. *Proc. Acad. Nat. Sci., Philadelphia*, 6: 87-91.
- HAGEN, HERMANN A. 1870. Monograph of the North American Astacidae. *Illus. Cat. Mus. Comp. Zool., Harvard Coll.*, (3): 1-109, 11 pls.
- HAY, WILLIAM PERRY. 1899. Description of two new species of crayfish. *Proc. U.S. Nat. Mus.*, 22 (1187): 121-123, 2 figs.

- HOBBS, HORTON H., JR.** 1945. Two new species of crayfishes of the genus *Cambarellus* from the Gulf Coastal states, with a key to the species of the genus (Decapoda, Astacidae). *Amer. Midl. Nat.*, 34(2): 466-474, 26 figs.
- _____ 1948. A new crayfish of the genus *Cambarus* from Texas, with notes on the distribution of *Cambarus fodions* (Cottle). *Proc. U.S. Nat. Mus.*, 98 (3230): 223-231, fig. 17.
- _____ 1951. A new crayfish of the genus *Procambarus* from Louisiana with a key to the species of the Spiculifer Group. *Journ. Wash. Acad. Sci.*, 41(8): 272-276, 11 figs.
- _____ 1953a. A new crayfish of the genus *Procambarus* from Alabama and Florida (Decapoda, Astacidae). *Proc. Biol. Soc. Wash.*, 66: 173-178, 10 figs.
- _____ 1953b. On the ranges of certain crayfishes of the Spiculifer Group of the genus *Procambarus*, with the description of a new species (Decapoda, Astacidae). *Journ. Wash. Acad. Sci.*, 43(12): 412-417, 13 figs.
- _____ 1956. A new crayfish of the genus *Procambarus* from South Carolina (Decapoda, Astacidae). *Journ. Wash. Acad. Sci.*, 46(4): 117-121, 17 figs.
- _____ 1958. The evolutionary history of the Pictus Group of the crayfish genus *Procambarus* (Decapoda, Astacidae). *Quart. Journ. Fla. Acad. Sci.*, 21(1): 71-91, 20 figs.
- LECONTE, JOHN.** 1856. Descriptions of new species of *Astacus* from Georgia. *Proc. Acad. Nat. Sci., Philadelphia*, 7: 400-402.
- PENN, GEORGE HENRY, JR.** 1946. A new crawfish of the genus *Procambarus* from Louisiana (Decapoda: Astacidae). *bour. Wash. Acad. Sci.*, 36(1): 27-29, 6 figs.
- _____ 1953. Two new crawfishes of the genus *Procambarus* from Texas, Louisiana, and Arkansas (Decapoda, Astacidae). *Amer. Mus. Novitates* (1636): 1-10, 19 figs.
- _____ 1956. A new crawfish of the genus *Procambarus* from Arkansas (Crustacea, Astacidae). *Lloydia*, 19(2): 109-119, 17 figs.
- _____ 1963. A new crawfish from the Hatchie River in Mississippi and Tennessee (Decapoda, Astacidae). *Proc. Biol. Soc. Wash.*, 76: 121-126, 10 figs.