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ABSTRACT

*Cambarus (Cambarus) angularis* is described from some 75 localities in the Powell, Clinch, and Holston river systems of northeastern Tennessee and southwestern Virginia. It seems to have its closest affinity with populations of *Cambarus (C.) sciottensis* in the New River system in southwestern Virginia. Distinguishing it from the latter and other members of the subgenus *Cambarus* is the following combination of characters: rostral margins thickened and in most adults forming distinct angles at base of acumen; densely punctate areola 3.3 to 5.6 times as long as broad; chelae with single row of usually low tubercles on mesial margin of palm, fingers gaping in larger adults; central projection of first pleopod strongly recurved, almost always reaching level of distal base of mesial process, and with subapical notch; epistome conspicuously punctate.

That this new stream-dwelling crayfish, which inhabits large parts of the Clinch and Powell watersheds and at least a small segment of the Holston Basin in northeastern Tennessee and southwestern Virginia, differs from its closest relatives has been known by the first author for

almost a half century. Until the ranges of variation in it and in the neighboring *Cambarus* (*C.*) *sciotensis* Rhoades (1944) were better understood, however, its description has been delayed.

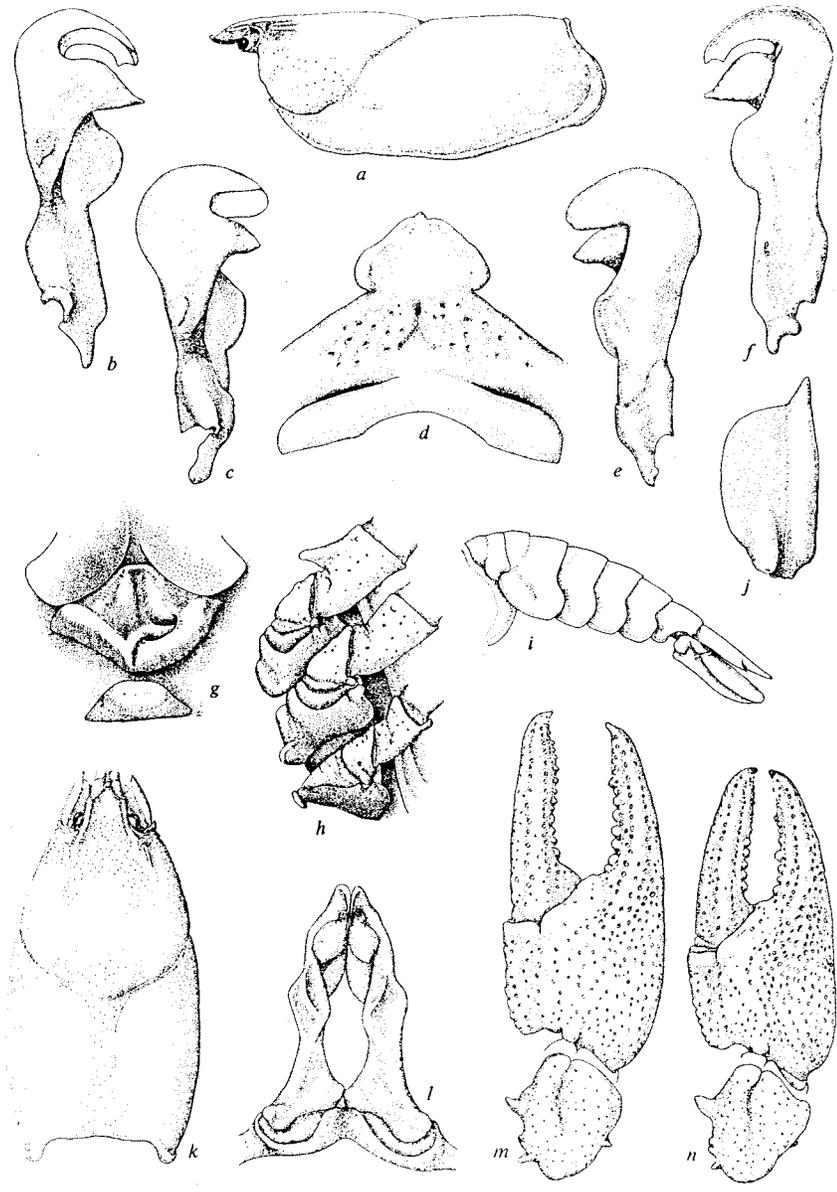
*Cambarus* (*Cambarus*) *angularis*, new species

Figure 1

Diagnosis: Body pigmented; eyes small but well developed. Rostrum with conspicuously thickened lateral ridges, broad basally, margins rapidly converging to level of orbit and more gradually tapering to base of acumen, latter usually well defined, although limited basally by neither marginal spines nor tubercles. Postorbital ridges thick, merging with carapace anteriorly or sometimes bearing small tubercle. Suborbital angle subacute. Cervical and branchiostegal spines represented by at most weak tubercles. Areola of adults 3.2–6.3 ( $\bar{x} = 4.5 \pm 0.6$ ,  $N = 98$ ) times as long as wide and comprising 34.5–41.5 ( $\bar{x} = 37.6 \pm 1.3$ ,  $N = 98$ ) % of entire length of carapace, 40.2–47.8 ( $\bar{x} = 47.8 \pm 1.2$ ,  $N = 98$ ) % of postorbital carapace length, and bearing three to five punctations in narrowest part. Chela with single row of six or seven adpressed tubercles on mesial surface of palm, rarely with row of three or four small ones on proximal dorsolateral flank of mesial row, palm otherwise conspicuously punctate; lateral surface weakly costate. Fingers, widely gaping in larger individuals, with submedian longitudinal ridges dorsally and ventrally; tubercles, none conspicuously larger than adjacent ones, restricted to opposable margins of both fingers and occasionally few on mesial base of dactyl. Hook present on ischium of third pereopod overlapping basioischial articulation and opposed by small tubercle on basis; coxa of fourth pereopod with compressed caudomesial boss; that of fifth lacking boss. Pleura of third through fifth abdominal segments subtruncate ventrally, rounded posteroventrally.

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Fig. 1. *Cambarus* (*C.*) *angularis*, new species (all from holotype except g, n from allotype and c, e from morphotype). a, Lateral view of carapace; b, c, Mesial view of first pleopod; d, epistome; e, f, Lateral view of first pleopod; g, Annulus ventralis and adjacent sclerites; h, Basal podomeres of third, fourth, and fifth pereopods; i, Lateral view of abdomen; j, Antennal scale; k, Dorsal view of carapace; l, Caudal view of first pleopods; m, n, Dorsal view of distal podomeres of cheliped.



First pleopods of first form male terminating in two elements: corneous central projection strongly recurved, bladelike, with subapical notch, and reaching proximally beyond distal base of bulbous, acute mesial process which directed caudolaterally at 45 degrees to shaft of appendage. Caudal element lacking, but strong corneous ridge often present just proximal to caudal base of central projection. Conspicuous, non-calcified mound bearing conspicuous setal tuft present on proximal side of mesial lamella of pleopod, mound sometimes with corneous ridge proximally. First pleopod in female barely reaching annulus ventralis.

Holotypic male, form I: Cephalothorax subovate in cross section; carapace depressed (Fig. 1a, k), greatest width about 1.5 times height at caudodorsal margin of cervical groove. Rostrum subequal in length and width at base, with conspicuously thickened, elevated margins tapering rapidly posterior to orbit, then more gradually to base of acumen where suddenly convergent to apex, latter almost reaching distal extremity of penultimate podomere of antennule; upper surface concave, punctate from midlength posteriorly, and lacking median carina. Subrostral ridges moderately strong and evident in dorsal aspect almost to base of acumen. Suborbital angles well defined and subacute. Postorbital ridges conspicuous but short, grooved laterally, and with rudimentary apical tubercle. Branchiostegal spines rudimentary or obsolete. Areola 5.2 times as long as broad, moderately densely punctate with room for as many as five or six punctations in narrowest part, although only three present; length of areola 37.6% of total length of carapace (43.2% of postorbital carapace length). Cervical spines lacking and not represented by conspicuous tubercles on posterior flank of cervical groove. Carapace punctate dorsally, becoming granulate laterally and tuberculate anterolaterally.

Abdomen (Fig. 1i) subequal in length to carapace; pleura of third through fifth segments truncate ventrally and rounded posteroventrally. Cephalic section of telson with lateral margins weakly convergent posteriorly and bearing two spines in each caudolateral corner, more mesial pair movable; caudal section moderately narrow and gently rounded. Proximal podomere of uropod with mesial lobe tapering and ending in corneous tip; very small projection on lateral lobe, that of left with minute corneous tip; broad, subtruncate mesial ramus with small distolateral corneous spine and with weakly developed median keel ending in small premarginal corneous spine.

Cephalomedian lobe of epistome (Fig. 1d) subtriangular with small, triangular, cephalomedian projection; margin thickened and elevated ventrally; main body with median inverted Y-shaped depression and conspicuous fovea at base of Y; areas lateral to median depression bearing conspicuous large punctations; epistomal zygoma forming weak asymmetrical arch. Ventral surface of proximal podomere of antennule with small corneous spine at base of distal third. Antennal peduncle with angular prominence on distolateral angle of basis bearing small corneous tip, otherwise lacking spines and tubercles; flagellum broken but reaching sixth abdominal tergum. Antennal scale (Fig. 1j) 2.2 times as long as broad with mesial and lateral margins subparallel for more than half length, distomesial margin turning strongly laterally to base of prominent distolateral spine which extending to level of distal margin of penultimate podomere of antennular peduncle. Mesial half

Table 1.—Measurements (mm) of *Cambarus (C.) angularis*.

	Holotype	Allotype	Morphotype
Carapace			
Entire length	41.5	39.9	30.3
Postorbital length	36.1	34.2	26.0
Width	23.2	21.5	15.6
Height	15.8	15.0	13.0
Areola			
Width	3.0	3.3	2.5
Length	15.6	14.6	11.4
Rostrum			
Width	7.1	6.5	4.8
Length	7.2	7.0	5.0
Right Chela			
Length, palm mesial margin	13.4	11.0	8.1
Palm width	18.7	15.8	11.0
Length, lateral margin	41.1	34.1	25.0
Dactyl length	25.0	20.7	14.6
Abdomen			
Width	19.6	20.4	14.1
Length	41.3	39.0	31.3

of ischium of third maxilliped with linear clusters of stiff setae, lateral half with few punctations bearing small plumose setae, lateral ridge flanked by punctations bearing clusters of similar setae; distolateral extremity of podomere produced into acute prominence.

Right chela (Fig. 1m) about 2.2 times as long as wide, moderately depressed; palm with length of mesial margin distinctly less than maximum width and bearing single row of eight tubercles, distal two much more widely spaced than more proximal ones; remainder of palm densely punctate and lacking tubercles other than those associated with adjacent podomeres. Both fingers with low but well-defined dorsal and ventral median longitudinal ridges flanked by prominent punctations. Opposable margin of fixed finger with row of 10 tubercles (nine on left), none conspicuously larger than others but distal four distinctly smaller than those situated more proximally; single tubercle also present at lower level between seventh and eighth tubercles of row; minute denticles extending distally from sixth tubercle to corneous tip of finger and situated ventral to more distal members of row. Opposable margin of dactyl with row of 14 (12 on left) rounded corneous tubercles (distal two minute), proximal four larger than more distal ones; minute denticles, extending distally from eighth tubercle to base of corneous tip of finger; mesial surface of finger punctate, lacking tubercles.

Carpus of cheliped longer than broad (14.7 and 11.1 mm), with curved, somewhat oblique submedian furrow dorsally; mesial surface with large procurved tubercle near midlength and two much smaller, partly fused tubercles more proximally; ventral surface with two prominent rounded tubercles on distal margin, more lateral one articulating with concave tubercle on proximal ventrolateral surface of palm, and three smaller more mesially situated ones; otherwise, podomere punctate. Merus with two very small, almost rudimentary, dorsodistal tubercles; ventral surface with mesial row of ten tubercles and lateral one of two. Basioischial podomere with row of five tubercles distal to fracture suture.

Hook on ischium of third pereopod only (Fig. 1h), subacute, overreaching basioischial articulation, and opposed by small tubercle on basis. Coxa of fourth pereopod with prominent caudomesial boss, caudal face of which lying in almost same plane as remainder of caudal surface of main body of podomere. Coxa of fifth pereopod without boss. First pleopods (Fig. 1b, f, l) reaching coxae of third pereopods, subsymmetrical, and contiguous basally. See "Diagnosis" for description

of terminal elements.

Allotypic female: Excluding secondary sexual characteristics, differing in only few respects from holotype: apex of rostrum slightly overreaching penultimate podomere of antennular peduncle; areola with six punctations across narrowest part; cephalic section of telson lacking right caudolateral movable spine; cephalomedian lobe of epistome more distinctly triangular and ventral surface more irregular; spine on ventral surface of proximal podomere of antennular peduncle located nearer distal extremity; distolateral spine of antennal scale clearly overreaching penultimate podomere of antennular peduncle; right chela (Fig. 1n) with opposable margin of fixed finger bearing row of eight (left with 11) tubercles along proximal 4/5, only one tubercle distal to that on lower level, opposable margin of dactyl with row of 11 tubercles; carpus of cheliped with only one or two tubercles mesial to more mesial tubercle on distal margin; 11 tubercles in ventrolateral row of merus; mesial margin of basioischial podomere with four tubercles. (Also see Table 1.)

Annulus ventralis (Fig. 1g) firmly fused to sternite XIII but posterior half semi-hinged to anterior half, its shape resembling tilted rhomboid, 1.6 times longer than broad; cephalomedian trough moderately deep; transverse sulcus rather well defined with tongue extending sinistrally, disappearing under high caudolateral wall. Postannular sclerite about 0.6 as wide and 0.4 as long as annulus.

Morphotypic male, form II: Differing from holotype as follows: rostral margins more tapering at base of acumen, not subangular; apex of acumen reaching distal extremity of penultimate podomere of antennular peduncle; postorbital ridges lacking apical tubercle; narrowest part of areola with four punctations; cervical spine represented by low tubercle and anterolateral part of carapace more strongly tuberculate; lateral lobe of uropodal peduncle lacking projection; Y-shaped depression on main body of epistome lacking, but fovea well defined and deep; angular prominence on basis of antennal peduncle with acute corneous tip; distolateral spine on antennal scale almost reaching distal extremity of antennular peduncle; opposable margin of fixed finger of cheliped with eight (left with nine) rounded tubercles, that of dactyl with 11; major tubercle on mesial surface of carpus of cheliped curved more strongly distally and bearing acute corneous tip, and only one, instead of three, ventromesial tubercles present; ventromesial row of tubercles on merus of left cheliped

consisting of only nine; mesial margin of basioischial podomere with row of four tubercles; as usual, hooks on ischium of third pereopods much reduced, not reaching basioischial articulation. First pleopod (Fig. 1c, e) differing from holotype in being heavier and more compact, and with central projection distinctly rounded, not bladelike, lacking subapical notch, and calcified instead of being corneous. (Also see Table 1.)

Color notes: Cephalothorax and abdomen concolorous brown to brown-green. Branchiostegites and hepatic regions lighter, with white to cream granular tubercles. Pair of darker vermiculated blotches anterior to cervical groove marking attachment of mandibular muscles. Rostral margins brown to amber, and antennae brown. Ventral surfaces of cephalothorax and abdomen whitish. Chelae tan dorsally, whitish ventrally. Palm with tubercles on mesial margin and articular condyles on dorsal surface yellow to amber. Dactyl with tubercles on mesial margin also yellow to amber. Fingers with tubercles on opposable margins yellow. Mesial surface of carpus of cheliped with larger procurved white to yellow spine, which sometimes bearing amber corneous tip. Pereiopods light green dorsolaterally and whitish ventrolaterally; distal podomeres darker dorsally than proximal ones.

Size: The largest specimen measured by us is a first form male having a carapace length of 53.7 mm (postorbital length 46.9 mm). Corresponding lengths of the smallest first form male are 35.1 and 30.0 mm; those of the smallest ovigerous female are 27.9 and 23.2 mm.

Type locality: Caney Valley Creek, 6.1 miles (9.8 km) southeast of Tazewell, Claiborne County, Tennessee, on U. S. Highway 25E. The specimens were collected 15 April 1951 by W. R. West and H. H. Hobbs, Jr. The slightly cloudy water flowed with a rapid current over a sandy bottom littered with large rocks. The stream was two to a little more than five meters wide and 15 cm to 0.5 m deep. The water had a pH of 5.5 and temperature of 13° C. Macroscopic vegetation was absent from the creek bed but members of the genera *Platanus*, *Acer*, *Quercus*, and *Pinus* were represented in the adjoining woods.

Disposition of types: The holotypic male, form I, the allotype, and the morphotypic male, form II, are deposited in the National Museum of Natural History (Smithsonian Institution), USNM 260252, 260253, and 260254, respectively. The paratypic series is restricted to the lots listed under "Range and specimens examined" that are followed by "PARATYPES." Series consisting of a first and second form male and

a female are deposited in the Academy of Natural Sciences of Philadelphia and the Virginia Museum of Natural History; the remaining paratypes are in the National Museum of Natural History.

Range and specimens examined: For the most part, this crayfish is largely confined to the Clinch River basin, frequenting most lotic habitats in the Powell and Clinch watersheds in northeastern Tennessee and southwestern Virginia. We have a few records from the Holston basin, and it may be more widespread in tributaries of the lower part of this river than we suspect. Except for the two lots of paratypes, mentioned under "Disposition of types," that have been deposited in the Academy of Natural Sciences and the Virginia Museum of Natural History, all of the specimens cited here are in the National Museum of Natural History (abbreviations that perhaps do not have obvious meanings include Br, branch; Ck, creek; ovig, ovigerous; Co, cos, county/ies; R, river; Rd, rds, road/s; Rte, state and county highways; St, state; Trib, tributary).

TENNESSEE: *Anderson Co.*— Clear Ck to Norris Reservoir, 2♂I, 1♀, 2j♀, 25 Nov 1938, R. Rhoades. Clear Ck, off US Hwy 441-Rte 71, Norris Dam St Park, 1♂I, 2♀, 19 Sept 1970, R. W. Bouchard, J. Way; 1♀, 27 Apr 1971, RWB, JW. Stream near Knox-Anderson Co line on US Hwy 25W, 1♂I, 1♀, 11 Nov 1951, P.C. Holt, H. H. Hobbs, Jr. Roaring Spring Ck at source, 1♂I, 29 Jan 1938, A. R. Cahn. *Campbell Co.*— Doak Ck, Norris Reservoir, 1♀, 29 Oct 1937, ARC. Chambers Branch at Rte 63, 4♂I, 2♂II, 1♀, 4 Oct 1969, RWB. Dosssett Ck off Rte 63, SW of Well Springs, 2♂I, 1♂II, 4♀, 1j♂, 1j♀, PARATYPES, 4 Oct 1969, RWB. *Claiborne Co.*— Stream 3 mi (4.8 km) SW of New Tazewell on Rte 33, 1♂II, 1♀, 12j♂, 11j♀, 16 Apr 1951, W. R. West, HHH. Sycamore Ck, 3.1 (5 km) mi SE of Tazewell on US Hwy 25E, 1♂I, 4♂II, 1♀, 6j♂, 6j♀, 15 Apr 1951, WRW, HHH. Ck 5.1 mi (8.2 km) N of Tazewell on US HWy 25E, 1♂I, 5♂II, 3♀, 9j♂, 3j♀, 15 Apr 1951, WRW, HHH. Indian Creek at Co Rd 2441, 13♂I, 3♂II, 14♀, 2j♂, 2j♀, PARATYPES, 4 Dec 1968, RWB & W. C. Starnes; 19♂I, 22♂II, 25♀, 7j♂, 8j♀, 2 ovig♀, PARATYPES, 3 Apr 1969, RWB, J. E. Pugh, D. J. Peters, HHH; 2♂I, 1♀, PARATYPES, 2 Oct 1970, D. A. Etnier, Erichson, Gregory. Little Sycamore Ck at Claiborne-Hancock Co line on Rte 33, 2♂I, 1♂II, 6♀, 2j♂, 1j♀, 5 ovig♀, 21 Apr 1962, J. F. Fitzpatrick, Jr., HHH. Ck 2.1 mi (3.4 km) SE of Tazewell on US Hwy 25E and 0.2 mi (0.3 km) NW on unnumbered Rd, 2♂I, 1♂II, 2♀, 4j♂, 7j♀, 1 ovig♀, 21 Apr 1962, JFF, HHH. Spring 3.9 mi (6.2 km) S of jct of US Hwy 25E and Rte 33 on secondary Rd, 1♂II, 12 Dec 1970, L. Fleming, R. Fox. Gap Ck off Rte 63 at RR, S of Arthur, 1♀, 2 Oct 1970, DAE

et al. Spring trib to Old Town Ck at Tazewell, 6♂II, 3♀, 9j♂, 5j♀, 16 Apr 1951, WRW, HHH. Big Sycamore Ck 7 mi (11.2 km) S of Tazewell, 3♂II, 1♀, 18 Oct 1893, B. W. Evermann (?). Roadside stream along US 25E S of Va state line, 1♂I, 1♂II, 1♀, 12 Dec 1970, LF et al. Caney Valley Ck, 6.1 mi (9.8 km) SE of Tazewell on US Hwy 25E, 5♂I, 2♂II, 6♀, 6j♂, 10j♀, 1 ovig♀, HOLOTYPE, ALLOTYPE, MORPHOTYPES, AND PARATYPES, 15 Apr 1951, WRW, HHH. Big Barren Ck on Rte 33, 5.2 mi (8.3 km) SE of New Tazewell, 1♂I, 7♂II, 6♀, 8j♂, 9j♀, 2 ovig♀, PARATYPES, 3 Apr 1969, RWB, JEP, DJP, HHH. Trib to Indian Ck on Co Rd 2441, 3.4 mi (5.4 km) E of Harrogate, 21♂I, 14♂II, 17♀, 3j♂, 7j♀, 1 ovig♀, PARATYPES, 3 Apr 1969, JEP, DJP, HHH. Davis Ck off Rte 63, NE of Pleasant Hill, 5♂I, 9♀, 5j♂, 4j♀, 4 Oct 1969, RWB. *Grainger Co.*— Mouth of S trib to Indian Ck, E of US Hwy 25E, 10 mi SE of Tazewell, 3j♂, 2j♀, 9 Jun 1947, R.M. Bailey, et al. Mill Ck, 1.1 mi (1.7 km) NW of Thornhill on US Hwy 25E, 1♂I, 2♂II, 3♀, 14j♂, 11j♀, 15 Apr 1951, WRW, HHH. Indian Ck 11.4 mi (18.2 km) SE of Tazewell on US Hwy 25E, 1♂II, 1♀, 2j♂, 2j♀, 15 Apr 1951, WRW, HHH. Buffalo Springs on tertiary Rd off Buffalo Springs Rd, 1♂II, 1♀, 13 Dec 1950, LF et al. Williams Ck at Co Rd 2478, 9♂I, 5♀, 1j♂, 2j♀, 6 Oct 1969, RWB. Puncheon Camp Ck at Co Rd 2478, Coffman Camp, 4♂I, 2♂II, 6♀, 2j♂, 3j♀, PARATYPES, 6 Oct 1969, RWB. *Hancock Co.*— Ck 3.4 mi (5.4 km) NE of Claiborne Co line on Rte 33, 1♂I, 2♂II, 1♀, 1j♂, 3j♀, 21 Apr 1962, JFF, HHH. Clinch R at Rte 70, Kyles Ford, 2♂I, 1♂II, 1♀, 1j♂, 1 ovig♀, 21 Apr 1962, JFF, HHH; 1j♂, 20 Jun 1969, DAE. Cantwell Valley Cave, 1♀, 28 Oct 1966, C. Mans, J.R. Holsinger. Powell R downstream from mouth of Mountain Ck (Martin Ck?), 1j♂, 18 Mar 1971, DAE, Gregory. East Fork of Panther Ck at Rte 33, 1♂II, 2♀, 3j♀, 25 Jan 1969, DAE et al. *Union Co.*— Trib Norris Lake, 7 mi (11.2 km) NE of Maynardsville on Rte 33, 1♂I, 2♂II, 1♀, 5j♂, 9j♀, 16 Apr 1951, WRW, HHH. Dam on Lost Creek, 1♀, 8 Jul 1937, ARC. Sharp Br, Norris Reservoir, 1j♀, 27 Sept 1934, L.B. Kalter. Dodson Ck at Co Rd 2347, 4♂I, 14♂II, 21♀, 4j♂, 2j♀, 6 Oct 1969, RWB. Flat Ck at Rte 131, NE of Chesny, 2♂I, 1♀, 6 Oct 1969, RWB. Crooked Ck at Co Rd 2347, 1♂I, 10♀, 1j♂, 6j♀, 6 Oct 1969, RWB. Fall Ck at Co Rd 2347, 4♂I, 2♂II, 8♀, 2j♂, 1j♀, 6 Oct 1969, RWB.

VIRGINIA: *Lee Co.*— 0.5 mi (0.8 km) above mouth of trib to Powell River, E of Jonesville on U.S. Hwy 58, 1♂II, 1j♂, 15 Jun 1937, L. P. Schultz & E. D. Reid. Trib of Powell River 12 mi (19.2 km) SW of Big Stone Gap, 1♂II, 1j♂, 1j♀, 15 Jun 1937, LPS & EDR. Indian Ck 2 mi (3.2 km) E of Ewing, 3♂II, 3♀, 15 Jun 1937, LPS & EDR. Ck 4 mi (6.4 km) W. of Ewing, 1♂II, 3♀, 18 Aug 1948, J. T. Wheeler; 1♂II, 3♀, 18 Aug 1948, JTW; 2♂I, 1♀, 8j♂, 7j♀. 19 Aug 1948, JTW; 1♂I, 1♂II, 1♀, 3j♂, 2j♀, 24 Aug 1948,

JTW. Hardy Ck, 11.1 mi (17.8 km) W of Jonesville on US Hwy 58, 14♂II, 12♀, 20j♂, 20♀, 16 June 1950, C. W. Hart, HHH. Creek 3.1 mi (5.0 km) N of Pennington Gap on Rte 20, 4♀, 17 Jun 1950, CWH, HHH. Blackwater Ck, 11 mi (17.6 km) S of Jonesville, 5♀, 2j♀, 2 Aug 1951, P. Osborne. Flagpond Br, 15 mi SE of Jonesville, 8♂II, 13♀, 3j♂, 3j♀, 2 Aug 1951, PO. Wallen Ck, on W side of Powell Mt, 0.5 mi (0.8 km) W of Scott Co line on US Hwy 58, 3♀, 3j♂, 4j♀, 3 Sep 1951, J. T. Wood; 4♂I, 1♂II, 5♀, 5j♂, 4j♀, PARATYPES, 15 Nov 1970, RWB, JW. Russell Co.—Rocks along tumbling ck (no other locality data), 1♂II, 15 Aug 1935, R. E. Bellamy. Roaring Spring Ck, 2 mi E of Lebanon on US Hy 19, 1♂I, 3♀, 24 Sep 1938, Rendell Rhoades. Cave 2.5 mi (4 km) SW of Dickensonville in semi-darkness, 1♂I, 4♀, 23 Sep 1938, RR. Lewis Ck, 2.1 mi (3.4 km) SW of Co line on Rte 67 at Skeggs, 1♂II, 1j♀, 18 Jun 1950. WRW, HHH. Chaney Creek just below mouth of Middle Fork, approx 100 m W of jct of Co rds 616 & 615, 1♂II, 1♀, 28 Sept 1957, PCH. Quillen's Field Cave, 1♀, 24 Jan 1961, JRH. Scott Co.—Stock Ck at Natural Tunnel, 1♂I, 2♂II, 1♀, 1j♀, PARATYPES, 16 Jun 1950, CWH, HHH. Troublesome Ck 8.2 mi (13.1 km) W of Gate City on US Hwy 58, 15♂II, 8♀, 32j♂, 19j♀, 16 Jun 1950, CWH, HHH. Big Branch, 4.5 mi (7.2 km) upstream from Clinchport, 1♂I, 6♂II, 1♀. 15 Apr 1960, C. Freeman. Mill Ck at Hill Station, 5♂I, 1♂II, 6♀, 1j♂, 1 ovig♀, PARATYPES, 15 Apr 1960, CF. Long Hollow Br, 5 mi (8 km) upstream from Clinchport, 1♂I, 2♀, 15 Apr 1960, CF. Smyth Co. Cave off Rte 42 near Bland Co line, 14 mi (22 km) NE of Broadford, 1♂II, 30 Aug 1953, R. L. Hoffman. Tazewell Co.—Maiden Spring Ck, 1♂I, 1♀, 1j♂, 4j♀, 5 Jun 1939, ARC. Spring near Concord Church, S. Fk of Clinch R at Rte 61, 1♂II, 1♀, 2j♂, 2j♀, 16 Aug 1940, J. Fowler. North Fork of Clinch R on US Hwy 19 at Tazewell, 1♂I, 3♂II, 4♀, 18 Jun 1950, CWH, HHH. Pounding Mill Br, 7.1 mi (11.4 km) E of Tazewell on US Hwy 19, 1♂II, 1♀, 2j♂, 1j♀, 18 Jun 1950, CWH, HHH. Indian Ck 4.1 mi (6.6 km) W of Co line on US Hwy 19, 8♂II, 1♀, 1j♂, 18 Jun 1950, CWH, HHH. Maiden Spring Ck, 14.2 mi (22.7 km) SW of Tazewell on Rte 91, 1♂II, 4♀, 3j♂, 3j♀, 8 Jun 1951, E. C. Raney, C. R. Robbins. Clinch R at NE city limits of Tazewell, 4♂II, 6♀, 1j♀, 1 ovig♀, 26 Jun 1955, W. J. Harman, HHH. Clinch R at Wittens Mills, 6.4 mi (10.2 km) NE of Tazewell on US Hwy 460, 1♂II, 4♀, 8 Jun 1951, ECR, CRR. Wise Co.—Locality lacking, 1♂II, 2♀, 16 Aug 1935, REB. Trib of Powell River at Big Stone Gap, 7♂II, 8♀, 1j♂, 1j♀, 17 Jun 1950, CWH, HHH.

Relationships: *Cambarus (C.) angularis* has its closest affinities with New River populations of *C. (C.) sciotensis*, each resembling the other in general mien and sharing similar rostra; comparatively broad areolae bearing many, often very many, densely set, shallow punctations;

epistomes; antennal scales; and chelipeds. But it differs from the latter species in several respects: the lateral surface of the chela is not distinctly costate and lacks a marked impression at the dorsal and ventral bases of the fixed finger. The carpus of the cheliped usually possesses two closely-set small tubercles proximomesially instead of one. The pleura of the third through fifth segments of the abdomen are subtruncate ventrally instead of being rounded. The central projection of the first pleopod of the first form male is longer and more strongly recurved, the tip almost always reaching proximally to at least the level of the distal base of the mesial process.

Ecological notes: Throughout its range, this crayfish has been found in moderately to swiftly flowing waters and seems to be most abundant in riffle areas. It has also been found in subterranean streams.

Life-history notes: Among the 80 collections examined by us, one or more was made in every month of the year except February, March, and May. Barring July, first form males were present during all the months represented. Eleven of the ovigerous females we have observed were found in April, and one was collected on June 26, 1955. No females carrying young have been seen by us but, with little doubt, they are most abundant in May and June.

Unique feature: One of the first form males (USNM 114236) possesses in addition to a phallic papilla on the fifth pereopods a well developed one on the left fourth.

Name: *Angulus* (L.) = angle; referring to the angles at the base of the acumen of the rostrum in most individuals.

Entocytherid symbionts: *Dactylocythere falcata* (Hobbs & Walton) and *Donnaldsoncythere donnaldsonensis* (Klie) were infesting the population in the type locality.

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