

***Cambarus (Jugicambarus) tuckasegee*, a new species of crayfish
(Decapoda: Cambaridae) from the Little Tennessee River basin,
North Carolina**

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Abstract.—*Cambarus (Jugicambarus) tuckasegee* is a new species of stream-dwelling crayfish that appears to be endemic to part of the Tuckasegee River subdrainage of the Little Tennessee River basin in the Blue Ridge province of North Carolina, where currently it is known from Soco Creek, Raven Fork, and the Oconaluftee River. It seems to share strong affinities only with *Cambarus (J.) distans*, which occurs in Kentucky, Tennessee, Alabama, and ostensibly in northwestern Georgia. It is readily distinguishable from this and all other members of the subgenus *Jugicambarus* by a combination of characters that includes: a short central projection with a deep subapical notch, and a long, caudoproximally directed mesial process, both on the gonopod of the form I male; a very inflated palm and notably short, stout fingers, all lacking tufts of long, stiff setae; a broad, densely punctate areola; a rostrum with very thickened, sometimes cephalically produced margins; and five to seven tubercles or spines on the ventral surface of the carpus.

Four members of the subgenus *Jugicambarus* of the crayfish genus *Cambarus* are known to occur in North Carolina (Cooper & Braswell 1995, Cooper et al. 1998). *Cambarus (Jugicambarus) asperimanus* Faxon, 1914, is a common inhabitant of probably all streams in the Blue Ridge, excluding those in the Hiwassee River basin, and of upland streams in the western Piedmont Plateau; *Cambarus (Jugicambarus) carolinus* (Erichson, 1846), is a primary burrower with a spotty distribution in wetlands of the Little Tennessee and Hiwassee River basins; *Cambarus (Jugicambarus) dubius* Faxon, 1884, is another primary burrower, known from quite a few bogs and similar habitats in the northern Blue Ridge and western Piedmont; and *Cambarus (Jugicambarus) nodosus* Bouchard & Hobbs, 1976, is a hypogean or hypotelminorheic

species that is limited in North Carolina to several fairly close sites in the extreme western Hiwassee River basin. A fifth North Carolina member of the subgenus, an undescribed and apparently endemic stream species, was recently discovered in Soco Creek, a tributary of the Oconaluftee River, which is a major northeastern branch of the Tuckasegee River in the Little Tennessee River basin. Its description follows.

Abbreviations used in the text are as follows: BYUC, Brigham Young University (M. L. Bean Museum) collection, Provo, UT; GMNH, University of Georgia Museum of Natural History, Athens; INHS, Illinois Natural History Survey, Champaign; j, juvenile; NC, North Carolina State highway; NCSM, North Carolina State Museum of Natural Sciences, Raleigh; PCL, postorbital carapace length; R, river; SR, state

secondary (county) road; TCL, total carapace length; US, United States highway; USGS, United States Geological Survey; USNM, National Museum of Natural History, Smithsonian Institution, Washington, D.C.; and UTM, Universal Transverse Mercator coordinates.

Cambarus (Jugicambarus) tuckasegee,
new species
Fig. 1, Table 1

Diagnosis.—Body and eyes pigmented, eye large (\bar{x} adult diam 2.1 mm). Rostrum with thickened margins, moderately to strongly convergent, occasionally subparallel, from base to base of acumen, which not delimited by tubercles or spines; margins abruptly thinning, sometimes slightly produced at base of acumen, then broadly concave and more strongly converging to dorsally directed apical tubercle; acumen comprising 34.6–46.6% (\bar{x} = 39.4%, n = 36) of rostrum length, latter comprising 17.6–24.4% (\bar{x} = 21.7%, n = 36) of TCL. Areola 3.0–4.8 (\bar{x} = 3.8, n = 48) times as long as broad, constituting 31.7–37.5% (\bar{x} = 34.2%, n = 51) of TCL and 41.4–45.1% (\bar{x} = 43.1%, n = 62) of PCL, and usually with 5 or 6 punctations across narrowest part. Thoracic section of carapace dorsally and dorsolaterally punctate, laterally with small granules. Cervical spines reduced to small, rounded tubercles; cervical groove shallow. Suborbital angle obtuse to subacute, with rounded or acute tubercle; branchiostegal spine reduced to blunt tubercle. Postorbital ridge with rounded cephalic margin bearing small tubercle. Antennal scale 2.1–2.7 (\bar{x} = 2.3, n = 30) times as long as broad, widest distal to midlength; lateral margin thickened and terminating in stout, distolaterally directed spine; mesial (lamellar) margin subparallel to lateral margin or slightly rounded.

Palm of chela very inflated, 1.4–1.6 (\bar{x} = 1.5, n = 33) times as wide as deep, 1.2–1.5 (\bar{x} = 1.4, n = 33) times wider than length of mesial margin; latter with row of 7–9

large, semierect tubercles, subtended dorsally by row of 2–4 (rarely more) smaller tubercles, plus other minute tubercles dorsolateral to them. Lateral eminence of articular ridge of chela, both dorsally and ventrally, with multiple, corneous distal tubercles. Fingers short, stout, slightly gaping if at all, without tufts of setae at opposable bases; dorsal surfaces of both fingers with strong longitudinal ridges; dactyl length 1.4–1.7 (\bar{x} = 1.5, n = 32) times length of mesial margin of palm, finger with few (if any) weak tubercles on mesial surface. Palm and fingers of chela devoid of long, erect bristles. Carpus with weak dorsomesial tubercles; ventral surface with pair of distal tubercles or spines, and multiple tubercles or spines proximomesial to them. Dorsal surface of merus with at least 2 strong subdistal tubercles or spines, and row of produced tubercles along dorsal ridge.

Hook on ischium of third pereopod of males, that of form I male large, tapered, laterally compressed, overreaching basioischial articulation by most of length and opposed by weak tubercle on basis; coxa of fourth pereopod of male with moderately strong, vertically disposed caudomesial boss.

In situ gonopods (first pleopods) of form I male (based on holotypic male; Fig. 1G) symmetrical, with small, slightly separated proximomesial apophyses; central projection directed caudally, curving slightly mesially; mesial process basally bulbous, tapering and curving caudolaterally to subacute, caudally directed tip; in lateral aspect (Fig. 1C) shaft straight; central projection short, not tapered, curved over 90° to plane of shaft, with proximally directed subapical notch; mesial process very long, inflated at base, directed caudoproximally, tapered and attenuate toward caudal end, tip acute; in mesial aspect (Fig. 1B), shaft with moderately long setae at about midlength. Total length of gonopod 25.9% of TCL (28.6% of PCL).

Annulus ventralis (based on allotypic fe-

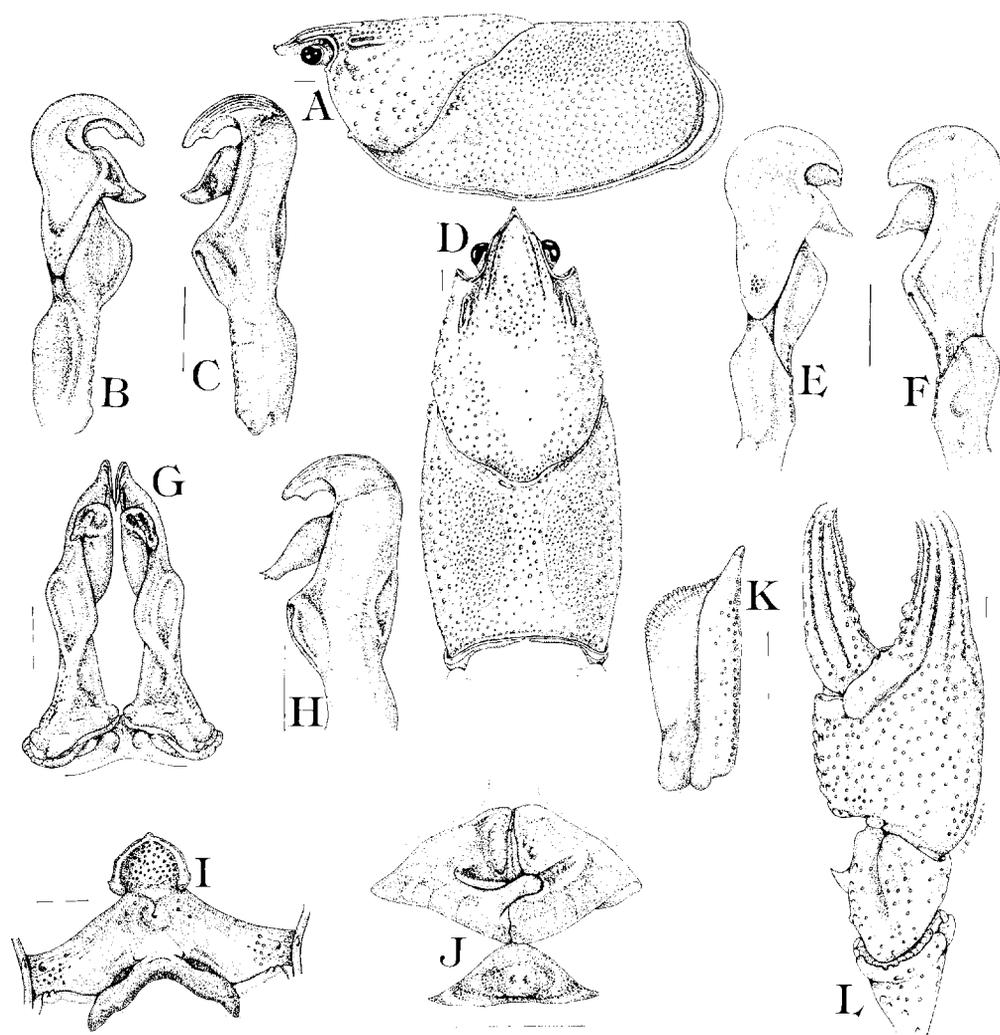


Fig. 1. *Cambarus (Jugicambarus) tuckasegee*, new species (all from holotypic male, form I, except E, F from morphotypic male, form II; H, from paratopotypic male, form I; J, from allotypic female). A, lateral aspect of carapace; B, E, mesial aspect of left gonopod (first pleopod); C, F, H, lateral aspect of left gonopod; D, dorsal aspect of carapace; G, caudal aspect of in situ gonopods; I, epistome; J, annulus ventralis and postannular sclerite; K, antennal scale; L, dorsal aspect of distal podomeres of right cheliped (tips of fingers missing). Scale lines equal 2 mm.

male; Fig. 1J) slightly asymmetrical, basically subrhomboidal in outline, ca. 1.9 times as wide as long; cephalic margin domelike, attached to sternum, but annulus capable of slight hingelike motion; cephalic half not depressed, with deep, fairly broad median trough flanked each side by strong ridge; dextral ridge proceeding caudally, then downcurving and disappearing at margin of transverse fossa near mid-

length of transverse tongue; sinistral ridge proceeding caudosinistrally, becoming poorly defined upper arm of reverse C-shaped caudosinistral wall; transverse tongue short, curved, plunging into deepest part of fossa beneath sinistral wall; caudal half of annulus thick, caudal margin of caudosinistral wall slightly rounded; caudodextral wall not quite as thick, oblique; lateral corners of annulus subangular; si-

Table 1.—Measurements (mm) of types of *Cambarus (Jugicambarus) tuckasegee*, new species.

	Holotypic male, form I	Allotypic female	Morphotypic male, form II
Carapace			
Total length	37.5	30.9	36.7
Postorbital length	31.8	25.7	30.5
Width	19.8	15.9	19.6
Depth	13.8	8.8	12.0
Length rostrum	6.6	6.0	7.0
Length acumen	2.6	2.3	2.5
Length areola	14.0	11.1	13.5
Width areola	4.1	3.3	3.4
Antennal scale			
Length	6.4	5.4	6.1
Width	2.6	2.3	2.6
Abdomen			
Length	40.5	34.8	38.2
Width	17.6	14.5	16.7
Cheliped			
Length lateral margin chela	30.4*	21.9	25.9
Length mesial margin palm	10.6	8.1	9.3
Width palm	15.3	11.4	12.6
Depth palm	9.6	7.5	8.2
Length dactyl	17.0*	11.7	14.2
Gonopod length	9.1	N/A	8.5

* Estimated; tips of fingers damaged.

nus reverse S-shape, dissecting caudal margin at midline.

Description of holotypic male, form I.—Body and eyes pigmented, eye 2.3 mm diameter. Cephalothorax (Fig. 1A, D) subcylindrical, moderately depressed dorsoventrally (thoracic section 1.4 times wider than deep). Areola 3.4 times longer than wide, constituting 37.3% of TCL (44.0% of PCL), very punctate, 7 punctations across narrowest part; width of areola constituting 20.7% of greatest carapace width; branchio-cardiac grooves very weak. Rostrum with very thickened margins moderately converging to base of acumen, where abruptly terminating, slightly produced, rounded, with cleft between dorsal and subrostral ridges; margins of acumen narrow, broadly concave and more strongly converging to blunt, dorsally directed apical tubercle reaching nearly to distal margin of penultimate podomere of antennular peduncle;

acumen comprising 39.4% of rostrum length, latter constituting 17.6% of TCL; floor (dorsal surface) of rostrum broad, plane, cephalic three-fourths glabrous, caudal fourth punctate; usual row of setiferous punctations along inner edge of dorsal ridge; subrostral ridge narrowly visible in dorsal aspect to base of acumen.

Postorbital ridge fairly short, straight, dorsolaterally grooved, caudally swollen; cephalic margin with vestigial tubercle. Suborbital angle obtuse, bearing small, blunt tubercle; branchiostegal spine reduced to tubercle. Thoracic section of carapace dorsally and dorsolaterally with minute and large punctations, laterally with rounded granules; cephalic section 1.7 times longer than areola, constituting 62.7% of TCL, laterally with small to moderate tubercles and row of small tubercles along ventral margin of cephalic section of cervical groove; gastric region mostly glabrous. Cervical spine

region on right with 4 small to moderate tubercles (5 on left).

Antennal peduncle with acute distolateral tubercle on basis, small rounded ventral tubercle on ischium; tip of antennal flagellum reaching caudal margin of fifth abdominal tergite when flagellum adpressed; antennular peduncle with small median spine at midlength of ventral surface of basal podomere. Antennal scale (Fig. 1K) 2.5 times as long as wide, widest distal to midlength; lateral margin thickened and terminating in strong, distolaterally directed spine, tip of which reaching nearly to distal margin of ultimate podomere of antennular peduncle; lamella approximately 1.2 times as wide as thickened lateral portion, distal margin gently declivous, mesial margin subparallel to lateral margin for most of length.

Abdomen slightly longer and narrower than carapace; pleura slightly rounded on ventral and caudal margins. Proximal podomere of uropod with very small caudolateral spine on lateral lobe, slightly larger spine on mesial lobe; mesial ramus of uropod with small caudolateral spine, and strong median ridge ending caudally in small, subterminal spine; lateral ramus with median ridge on cephalic section, margin of transverse flexure on right ramus bearing row of 12 fixed spines and 1 large, articulated sublateral spine. Telson with 2 spines in right caudolateral corner of cephalic section, mesialmost articulated, left corner with single fixed spine (articulated spine congenitally absent); transverse flexure of telson strong, dorsal surface of caudal portion very setiferous, caudal margin gently curved.

Epistome (Fig. 11) with subseptagonal cephalic lobe, cephalomedian margin of which interrupted at base of short projection; lateral corners thickened, elevated (ventrally), with tuberclelike ventrolateral angle; floor (ventral surface) of lobe slightly convex, very punctate; central depression of body broad, with shallow cephalomedian fovea; lamellae broad, with some shallow punctations, lateral corners subtruncate,

with 1 prominent tubercle cephalic to pair of caudal tubercles each side; zygoma strongly arched, cephalolateral margins flanked by usual pits.

Third maxilliped with tip of endopodite reaching distal margin of antennal peduncle; exopodite very hirsute, tip reaching midlength of merus of endopodite; longitudinal ridge of ventrolateral margin of ischium with row of punctations bearing short setae along inner edge; ventrolateral half of ischium quite punctate, distolateral corner slightly produced, acute; ventromesial half of ischium and ventral surface of basis with long, stiff bristles; mesial margin of ischium with row of 29 denticles. Right mandible with incisor ridge bearing 8 denticles.

Total chela length 81.1% of TCL; palm (Fig. 1L) very inflated, 1.4 times wider than long, 1.6 times wider than deep; mesial margin of right palm bearing row of 9 strong tubercles, proximal pair fused at bases; mesial row subtended dorsally by row of 5 smaller tubercles, 1 other tubercle dorsolateral to row; dorsal surface of palm densely punctate, distolateral portion weakly costate for short distance, lacking impression, with aggregation of deep punctations; articular ridge very strong, proximal margin well defined by deep groove; distal margin of lateral eminence with 3 corneous tubercles; lateral surface of palm thick, rounded, with median row of large punctations, distalmost several of which with basal tubercles; ventral surface of palm very punctate; articular ridge strong, lateral eminence with prominent subconical subdistal tubercle and 3 distal tubercles; 2 tubercles proximal to ridge. Fingers of chela of cheliped very slightly gaping in proximal half, opposable bases with sparse setae. Fixed finger (Fig. 1L) dorsolaterally costate, inner margin of costation scalloped by deep punctations; proximolateral base of finger with slight impression; submedian ridge strong, elevated, flanked each side by punctate groove, flanked mesially by second ridge; tip of finger damaged; lateral

surface of finger with row of large punctations; ventral surface with low, rounded ridge, flanked laterally by row of punctations, mesially by punctate groove; proximolateral base of finger lacking depression; opposable surface with subconical tubercle (tip abraded) ventral to denticles near midlength of finger, and 3 tubercles on proximal half dorsal to denticles, proximalmost tubercle very small, third from base massive; denticles strong, long, in dense mat of 3–6 rows from tip of finger to subconical tubercle, then in 2 or 3 rows from there to base of finger and continuing onto articular ridge. Dactyl of chela (Fig. 1L) thick, tip damaged; finger 1.6 times as long as mesial margin of palm; dorsal surface of dactyl with strong submedian ridge flanked each side by punctate groove, flanked mesially by second ridge; mesial surface of finger with pair of very weak basal tubercles, remainder punctate; ventral surface with low, rounded ridge, flanked mesially by short, shallow punctate groove, laterally by row of large punctations; opposable surface with row of 4 strong tubercles on proximal half of finger, fourth from base largest and located ventral to denticles; latter prominent, in mat of 2–5 rows on distal half of finger, 2 rows on proximal half.

Carpus of cheliped (Fig. 1L) 1.3 times as long as wide, 1.2 times length of mesial margin of palm; dorsal surface with oblique sulcus, lateral to which surface punctate, mesial to which with 5 moderate dorsomesial tubercles; mesial surface of carpus with short, slightly curved, acute subdistal spine and 1 proximal tubercle; ventral surface with stout, subconical distolateral (articular) tubercle, smaller distomedian tubercle with corneous tip, 1 large subconical tubercle proximomesial to latter, and row of 3 other tubercles near base of subdistal spine of mesial surface. Merus of cheliped 1.5 times longer than greatest depth, length 40.8% of TCL; dorsal surface with 3 rounded subdistal tubercles and row of produced tubercles along dorsomedian ridge; ventrolateral ridge with 4 subacute tubercles of varying

size, and 1 vestigial distal tubercle; ventromesial ridge with 9 conical tubercles, and 1 large, subacute distal tubercle; ventral surface of ischium with 4 subacute tubercles.

Hook on ischium of third pereopod simple, tapered, oblique, overreaching basioischial articulation by most of length, opposed by weak, setiferous tubercle on basis. Coxa of fourth pereopod with moderate caudomesial boss, in plane of margin of coxa.

Gonopods as described in "Diagnosis."

Description of allotypic female.—Except for secondary sexual characters, differing from holotypic male as follows: Areola constituting 35.9% of TCL (43.2% of PCL), with 6 punctations across narrowest part. Acumen comprising 38.3% of rostrum length, latter constituting 19.4% of TCL. Suborbital angle subacute, with acute tubercle. Cephalic section of carapace 1.8 times longer than areola and constituting 64.1% of TCL; cervical spine area with 2 or 3 very weak tubercles. Antennal scale 2.3 times as long as wide, lamella approximately 1.3 times as wide as thickened lateral portion. Telson with 2 spines each caudolateral corner of cephalic section. Epistome with subcircular cephalic lobe bearing small cephalomedian projection.

Total chela length 70.9% of TCL; palm 1.5 times wider than deep; mesial margin of right palm bearing row of 8 strong tubercles (9 on left), proximal 3 of which fused at bases; mesial row subtended dorsally by row of 4 smaller tubercles (3 on left); lateral eminence of dorsal articular ridge with 4 distal tubercles bearing corneous tips; ventral lateral eminence with 2 distal tubercles (3 on left); 2 tubercles proximal to ridge (1 on left). Fingers of chela without gape. Fixed finger with opposable surface bearing acute subconical tubercle ventral to denticles at midlength, and 4 tubercles on proximal fourth dorsal to denticles. Latter very strong, in 2 or 3 rows from tip to subconical tubercle, 1 or 2 rows from there to base. Dactyl of chela 1.4 times as long as mesial margin of palm; mesial sur-

face of finger with 1 proximal tubercle; opposable surface with strong denticles in 2 or 3 rows on distal half, 1 or 2 rows on proximal half. Carpus of cheliped 1.2 times as long as wide; dorsal surface with several strong dorsomesial tubercles. Merus of cheliped 1.6 times longer than greatest depth, length 40.5% of TCL; dorsal surface with 3 strong and 2 weak subdistal tubercles; ventrolateral ridge with 4 tubercles, plus very weak distal tubercle, and 2 weak tubercles between distal termini of both ventral ridges; ventromesial ridge with 10 tubercles (9 on left) and 1 moderate distal tubercle.

Annulus ventralis as described in "Diagnosis." In addition, first pleopods strong, tips with clusters of long setae, some smaller setae along margins; postannular sclerite subalate in outline, ventral surface domed, with some punctations.

Description of morphotypic male, form II.—Differing from holotypic male in following respects: Areola 4.0 times longer than wide, constituting 36.8% of TCL (44.3% of PCL), with 7 punctations across narrowest part; width of areola constituting 17.3% of greatest carapace width. Acumen comprising 35.7% of rostrum length, latter constituting 19.1% of TCL. Suborbital angle subacute, with tubercle; branchiostegal spine reduced to vestigial tubercle. Cephalic section of carapace constituting 63.2% of TCL. Cervical spine region with 2–4 small tubercles. Antennal scale 2.3 times as long as wide, lamella 1.3–1.4 times as wide as thickened lateral portion; distal margin subtransverse half of width before curving. Caudomesial spine on right mesial ramus of uropod bifurcate. Telson with 2 spines each caudolateral corner of cephalic section. Epistome with basically subcordiform cephalic lobe. Ischium of third maxilliped with distolateral corner produced as corneous spine.

Total chela length 70.6% of TCL; palm 1.5 times wider than deep; mesial margin of right palm bearing staggered row of 9 tubercles, and 4 tubercles dorsally subtend-

ing mesial row; lateral eminence of ventral articular ridge with moderate subdistal tubercle and 3 distal tubercles; 1 tubercle proximal to ridge. Opposable surface of fixed finger with row of 4 tubercles proximal to subconical tubercle; denticles in 2 or 3 (rarely 4) rows on distal half of finger. Dactyl of chela 1.5 times as long as mesial margin of palm, lacking tubercles on mesial surface; opposable surface with row of 5 strong tubercles on proximal half; denticles as on fixed finger. Carpus of cheliped with several weak dorsomesial tubercles. Merus of cheliped 1.6 times longer than greatest depth, length 39.2% of TCL; dorsal surface with 5 subdistal tubercles and row of weak tubercles along dorsal ridge; ventrolateral ridge with 6 small to moderate tubercles and 1 very weak distal tubercle; ventromesial ridge with 10 moderate tubercles (9 on left) and 1 strong distal tubercle.

Hook on ischium of third pereopod strong, tip overreaching basioischial articulation, not opposed by tubercle on basis. In situ gonopods with small, widely separated proximomesial apophyses; proximolateral area subtruncate, set off from rest of shaft by groove; in lateral aspect (Fig. 1F), shaft with strong juvenile suture; central projection short, directed caudally at about 90°; mesial process stout, strongly tapered, attenuated and very acute, directed caudoproximally and extending caudally farther than central projection.

Color notes.—Living specimens exhibit rather constant thoracic carapace pattern of dark saddle, incomplete across caudomedian margin, superimposed on tan, grayish-green, or mottled background. Lateral areas dark, with pale granules and streaks. Cephalic section of carapace also with saddle-like pattern, paler and more complete along dorsomedian cervical groove; all lateral tubercles pale. Floor (dorsal surface) of rostrum with uneven, dark median streak. Cervical spine area with white blotch, and larger white patch extending along ventral margin of carapace as far as cephalic end of

cervical groove. Antennal flagellae tan, banded with paler interstices.

Dorsal surfaces of chelae pale gray-green; tips of both fingers orange, bleeding onto more proximal areas of fingers; lateral margin of entire propodus yellowish, fading to pale gray on ventral surface of palm, mesial fifth of which dark; tubercles on mesial margin of palm greenish-gray; ventral articular ridge of palm orangeish-pink. Pereiopods tan with light mottling, proximomesial surfaces very pale; all tubercles on carpus and merus of cheliped light in color. All ventral structures cephalic to zygoma bluish-gray, zygoma white.

Dark color of carapace extending onto cephalicmost tergite of abdomen as dorso-lateral blotch on each side; succeeding terga with smaller, diagonal dash of same color producing narrow, zigzag dorsolateral stripe on each side of abdomen; caudal margins of all terga with narrow, transverse amber band. Each pleuron with dark tan, V-shaped marking at about mid-depth, ventral to which surface dark tan with light mottling. Tail fan pale with dark mottling, ridges and flexures dark.

Another variation basically mottled dark green, with same superimposed saddlelike pattern as described above. Lateral margins and ventral surfaces of propodus rosy pink, except mesial area dark. Cephalic margins of terga blue; cephalicmost tergite with darker green transverse band across cephalodorsal surface.

Disposition of types.—The holotypic male, form I, allotypic female, and morphotypic male, form II, are in the NCSM crustacean collection (NCSM 5322, 5323, 5324, respectively), as are paratopotypes consisting of 1 ♂ I, 1 ♂ II, 1 ♀, 5 j ♂ (5440), 1 ♂ II, 1 j ♂, 1 ♀, 1 j ♀ (5475), 10 j ♂ (5476), and paratypes consisting of 2 ♂ II, 1 j ♂, 2 ♀ (5170), 8 ♀, 6 j ♀ (5474), and 1 ♀ (5477). Other specimens are at GMNH: 13 subadult and j ♀ (GMNH 6194, paratopotypes), and 1 ♂ II, 8 j ♂ (GMNH 6195, paratypes).

Type locality.—North Carolina, Jackson

County, Soco Creek off US 19 at US 441 Bus, SE of Cherokee (Swain County)(Whittier USGS 7.5' quadrangle, UTM Zone 17, coordinates 290790E, 3927400N).

Range and specimens examined.—Known only from the Oconaluftee River, Soco Creek, and Raven Fork, within the Tuckasegee River subdrainage of the Little Tennessee River basin, North Carolina, where the following collections have been made (75 specimens; all collected by KS and associates, and all in NCSM collection unless otherwise indicated): *Jackson Co.*—(1) Soco Creek off US 19 at US 441 Bus (type locality): 1 ♀ (5323); 1 ♂ II (5324); 1 ♂ I, 1 ♂ II, 5 j ♂, 1 ♀ (5440); 18 Oct 1997; 1 ♂ II, 1 j ♂, 1 ♀, 1 j ♀ (5475); 10 j ♂ (5476); 13 subadult and j ♀ (GMNH 6194); 20 Apr 1999; 1 ♂ I (5322); 1 j ♂, 3 ♀, 2 j ♀ (BYUC 00-31); 12 Nov 1999. (2) Soco Creek, ca. 2 to 3 river km downstream from type locality (UTM 289600E, 3926600N): 1 ♂ II, 8 j ♂ (GMNH 6195); 8 ♀, 6 j ♀ (5474); 1 ♀ (5477); 19 Apr 1999. *Swain Co.*—(3) Oconaluftee R at SR 1359: 1 ♂ II (2999); 26 Jul 1989, coll. D. Penrose, F. Winborne. (4) Oconaluftee R near Birdtown: 2 ♂ II, 1 j ♂, 2 ♀ (5170); 22 Jul 1999, coll. N. Guthrie, D. R. Lenat, L. Eaton. (5) Raven Fork (Oconaluftee R) at Big Cove Rd, Great Smoky Mountains National Park: 1 ♀ (INHS 8642); 21 Sep 2000, coll. M. J. Wetzel, M. A. Morgan, B. Nichols.

Variations.—Variations other than those denoted in the "Diagnosis" include the following. In ventral outline the shape of the cephalic lobe of the epistome is quite variable, ranging from semicircular to subseptagonal. In most specimens, however, the shape is subcordiform, and a very small cephalomedian projection may be present. Although 65 of 72 specimens have a single fixed spine and a single articulated spine in each caudolateral corner of the cephalic section of the telson, a few have two spines in one corner, three in the other. One specimen has a single fixed spine in each corner,

with both articulated spines congenitally absent.

The carpus of the cheliped usually has from four to six strong or moderate dorsomesial tubercles, but in occasional specimens these tubercles are fewer and weaker. The mesial surface of the carpus almost always has a single proximal tubercle or spine in addition to the usual large subdistal spine, but some specimens have from two to five proximal tubercles or spines, and a number have a prominent spine or acute tubercle at or near the proximoventral base of the large subdistal spine. The ventral surface of the carpus almost always bears from five to seven spines or tubercles.

Most specimens either lack tubercles on the mesial surface of the dactyl of the cheliped, or have one to three weak tubercles on the proximal third or half of the finger. Some specimens, however, have four to six weak or moderate tubercles in this area. Nearly all specimens have a total of four tubercles on the opposable surface of the fixed finger of the chela, and these are located on the proximal half or less of the finger; some specimens, however, have only three such tubercles, and a single specimen has five. The proximalmost of these tubercles is always very small, and the fourth from the base is usually very large, but in 12 specimens the third tubercle from the base is the largest. The proximal half of the opposable surface of the dactyl almost always bears four tubercles, and the fourth from the base is large, subconical, and situated ventral to the denticles. Occasional specimens will have three or five tubercles on this surface, and in several of them it is the third tubercle from the base that is large, subconical, and situated ventral to the denticles. The number of subdistal ornaments on the dorsal surface of the merus ranges from one or two to as many as five or six, and their nature varies from small, rounded tubercles to strong, acute spines. The dorsal ridge of the merus almost always has a row of produced tubercles, but these are absent in a few juveniles. The total number of tu-

bercles or spines on the ventrolateral ridge of the merus ranges from two to seven, and they vary in development from moderate tubercles to strong spines. The ventromesial ridge of the merus is adorned with eight to ten small to moderately strong tubercles, plus a usually strong distal spine.

The cephalic margin of the postorbital ridge always bears a tubercle or spine. In adults this structure varies in development from a vestigial to an acute tubercle, but in juveniles it is a strong spine. The same is true of the branchiostegal spine, which is either minute or obsolete in adults, but may be strong in juveniles. Most specimens have two or three weak cervical tubercles, but occasional individuals may have none, or as many as four or five. The deepest part of the fossa of the annulus ventralis is dextral in 38 females, sinistral in 7 others.

Size and growth.—The largest specimen is a form I male with a TCL of 49.3 mm (41.0 mm PCL); the largest female measures 39.7 mm TCL (33.5 mm PCL). The latter specimen (NCSM 5477), kept alive since its capture on 19 April 1999, molted on 23 July 1999 and 19 January 2000. Between the 23 July 1999 molt and the time measurements of the live animal and the last exuvium were made (16 June 2000), the animal increased 4.3 mm in TCL (4.0 mm PCL) and 3.8 mm in total chela length. It was found moribund in the process of ecdysis on 30 August 2000.

Life history notes.—No ovigerous females or those with attached young have been collected. One of the two form I males was collected on 18 October, the other on 12 November.

Crayfish associates.—No other crayfish species have yet been found with *C. (J.) tuckasegee*. The crayfish fauna of the area, however, includes *C. (J.) asperimanus* and *Cambarus (Cambarus) bartonii* (Fabricius, 1798).

Affinities.—There are obvious similarities in non-trivial characters between *C. (J.) tuckasegee* and *Cambarus (Jugicambarus) distans* Rhoades, 1944 (s.s.), which occurs

in the Kentucky, Cumberland, and Tennessee River basins of Kentucky, Tennessee, and Alabama, and ostensibly in northwestern Georgia. The most prominent similarity is seen in the central projection of the form I male gonopod, which in both species is short and has a strong subapical notch. The mesial process of form I male *C. (J.) distans* (s.s.), however, is considerably shorter than that of *C. (J.) tuckasegee*, and is directed caudally at nearly 90° rather than strongly inclined caudoproximally at over 135°. The two species also differ in the nature of the rostrum, which in *C. (J.) distans* (s.s.) has convergent as opposed to subparallel margins and has a shorter acumen. Another major disparity lies in the very different chela of *C. (J.) distans* (s.s.), with its more depressed palm and its longer fingers.

A *Jugicambarus* population found in Murphy Hollow Creek on Sand Mountain in northwestern Georgia was assigned by Hobbs (1981:200–204) to *C. (J.) distans*. This followed Bouchard's (1976:593) report of the species in streams on the same mountain in Alabama. However, Hobbs (1981:202) said that the assignment of the Georgia specimens (eight adults, nine juveniles) was "tentative," and "the possibility exists that a separate taxon should be proposed to receive them." He indicated a number of ways in which this material differed from *C. (J.) distans* (s.s.), as described by Rhoades (1944). The members of this Georgia population resemble *C. (J.) tuckasegee* in the general configuration of the rostrum and in the long, caudoproximally oriented mesial process of the form I male gonopod, as well as in the similar color pattern. The similarities, however, end there since the Georgia specimens differ radically from *C. (J.) tuckasegee* in other important respects. These include the greater length and degree of curvature of the central projection of the form I male gonopod in the Georgia animal; its narrower and less punctate areola; its far less inflated palm and its considerably longer, less robust fingers; the different shape and nature of its annulus;

and the tuberculate condition of the lateral surfaces of its carapace. Thus, whatever its identity, the Georgia form is not conspecific with *C. (J.) tuckasegee*, although the two may be closely related, sharing a few more similarities than either appears to share with *C. (J.) distans* (s.s.). Unfortunately, no study of intraspecific variation in *C. (J.) distans* has ever been made (see Hobbs, 1981:64), and no morphological or meristic data on material reported as this species from Sand Mountain, Alabama (Bouchard 1976:593), have been published.

Cambarus (Jugicambarus) crinipes Bouchard, 1973, which occurs in the Cumberland River basin of Tennessee and part of Kentucky, was considered by Bouchard (1973) to be related to *C. (J.) distans*. In *C. (J.) crinipes*, the fingers of the chela are longer than those of *C. (J.) tuckasegee*, the chelae are very setiferous, the central projection of the form I male gonopod is tapered and lacks a strong subapical notch, and the species possesses a small but obvious cervical spine.

The new species bears some superficial resemblance to another stream-dwelling species of the subgenus, *Cambarus (Jugicambarus) parvoculus* Hobbs and Shoup, 1947. This species, however, has a narrower areola (length 5.7–9.7 times width, versus 3.0–4.8), with only 2–4 punctations across the narrowest part as opposed to 5–7 in *C. (J.) tuckasegee*; a shorter rostrum (length ca. 16–17% of TCL, versus ca. 18–25%); a longer central projection on the gonopod of the form I male; a very different, subovate, asymmetrical annulus ventralis, in which the walls of the caudal half are very inflated and rounded; far fewer tubercles or spines on the carpus; and a different, usually concolorous pattern.

Ecological notes.—All Soco Creek specimens were collected in relatively high gradient, fast-flowing streams dominated by boulder/cobble substrate. Stream width was generally 10 to 14 m. Canopy cover at the two collection sites on this creek was variable: riparian vegetation was predominant-

ly intact at the upstream site (type locality), but largely absent at the downstream site. Algal communities were well developed at both sites. Most crayfish were found beneath boulders at the stream margin, but some individuals were collected in mid-channel.

Fishes collected in Soco Creek were typical of a mid-size, high gradient Blue Ridge stream. They included *Cottus* sp. (cf. *C. bairdi* Girard); *Rhinichthys cataractae* (Valenciennes); *Nocomis micropogon* (Cope); and stocked *Oncorhynchus mykiss* (Walbaum) (M. Scott, pers. comm.).

Etymology.—The species name denotes its occurrence, probably as an endemic, in the Tuckasegee River subdrainage of the Little Tennessee River basin, North Carolina, and is a noun in apposition.

Suggested vernacular name: Tuckasegee stream crayfish.

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