

A NEW SPECIES OF CRAYFISH (DECAPODA:  
CAMBARIDAE) BELONGING TO THE GENUS *CAMBARUS*,  
SUBGENUS *HIATICAMBARUS*, FROM THE UPPER  
ELK RIVER DRAINAGE OF WEST VIRGINIA

Raymond F. Jezerinac and G. Whitney Stocker

*Abstract.*—A new species of crayfish, *Cambarus (Hiaticambarus) elkensis*, is described from the upper Elk, Holly, and Birch rivers of West Virginia. The species is most closely related to *C. (H.) chasmodactylus* but differs from it in having shorter fingers, a much narrower gape between the fingers, and moderate impressions at the base of the fixed finger, especially on the ventral surface.

While conducting a crayfish survey of the state of West Virginia in 1988, we captured what we thought to be *C. (H.) chasmodactylus* James (1966) from the upper Elk River drainage. We reported this (Jezerinac & Stocker 1989:3) as a new drainage record for the species. Additional collections were made in 1989 from the upper Elk basin, the Elk River and its tributaries below Sutton Lake, as well as in surrounding watersheds, notably the Greenbriar, Gauley, Cherry, and Cranberry rivers. Representatives of the species were caught only in the upper Elk River drainage. With the additional material, we noted that these crayfish differ in several respects from *C. (H.) chasmodactylus* and are described herein as members of a new species.

*Cambarus (Hiaticambarus) elkensis*,  
new species

Fig. 1, Table 1

*Cambarus bartonii veteranus.*—Faxon, 1914:389 [in part, Elk River, Cogar's Mills, West Virginia].

*Cambarus (Hiaticambarus) chasmodactylus.*—Jezerinac & Stocker, 1989:3 [in part].

*Diagnosis.*—Body pigmented, eyes well developed. Carapace subovate, dorsoventrally flattened. Rostrum with weakly con-

vergent, slightly concave, thickened margins, lacking spines or tubercles and terminating in upturned corneous tubercle. Areola 3.5 to 5.5 ( $\bar{X} = 4.6$ ) times as long as wide and comprising 35.1 to 38.1% ( $\bar{X} = 36.6\%$ ) of entire length of carapace, and bearing 5 to 7 punctations across narrowest part. Cervical spine absent or represented by small tubercle. Suborbital angle obtuse to obsolete. Postorbital ridges terminating cephalically in sharp spine or tubercle. Branchiostegal spine very small. Antennal scale 2.5 times longer than broad, with mesial and lateral margins subparallel near and at midlength; basiopodite with very small spine; ischiopodite lacking spine. Epistome subtriangular, zygoma with about 120° arch. Chela smooth and bearing one row of very indistinct tubercles along mesial margin of palm; lateral margin of fixed finger smooth; both fingers with very poorly defined dorsomedian longitudinal ridges; fixed finger moderately impressed at base especially on ventral surface; dactyl 1.8 to 2.3 ( $\bar{X} = 2.0$ ) times longer than mesial margin of palm; palm length 28.4 to 32.3% ( $\bar{X} = 30.8\%$ ) of chela length; elongated setae at base of fixed finger very sparse or absent (best seen on young specimens); gape of fingers subequal to width of dactyl in first form males, less so in second form males, and almost nonexistent in females. Mesial margin of carpus

of chela with large spiniform tubercle and smaller conical one proximally; ventral surface with conical knob on distal articular rim. Ventrolateral ridge of merus with 2 to 4 ( $\bar{X} = 2.5$ ) spines; ventromesial one with 6 to 12 ( $\bar{X} = 9$ ) spines. Ischium of only third pereopod with simple hook not reaching tubercle on corresponding basis. Boss on ischium of fourth pereopod prominent. First pleopod of Form I male (Fig. 1B, F) with short terminal elements; corneous central projection truncate distally, recurved at greater than  $90^\circ$  to main shaft of appendage, with subapical notch; mesial process inflated, tapering, rounded to acute distally, directed caudolaterally at angle slightly greater than  $90^\circ$  to main shaft of appendage. Female with annulus ventralis shallowly embedded in sternum, asymmetrical, and subrhomboidal. (Additional morphometric and meristic data, such as simple descriptive statistics, ratios, and regression analysis, may be obtained from the authors or the library at The Ohio State University at Newark.)

*Holotypic male, Form I.*—Cephalothorax (Fig. 1A, J) subovate in cross section, dorsoventrally compressed. Abdomen narrower than thorax (21.0 mm and 17.4 mm); greatest width of carapace distinctly greater than height at caudodorsal margin of cervical groove (21.0 mm and 15.2 mm). Areola 4.5 times as long as broad with 5 to 7 crowded punctations across narrowest part; length of areola 37.5% of total length of carapace. Rostrum with thickened, weakly convergent, elevated, concave margins devoid of spines or tubercles; dorsal surface of rostrum slightly concave with many punctations, rather sparse punctations on and at base of indistinctly delineated acumen. Subrostral ridges well developed and evident in dorsal aspect to base of acumen. Suborbital angle obtuse. Postorbital ridge moderately prominent, grooved dorsolaterally, and terminating cephalically in acute corneous tubercle. Branchiostegal spine represented by a spiniform tubercle. Cer-

vical spine reduced to small rounded tubercle on left side, absent on right. Carapace densely punctate dorsally except in gastric region, distinctly sculptured over attachment of mandibular muscle; lateral surface with many small granules in branchiostegal region; larger granules in mandibular and ventral half of hepatic region.

Abdomen slightly shorter than carapace (38.6 mm and 40.0 mm respectively); pleura rounded to subtruncate ventrally with angular caudoventral extremities on third through fifth segments. Cephalic section of telson with 2 spines on each caudolateral corner, mesial spines movable; borders of caudal section evenly rounded. Proximal podomere of uropod with both lobes terminating in corneous-tipped blunt spine; mesial ramus with low submedian dorsal keel ending in small, blunt, premarginal spine not extending beyond distal edge of ramus.

Cephalomedian lobe of epistome (Fig. 1I) broadly rounded with small cephalomedian projection, margin somewhat thickened and elevated ventrally; main body with distinct median groove and paired slitlike grooves immediately cephalic to arched epistomal zygoma. Ventral surface of proximal podomere of antennular peduncle with small spine at base of distal third. Antennal peduncle with strong lateral spine on basis, remaining podomeres lacking spines. Antennal scale (Fig. 1G) about 2.5 times as long as broad with mesial and lateral margins subparallel for some distance proximal and distal to midlength; strong distolateral spine reaching beyond midlength of ultimate podomere of antennular peduncle. Ventral surface of ischium of third maxilliped with broad, longitudinal band of long setae laterally and with submarginal lateral row of smaller plumose ones, few additional short plumose setae in area between; mesial margin with 21 denticles.

Right chela (detached) (Fig. 1L) 2.4 times as long as broad, mesial margin of palm 30.6% of chela length; dactyl 2.1 times palm

length; mesial margin of palm with one row of 7 indistinct tubercles; remainder of palm with widely spaced large, deep punctations on mesial region, more crowded on lateral region, lateral surface rounded. Gape between fingers subequal to dactyl width, and proximal half of opposable surface of fixed finger without tufts of setae; both fingers with poorly defined median longitudinal ridge on dorsal surface, absent on ventral surface, both with conspicuous deep punctations; opposable margin of fixed finger with row of 11 small (seventh enlarged) rounded corneous tubercles, single row of minute denticles present slightly ventral to tubercular row along distal fourth of finger; opposable margin of dactyl with row of 12 tubercles, minute denticles forming single row below level of tubercles along distal third. Lateral surface of fixed finger and mesial surface of dactyl non-costate, punctate.

Carpus of cheliped (Fig. 1L) longer than broad with deep dorsal furrow flanked by sparse punctations mesially and laterally; mesial surface with 1 spiniform tubercle and more proximally situated smaller conical one; ventral surface very sparsely punctate and bearing 1 tubercle on distal articular rim. Merus with 1 premarginal tubercle dorsally; ventrolateral ridge with 2, ventromesial ridge with 9 tubercles. Ventromesial margin of ischium with 2 very small tubercles.

Hook on ischium of third pereopod only (Fig. 1K), hook overreaching basioischial articulation and opposed by small tubercle on basis. Coxa of fourth pereopod with prominent caudomesial boss ventrally disposed, and somewhat flattened caudally. Boss on coxa of fifth pereopod vestigial. First pleopods (Fig. 1B, C) reaching coxae of third pereopods, symmetrical, with very small gap between bases (Fig. 1D). (See "Diagnosis" for descriptions of the pleopods and Fig. 1B, F.)

*Allotypic female.*—Excluding secondary sexual characteristics, differing from holotype in following respects: areola 5.0 times

as long as broad and constituting 36.6% of total length of carapace; very small cervical tubercle present on both sides; mesial margin of palm of right chela 30.9% of chela length; gape between fingers about  $\frac{1}{4}$  width of dactyl; few plumose setae present at base of fixed finger; no enlarged tubercle on opposable surface of fixed finger; 10 (right) and 11 (left) tubercles on opposable margin of dactyl; 2 dorsal premarginal tubercles on merus; ventrolateral ridge of merus with 3 (right) and 2 (left) tubercles; ventromesial ridge of merus with 11 (right) and 12 (left) tubercles.

Annulus ventralis subrhomboidal (Fig. 1H), wider than long, slightly movable, with caudal wall weakly developed. Postannular sclerite about half as wide and about  $\frac{1}{3}$  as long as annulus. First pleopods reaching midlength of annulus when abdomen flexed.

*Morphotypic male, Form II.*—Differing from holotype in following respects: areola 4.2 times as long as broad; areola length 36.2% of carapace length; cervical tubercle absent on both sides; spine on ventral surface of proximal podomere of antennular peduncle near distal margin; spine on right antennal scale damaged, antennal scale 2.3 times longer than broad; right chela regenerated; left chela 2.3 times as long as broad; mesial surface of palm occupying 29.7% of chela length; dactyl length 2.2 times palm length; gape about  $\frac{3}{4}$  width of dactyl; setae at base of fixed finger; ventrodiscal margin of carpus with 2 tubercles; merus with 2 premarginal tubercles dorsally, 2 large and 1 small (left) and 4 (right) tubercles on ventrolateral ridge of merus; ventromesial ridge with 9 (right) and 7 (left) tubercles; ventromesial margin of ischium with 4 (right) and 3 (left) tubercles; hook on ischium of third pereopod much reduced, not overreaching basioischial articulation and opposed by small tubercle on basis; first pleopod (Fig. 1C, E) with juvenile suture on shaft, central projection inflated.

*Color notes.*—Basic color of dorsal surfaces of chela, carpus, merus, legs, and car-

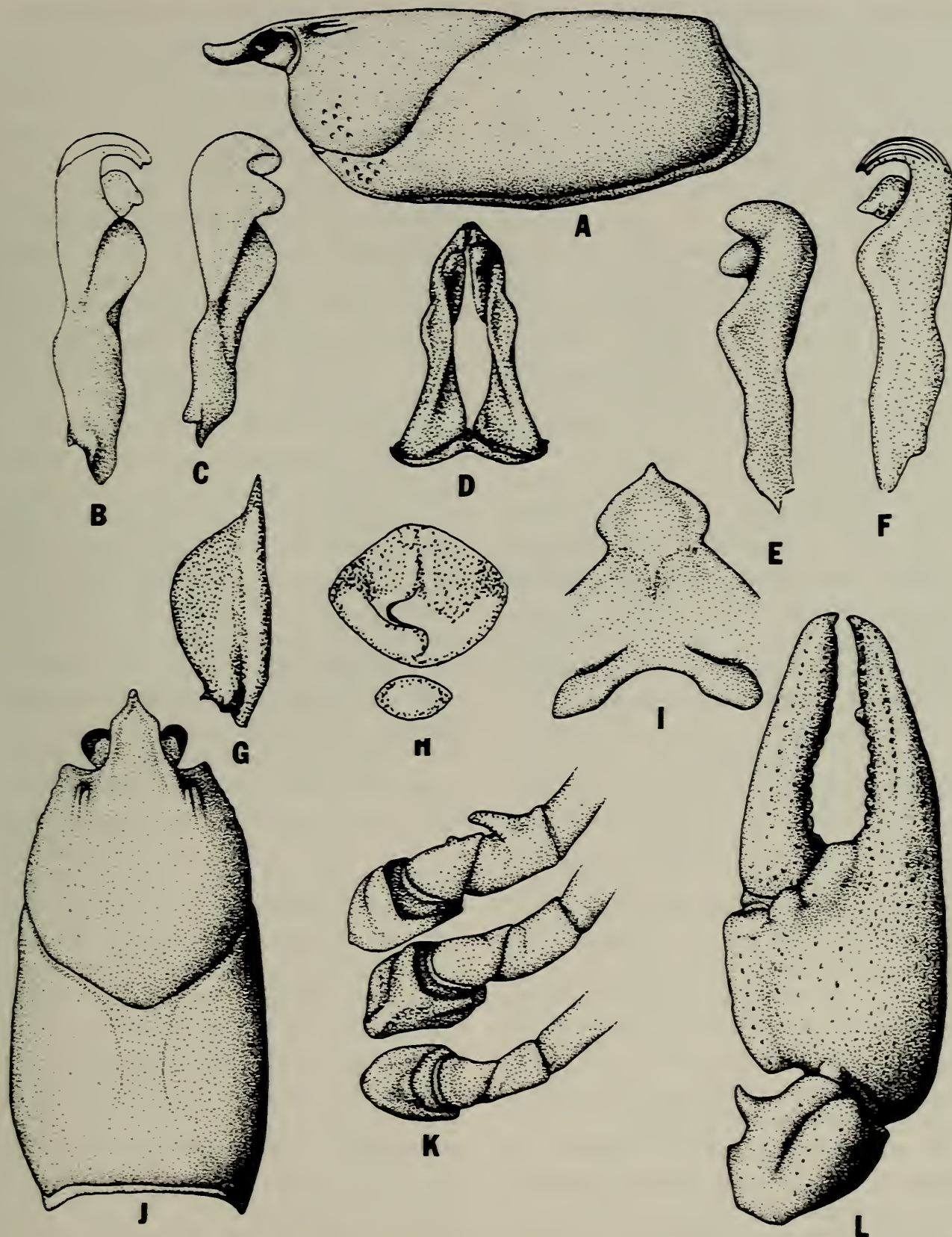


Fig. 1. *Cambarus (Hiaticambarus) elkensis*, new species. All from holotype male, Form I, except C, E, from morphotype male, Form II, and H, from allotype female): A, lateral view of carapace; B, C, mesial view of first pleopod; D, caudal view of first pleopods; E, F, lateral view of first pleopod; G, antennal scale; H, annulus ventralis; I, epistome; J, dorsal view of carapace; K, proximal podomeres of third, fourth, and fifth pereopods; L, dorsal view of distal podomeres of cheliped. (See Table 1 for precise measurements.)

apace brown; abdomen darker brown; tubercles on opposable margins of fingers and mesial spiniform tubercle of corpus yellowish; distinct black band lining cervical groove; mandibular adductor region with black reticulated pattern; rostral margins and dorsal tubercles on chela reddish; under-surface cream.

*Types.*—The holotype, allotype, and morphotype (USNM 260038, 260039, and 260040, respectively) are deposited in the National Museum of Natural History, Smithsonian Institution, Washington D.C. A small series of paratypes (1 ♂ I, 8 ♂ II, 10 ♀) is at The Ohio State University at Newark Crayfish Museum.

*Type locality.*—The Laurel Fork of the Left Fork of the Holly River (Holly River → Elk River → Kanawha River drainage) at Holly River State Park campground, Webster County, Hacker Valley District, West Virginia. (1.1 (air) km NNE of Hacker Valley.) At this site, the stream is about 10 m wide, 0.5 m deep, and flows over a substrate of sandstone boulders, cobbles, gravels, and sand. The specimens were captured from under cobbles lying on sands and gravels where there was considerable current. The adjacent terrestrial vegetation included hemlock (*Tsuga*), birch (*Betula*), alder (*Alnus*), and rhododendron (*Rhododendron*).

*Range and specimens examined.*—The species is endemic to the upper Elk Basin, specifically in the Elk River above Sutton Lake, and in the Holly and Birch rivers. The collectors were R. F. Jezerinac, G. W. Stocker and T. Jones (Coll 1) and GWS and TJ (Coll 2) unless otherwise stated.

We have examined 22 collections containing a total of 95 specimens—6 (Form I) males, 46 (Form II) males, and 43 females from the following localities: Nicholas County: Birch River Intersection (Inters) County Road (Co Rd) 10 and Co Rd 1/9 (0.8 (air) km E of Birch River), 10 Sep 1988, Coll 1 (1 ♂ II); Pocahontas County: Slaty Fork (Fk.) United States Route (U S Rte)

219, 0.3 km (0.4 mi) S of Co Rd 219/12 (0.3 (air) km SE of Slaty Fk.), 21 Aug 1988, Coll 2 (1 ♂ I, 6 ♀); Old Field Fk. U S Rte 250, 12.8 km (8.0 mi) NW of Co Rd 219/25 (at Marys Chapel), 19 Jul 1989, Coll 1 (2 ♂ II, 2 ♀); Old Field Creek (Ck.) Inters U S Rte 219 and Co Rd 219/1 (3.0 (air) km S of Slaty Fk.), 27 May 1989, GWS, RFJ (1 ♀); Webster County: Laurel Fk. Holly River State Park Campground (1.1 (air) km NNE of Hacker Valley), 17 Jun 1988, GWS, RFJ (4 ♂ II, 5 ♀); same locality 23 Aug 1988, Coll 2 (1 ♂ I, 3 ♂ II, 3 ♀); and 20 Jun 1990, GWS, Chelsey Stocker, Vicky Stocker (1 ♂ I, 2 ♂ II, 3 ♀); Right Fk. Inters St Rte 20 and Co Rd 5 (at Diana), 3 Sep 1988, GWS, RFJ (1 ♀); 20 Jul 1989, Coll 1 (1 ♂ II, 1 ♀); (10) Birch R. Co Rd 30, 6.1 km (3.8 mi) N of St Rte 20 (4.6 (air) km RW of Cowen), 23 Aug 1988, Coll 2 (1 ♂ II, 1 ♀); Elk R. Co Rd 26, 5.6 km (3.5 mi) NE of Co Rd 15 (3.0 (air) km NW of Bergoo), 22 Aug 1988, Coll 2 (4 ♂ II, 4 ♀); Back Fk. Co Rd 24, 5.1 km (3.2 km) E of St Rte 20 (2.2 (air) km E of Webster Springs), 20 Jul 1989, Coll 1 (1 ♂ I, 6 ♂ II, 6 ♀); Left Fk. Co Rd 3 just W of St Rte 20 (1.3 (air) km SW of Hacker Valley), 21 Jul 1989, Coll 1 (3 ♂ II, 1 ♀); Right Fk. Inters Co Rd 5/1 and Co Rd 15 (at Guardian), 21 Jul 1989, Coll 1 (2 ♂ II); Left Fk. Inters Co Rd 3 and Co Rd 8 (at Polling), 21 Jul 1989, Coll 1 (3 ♂ II); Elk R. Inters Co Rd 26/1 and Co Rd 26/7 (1.9 (air) km NE of Bergoo), 20 Jul 1989, Coll 1 (1 ♂ I, 4 ♂ II, 1 ♀); Elk R. Co Rd 26, 5.6 km (3.5 mi) NE of Co Rd 15 (3.0 (air) km NW of Bergoo), 20 Jul 1989, Coll 1 (2 ♂ II, 3 ♀, 1 ♀ ovig.); Elk R. Co Rd 15/3, 0.8 km (0.5 mi) E of St Rte 15 (0.5 (air) km SW of Curtin), 20 Jul 1989, Coll 1 (1 ♂ II); Birch R. Inters Co Rd 30 and Co Rd 40 (at Boggs), 21 Jul 1989, Coll 1 (2 ♂ II, 2 ♀); Leatherwood Cr. Co Rd 26/4, 0.8 km (0.5 mi) S of Co Rd 26 (1.1 (air) km S of Bergoo), 20 Jul 1989, Coll 1 (3 ♂ II, 3 ♀); Elk R. Co Rd 7 at Webster Springs Water Treatment Plant (2.4 (air) km W of Webster Springs), 22 Jul 1989, Coll 1 (1 ♂ II); USNM

43706 Elk R., Cogar's Mills, 30 Jul 1899, Collectors unknown (1 ♂ I) [locality unknown, Braxton County on USNM label].

*Variations.*—Most specimens examined have concave rostral margins that taper to the acumen and the rostral length is greater than the rostral width. Some specimens have subparallel rostral margins, others have margins that constrict rather sharply to form the acumen, and some have rather broad rostra. The suborbital angle varies from obsolete to obtuse. These variations are not restricted to any specific watershed.

*Size.*—The largest specimen examined is a Form II male from the Birch River in Webster County with a carapace length (CL) of 45.6 mm. The largest female has a 39.0 mm CL and those of the largest and smallest Form I males are 41.2 mm and 36.7 mm, respectively. For measurements of the types see Table 1.

*Life history notes.*—Form I males were captured on 20 June (1 specimen), 20 July (2), and 21 and 23 August (1 each). The only ovigerous female was caught on 21 July and carried 112 eggs having diameters of 2.2–2.6 mm. This female has a CL of 37.6 mm. Specimens are not available for the other months of the year.

*Ecological notes.*—As has been observed with other members of the subgenus *Hiaticambarus* (Hobbs, 1981:147), *C. (H.) elkensis* is found under loose rocks in riffles, or pools that have currents. The species was sought for unsuccessfully in small, head-water streams. In these smaller tributaries *C. (Cambarus) bartonii carinirostris* Hay (1914) was abundant. We also sampled large rivers, especially below Sutton Lake, and failed to capture it. *Cambarus (Puncticambarus) robustus* Girard (1852) was more common in these bodies of water. Since the species is found in the Birch River below Sutton Lake, we suspect that suitable habitat for this species was probably destroyed when Sutton Lake was constructed.

*Relationships.*—*Cambarus (H.) elkensis*

Table 1.—Measurements (in mm) of types of *Cambarus (Hiaticambarus) elkensis*, new species.

Character	Holotype	Allotype	Morpho- type
Carapace			
Height	15.2	12.3	14.2
Width	21.0	16.1	18.7
Length	40.0	32.8	37.3
Areola			
Length	15.0	12.0	13.5
Width	3.3	2.4	3.2
Rostrum			
Length	9.3	8.0	8.8
Length to anterior postorbital ridges	7.4	6.5	7.6
Width between eyes	4.5	3.7	4.6
Postorbital ridge			
Width	9.0	7.5	8.3
Chela (right)			
Length lateral margin	40.8	26.9	31.7
Length mesial margin of palm	12.5	8.3	9.4
Width of palm	17.1	11.0	14.0
Length of dactyl	26.0	17.1	20.5
Thickness of palm	10.2	6.7	8.4
Abdomen			
Length	38.6	34.0	38.2
Width	17.4	13.9	16.1
Gonopod			
Length	8.3	—	7.8
Antennal scale			
Length	6.6	5.4	6.2*
Width	2.6	2.2	2.7*

\* Left antennal scale.

appears to be most closely related to *C. (H.) chasmodactylus* but differs from it by having the dactyl length/palm length ratio < 2.3, less gaping fingers, and moderately strong impressions at the base of the fixed finger of the chela, especially on the ventral surface.

*Crayfish associates.*—Collected with *C. (H.) elkensis* at one or more sites were *Orconectes (Crockerinus) sanbornii sanbornii* (Faxon, 1884), *O. (Procericambarus) spi-*

*nosus* (Bundy, 1877), *C. (C.) b. carinirostris*, and *C. (P.) robustus*.

*Etymology.*—We name this crayfish after the Elk River of West Virginia to which it appears to be endemic.

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(RFJ) Department of Zoology, The Ohio State University at Newark, University Drive, Newark, Ohio 43055, U.S.A.; (GWS) 13773 Bodle Road, Newark, Ohio 43055, U.S.A.