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CRAYFISHES OF OKLAHOMA REVISITED: NEW STATE RECORDS AND CHECKLIST OF SPECIES

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ABSTRACT—Examination of museum records and field observations have included 4 new records for species of crayfish in Oklahoma (*Cambarellus puer, Orconectes deanae, O. lancifer,* and *O. macrus*) and a new drainage record for *O. neglectus neglectus*. These records bring the number of crayfish known in Oklahoma to 28 and emphasize the importance of revisiting aquatic habitats in regions that have been visited previously. Such records can help in determining the conservation status of poorly known taxonomic groups.

RESUMEN—La revisión de registros de museos y observaciones de campo mostró 4 registros nuevos de especies del cangrejo de río en Oklahoma (*Cambarellus puer, Orconectes deanae, O. lancifer* y *O. macrus*) y un nuevo registro de cuenca para *O. neglectus neglectus*. Estos registros suben el número total de cangrejos de río conocidos en Oklahoma a 28 y destacan la importancia de visitar nuevamente hábitats acuáticos en regiones que se han visitado previamente. Tales registros pueden ayudar en la determinación del estado de conservación de grupos taxonómicos poco conocidos.

Crayfishes are a diverse and important component of freshwater ecosystems. They occur natively on every continent but Africa and Antarctica and reach their highest diversity in the United States (Hobbs, 1988). Reviews of the crayfish fauna in the United States indicate that approximately 50% of its members are in need of some form of conservation attention (Master, 1990; Taylor et al., 1996). Up-to-date distribution information is required for accurate, rangewide conservation assessments. Towards this goal, we add to the faunal list for Oklahoma by documenting new records for several crayfishes. We also provide an updated species checklist for the state.

Over the past 70 years, the crustacean fauna of Oklahoma has received only periodic attention. Creaser and Ortenburger (1933) presented a species list, a dichotomous key, and distribution maps for specimens collected from 86 locations within the state. They listed 11 crayfish species from Oklahoma. *Cambarus setosus* was included only because of its occurrence in extreme southwestern Missouri. Reimer (1969) updated the taxonomy of the crayfish fauna for the state and provided additional records, a dichotomous key, and distribution maps. After confirming the presence of *Cambarus setosus* in Oklahoma and concluding that the occurrence of one species, *Cambarus immunis* (=*Orconectes immunis*), reported by Creaser and Ortenburger (1933) was erroneous, Reimer (1969) reported 19 species and subspecies from the state. A more recent compilation of taxa known from Oklahoma is within a checklist of American crayfishes (Hobbs, 1989). Hobbs (1989) discounted the presence of *Cambarus ludovicianus* and reported 23 species from the state. Hobbs (1993) described the cave dwelling *Cambarus subterraneus* from Oklahoma, increasing the state total to 24 species.

The steady increase in the recorded crayfish diversity of Oklahoma since Creaser and Ortenburger (1933) has been due primarily to taxonomic revisions and new species descriptions. We report below on the presence of 4 species previously unknown from Oklahoma waters and a significant within-state range expansion for a fifth species. The 4 species new to the state were discovered after examining museum holdings and recent collections made by Oklahoma Department of Environmental Quality (ODEQ) personnel and by conducting our own field sampling. These new records highlight the value of museum collections and the continued sampling of habitats in states that have been previously surveyed for various taxonomic groups of interest. The crayfish fauna of Oklahoma is still understudied, and we hope that readers will use our records and checklist as a starting point for future studies.

Since 1974, ODEQ has conducted an aquatic habitat monitoring program throughout the state. The program monitored approximately 100 sites. Most sites were sampled with standard minnow seines with the primary goal of recording fish community structure (Pigg and Gibbs, 1995). In addition to fishes, macroinvertebrates, such as unionid mussels, shrimps, crayfishes, and large insects also were collected from approximately 100 sites. Crayfishes collected from 1992 to 1996 were deposited in the Illinois Natural History Survey Crustacean Collection (INHS) and at the University of Oklahoma, now the Sam Noble Museum of Natural History (OMNH). Examination of these collections revealed the presence of 3 previously unrecorded species from the state and major range expansion of another species. The Crustacean Collection of the United States National Museum, Smithsonian Institution (USNM), also was searched for additional Oklahoma records. This search revealed 2 collections of a fourth species new to the state. In addition to museum records, we sampled at several sites in 2002 using standard minnow seines and hand collecting, which provided additional records for the species addressed below.

The above efforts have resulted in the discovery of records that bring the total number of crayfish species known from Oklahoma to 28 (Table 1). These new records and their accounts are detailed below. These accounts include county, museum acronym and catalog number, number of specimens (in parentheses), stream or lake name, receiving drainage (in parentheses), common locality, date of capture, and Universal Transverse Mercator (UTM) coordinates, if available. In addition, we provide notes on habitat and total global range for each species. We follow Hobbs (1989) in not recognizing *Cambarus ludovicianus* from the state.

TABLE 1—Checklist of crayfishes (Cambaridae) known from Oklahoma. Report of presence of taxa by previous authors indicated by "X". Equivalent taxonomic units used by Creaser and Ortenburger (1933) are indicated by parentheses; those used by Reimer (1969) indicated by brackets; those by Hobbs (1989) indicated by quotation marks.

Taxon	1933	1969	1989
Cambarellus Ortmann, 1905			
1. *C. puer*			
Cambarus Erichson, 1846			
2. *C. diogenes*	X	X	X
3. *C. setosus*	X[a]	X	X
4. *C. subterraneus*			
5. *C. tartarus*		X	
Fallicambarus Hobbs, 1969			
6. *F. fodiens* [=*Cambarus hedgpethi*] "=*F. hedgpethi*"		X	X
Faxonella Creaser, 1933			
7. *F. blairi*		X	X
8. *F. clypeata* (=*Cambarus clypeatus*)	X	X	
Orconectes Cope, 1872			
9. *O. causeyi*		X	X
10. *O. deanae*			
11. *O. difficilis* (=*Cambarus difficilis*)	X	X	X
12. *O. lancifer*			
13. *O. leptogonopodus* [=*O. l. leptogonopodus*]		X	X
14. *O. macrus*			
15. *O. meeki brevis*		X	X
16. *O. menae*		X	X
17. *O. nais* (=*Cambarus nais*)	X	X	X
18. *O. nana* [=*O. n. nana*]		X	X
19. *O. neglectus neglectus* (=*Cambarus neglectus*)	X	X	X
20. *O. palmeri longimanus* (=*Cambarus longimanus*)	X	X	X
21. *O. saxatilis*			X
22. *O. virilis*			X
Procambarus Ortmann, 1905			
23. *P. acutus acutus*	X	X	X
(=*Cambarus blandingi acutus*)			X
24. *P. clarkii*		X	X
25. *P. curdi*			X
26. *P. gracilis*	X	X	
(=*Cambarus gracilis*)			X
27. *P. simulans* (=*Cambarus simulans*) [=*P. s. simulans*]	X	X	
28. *P. tenuis*		X	X

[a] = extralimital.

NEW STATE RECORDS—*Cambarellus puer* Hobbs, 1945: McCurtain County—USNM 146080 (1), unnamed swamp (Little River, Red River drainage), on N side of Little River 7 mi S of Broken Bow on United States Highway 259, 24 March 1974; USNM 208833 (1), same location as USNM 146080, 22 April 1979.

Cambarellus puer is usually found in permanent, well vegetated, shallow, mud-bottomed swamps, sloughs, and lowland streams. Page (1985) also reported the species from temporary roadside ditches in Illinois. The species occurs in the western Gulf Coastal Plain from extreme southern Illinois to Louisiana and west to the lower Colorado River drainage of eastern Texas (Hobbs, 1989). *Cambarellus puer* was previously known to occur in the Little River drainage in adjacent southwestern Arkansas; hence, the records reported here do not represent a major range expansion for the species. Hobbs apparently was unaware of the cataloged USNM records for *C. puer* from Oklahoma when he published his checklist (Hobbs, 1989).

Orconectes deanae Reimer and Jester, 1975: Canadian County—INHS 8967 (2), North Canadian River (Canadian River drainage), just N El Reno, 10 October 1993, UTM Zone 14 594401E, 3935700N; Major County—INHS 8920 (1), North Canadian River (Canadian River drainage), 2 mi N Seiling, 1 July 2002, UTM Zone 14 507166E, 4004056N; Muskogee County—OMNH C-393 (1), Arkansas River (Mississippi River drainage), at Webbers Falls, 29 May 1997, UTM Zone 15 304982E, 3937162N; Okfuskee County—INHS 8966 (7), Alabama Creek (North Canadian River drainage), just W Weleetka, 21 July 1997, UTM Zone 14 759582E, 3913733N; Woodward County—INHS 6359 (8), North Canadian River (Canadian River drainage), at NE edge of Woodward, 24 May 1993, UTM Zone 14 465083E, 4033317N; INHS 6403 (5), same location as INHS 6359, 6 July 1993; OMNH C-359 (10), same location as INHS 6359, 14 September 1996; OMNH C-379 (3), same location as INHS 6359, 14 July 1997; OMNH C-383 (8), Fort Supply Lake (North Canadian River drainage), just S of Fort Supply, 9 June 1997, UTM Zone 14 448990E, 4042623N (middle of lake).

Orconectes deanae is known to occur in both lotic and lentic habitats. The type locality for the species is Conchas Lake, an approximately 4,050-ha reservoir built in 1939 on the Canadian River in northeastern New Mexico (Reimer and Jester, 1975). Reimer and Jester (1975) reported collecting the species from under rocks on substrates of gravel, sand, and bedrock in shallow shoreline areas of Conchas Lake. In Oklahoma, the species occurs in woody debris piles in sandy-bottomed runs of creeks and rivers and, as the Fort Supply Lake record indicates, in small reservoirs. Prior to the collection of the abovementioned specimens, the global range of *O. deanae* was thought to be limited to the Canadian River drainage in San Miguel and Quay counties, New Mexico (Bouchard, 1980; Hobbs, 1989). With such a narrow distribution, and the presence of an aggressive nonnative crayfish species in the range of *O. deanae* (Bouchard, 1980), Taylor et al. (1996) listed the species as endangered in their conservation status review of North American crayfishes. The 9 new Oklahoma records listed above expand the known range of *O. deanae* by approximately 840 km to the east. The species is now known to occur in both the Canadian and North Canadian river drainages, being distributed in the latter across almost its entire length in Oklahoma. As such, a reassessment of its conservation status seems warranted. The Arkansas River record from Webbers Falls, Muskogee County is located approximately 8 km upstream of the mouth of the Canadian River. Although future fieldwork in the Arkansas River drainage might result in additional records for the species, the absence of records in numerous collections made by ODEQ personnel and others in that drainage suggests that *O. deanae* is not widely distributed.

Orconectes lancifer (Hagen, 1870): McCurtain County—INHS 8968 (7), Waterfall Creek (Red River drainage), 10 mi S Idabel on United States Highway 259, 27 July 1994, UTM Zone 15 331032E, 3745443N.

Orconectes lancifer lives in deep, permanent waters of oxbows, bayous, and lowland streams over substrates of mud or mixed mud and sand (Page, 1985). Its distribution resembles that of *Cambarellus puer,* occurring in the western Gulf Coastal Plain from extreme southern Illinois to Louisiana and west to eastern Texas. *Orconectes lancifer* was previously reported from the Red River drainage in Red River County, Texas,

which borders McCurtain County, Oklahoma, and from the Red River drainage in southwestern Arkansas (Reimer, 1969). Given the abundance of oxbow lakes and lowland habitat along the Red River in southeastern Oklahoma, we consider it likely that *O. lancifer* will be found at additional sites in that region of the state.

Orconectes macrus Williams, 1952: Delaware County—INHS 6317 (5), Honey Creek (Neosho River drainage), 1 mi S Cave Spring Church 3.5 mi S Highway 25, 19 July 1996, UTM Zone 15 349401E, 4045936N; INHS 6355 (7), Honey Creek (Neosho River drainage), 7.5 mi SE Grove, 14 May 1993; OMNH C-347 (1), same location as INHS 6355, 25 April 1998; OMNH C-350 (2), same location as INHS 6355, 21 July 1998; INHS 6379 (14), Cave Springs Branch (Honey Creek, Neosho River drainage), at Oklahoma/Missouri state line, 20 July 1994, UTM Zone 15 355172E, 4045651N; OMNH C-397 (2), Spring Creek (Neosho River drainage) near Oaks, 17 May 1997, UTM Zone 15 333389E, 4004381N; OMNH C-415 (1), pond in floodplain of Beaty Creek (Neosho River drainage), 1.5 mi upstream of confluence with Spavinaw Creek, 28 June 2001, UTM Zone 15 342940E, 4026936N; Ottawa County—INHS 6372 (3), Sycamore Creek (Neosho River drainage), 2.5 mi SE Wyandotte on Highway 10, 19 July 1994, UTM Zone 15 349015E, 4070238N; INHS 6377 (4), Sycamore Creek (Neosho River drainage), 3.0 mi SE Wyandotte, 19 July 1994; INHS 8885 (12), same location as INHS 6377, 9 July 2002.

Orconectes macrus occurs in shallow, swift-flowing regions of clear, permanent streams with substrates of gravel and rock. The species is restricted to the Neosho River drainage (Arkansas River drainage) in the Ozark Highlands of the central United States. Pflieger (1996) reported the species to be common in the Neosho River drainage in southwestern Missouri, and its presence in northwestern Arkansas was originally documented by Williams (1954). Our records simply expand the known range of *O. macrus* into a larger portion of the Neosho River basin and confirm its presence in Oklahoma.

WITHIN-STATE RANGE EXPANSION—*Orconectes neglectus neglectus* (Faxon, 1885); Johnston County—INHS 4765 (3), Blue River (Red River drainage), 1 mi N Connerville at United States Highway 377, 3 June 1993, UTM Zone 14 717255E, 3814815N; INHS 5536 (4), same location as INHS 4765, 8 October 1996; INHS 6324 (33), Blue River just W Connerville, 3 August 1995; OMNH C-416 (1), Cummin's Spring (Blue River drainage), 0.5 mi N Connerville, 5 July 2001; OMNH C-417 (1), unnamed spring (Blue River drainage), 0.75 mi N Connerville, 25 September 2001.

Orconectes neglectus neglectus is usually found in clear, permanent lotic habitats ranging in size from small creeks to large rivers with firm, rocky substrates. In those habitats, it most frequently occurs in shallow riffles and pools. As noted above, the species also was collected in clear groundwater springs. Prior to the discovery of the above records, the species natively ranged from the Ozark Highlands in northeastern Oklahoma, northwestern Arkansas, and southwestern Missouri (Arkansas and White river drainages) to tributaries of the Kansas River drainage in Kansas, Nebraska, and eastern Colorado (Reimer, 1969; Hobbs, 1989). Our data represent the first known records for the species from the Red River drainage and expand its known range in Oklahoma by approximately 190 km to the southwest. The possibility exists that the Blue River records reported above might represent an introduced population. Most likely due to its use as fishing bait, *O. n. neglectus* has been introduced into drainages on both coasts of the United States. A population of the species has been established in the Rogue River drainage of western Oregon since at least the late 1970s (Bouchard, 1978), and a relatively new population has been discovered in the Hudson River drainage of eastern New York (Daniels, 2001). Although it is sometimes difficult to determine whether or not a population is native, the lack of museum records for *O. n. neglectus* from other parts of the Red River drainage and the disjunct nature of the Blue River population lends additional support to its classification as nonnative. If historical records from other portions of the Red River drainage become available, this contention could be challenged. Additional surveys in this region of Oklahoma should be conducted to determine if other populations occur.

With 28 confirmed species (Table 1), the crayfish diversity of Oklahoma is surpassed

only by Texas in the western United States. This relatively large number of native species is due to the diversity of aquatic habitats found within the state and the presence of the western edges of the Ozark and Ouachita highlands in eastern Oklahoma. Within the United States, the Ozark and Ouachita highlands are regions of extremely high native biodiversity. Crayfishes reflect this biogeographic pattern; the 2 regions contain approximately 55 species, of which 36 are endemic. Taylor et al. (1996) highlighted the depauperate state of biogeographical literature for North American crayfish and emphasized the need for current distributional and biological data. The above results provide new distributional information for 5 species and demonstrate that there is still much to gain from future faunal surveys and field observations of crayfishes in areas that have been previously sampled.

The majority of records reported in this paper are the result of the field efforts of the late Jimmie Pigg (1930–1999), a Senior Environmental Specialist with the Oklahoma Department of Environmental Quality. Mr. Pigg dedicated his life to monitoring and documenting the aquatic fauna of Oklahoma and to the science and conservation education of Oklahoma youth. His efforts have greatly increased our knowledge of the natural resources of Oklahoma. We thank B. Molano-Flores for assisting with the Spanish translation of the resumen. Partial funding was provided by the Oklahoma Biological Survey, Oklahoma Department of Wildlife Conservation, and Oklahoma Water Resources Research Institute grants to EAB.

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