

The Distribution of Crayfishes (Decapoda: Cambaridae) of the Licking River Watershed, Eastcentral Ohio: 1972–1977¹

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ABSTRACT. Between 1972 and 1977, five species of crayfishes inhabited the Licking River watershed. Those found throughout the system, in order of their abundance, were *Orconectes (Crockerinus) sanbornii sanbornii*, *Cambarus (Puncticambarus) robustus*, and *O. (Procericambarus) rusticus*. The first two species were captured at 88% and 49% of the sites, respectively. *Cambarus (Cambarus) bartonii cavatus* and *C. (Lacunicambarus) diogenes* were found in first order headwater streams, springs, and roadside ditches containing water. *Orconectes (P.) rusticus* has been introduced into the watershed and appears to be increasing its range within the basin. Since the primary survey, two additional introduced crayfish species were found at the Hebron State Fish Hatchery: *O. (Gremicambarus) virilis*, and *O. (G.) immunitis*.

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INTRODUCTION

Few studies are available on the entire crayfish fauna inhabiting watersheds in Ohio. Rhoades (1941) presented data on the distribution of *O. (Rhoadesius) sloanii* in the Great and Little Miami River drainages. Other species present in this watershed were not mentioned. The distribution of *O. (Procericambarus) rusticus* and *O. (Crockerinus) s. sanbornii* in the lower Scioto River and Ohio Brush Creek basins was described by Rhoades (1962). Flynn and Hobbs (1984) elaborated upon the distribution of these two species in Ohio Brush Creek. Stillwell (1965) did a complete survey of Africa Run, a tributary of Alum Creek, the Scioto River drainage in Delaware County, OH; she recorded five species. The crayfish fauna of the upper Auglaize and St. Marys rivers in Auglaize County was studied by Clark and Rhoades (1979) in 1941–1943. They recorded the distribution of seven species. St. John (1982) studied two headwater streams, one in the Great Miami and the other in the Little Miami River basin, and presented data on five species. The most thoroughly evaluated Ohio watershed is that of the Chagrin River. Jezerinac (1982) sampled 129 localities and plotted the distribution of seven species.

The purpose of the present study was to determine what crayfish species were present in the Licking River and their distributions so that the data can be used to monitor crayfish distributional changes in the future.

STUDY AREA

The Licking River watershed drains approximately 2031 km² in Fairfield, Knox, Licking, Morrow, Muskingum, and Perry counties in eastcentral Ohio. The main stream heads in the extreme southwest corner of Morrow County (South Bloomfield Township) at an elevation of 401 m. Its confluence with the Muskingum River is in the city of Zanesville at an elevation of 210 m.

The average gradient of the main stream is 1.8 m/km. Other tributaries of the river have gradients as low as 0.3 m/km (Goose Run) or as high as 17.8 m/km (Dog Hollow Run). The average gradient of the 56 named

tributaries, however, is 7.8 m/km (State of Ohio 1960).

Considerable literature is available describing the watershed. Two State publications (State of Ohio 1979, 1984) present general hydrological, demographic, socio-economic, and water quality data. Stout et al. (1943) described the complex geological history of the river. Franklin (1961) presented data on the bedrock geology of the basin whereas Forsyth (1976) described the glacial deposits. Gordon (1969) described the natural woody vegetation, and Trautman (1940) discussed the natural history and environmental changes that have occurred in the region, especially the Buckeye Lake area.

MATERIALS AND METHODS

Crayfishes were collected from the Licking River basin during May through September from 1972 through 1977. Specimens were captured using a 6.2 m x 1.2 m x 0.9 cm mesh bag seine, a 1.2 m x 1.9 m x 0.9 cm mesh minnow seine, or by hand, and preserved in 70% ethanol. All specimens and the field notes for each collection have been catalogued and deposited in The Ohio State University Museum of Zoology, Columbus, OH.

A total of 242 sites were investigated and crayfish were captured at 235 sites. Four thousand thirty-six specimens were collected and identified using the taxonomic keys of Hobbs (1972); the nomenclature of Hobbs (1989) was followed.

RESULTS

Five species of crayfishes were found during the 1972–1977 survey and their distribution in the Licking River watershed was recorded (Figs. 1, 2). *Orconectes (C.) sanbornii sanbornii* was found at 214 sites (88% of the sites; 2,965 specimens), *Cambarus (Puncticambarus) robustus* at 119 sites (49%; 475 specimens), *C. (Cambarus) bartonii cavatus* at 49 sites (20%; 147 specimens), *O. (P.) rusticus* at 47 sites (19%; 424 specimens), and *C. (Lacunicambarus) diogenes* at 10 sites (4%; 25 specimens).

DISCUSSION

Orconectes (C.) s. sanbornii was first recorded from the Licking River drainage (3 localities) in 1920 by the Ohio

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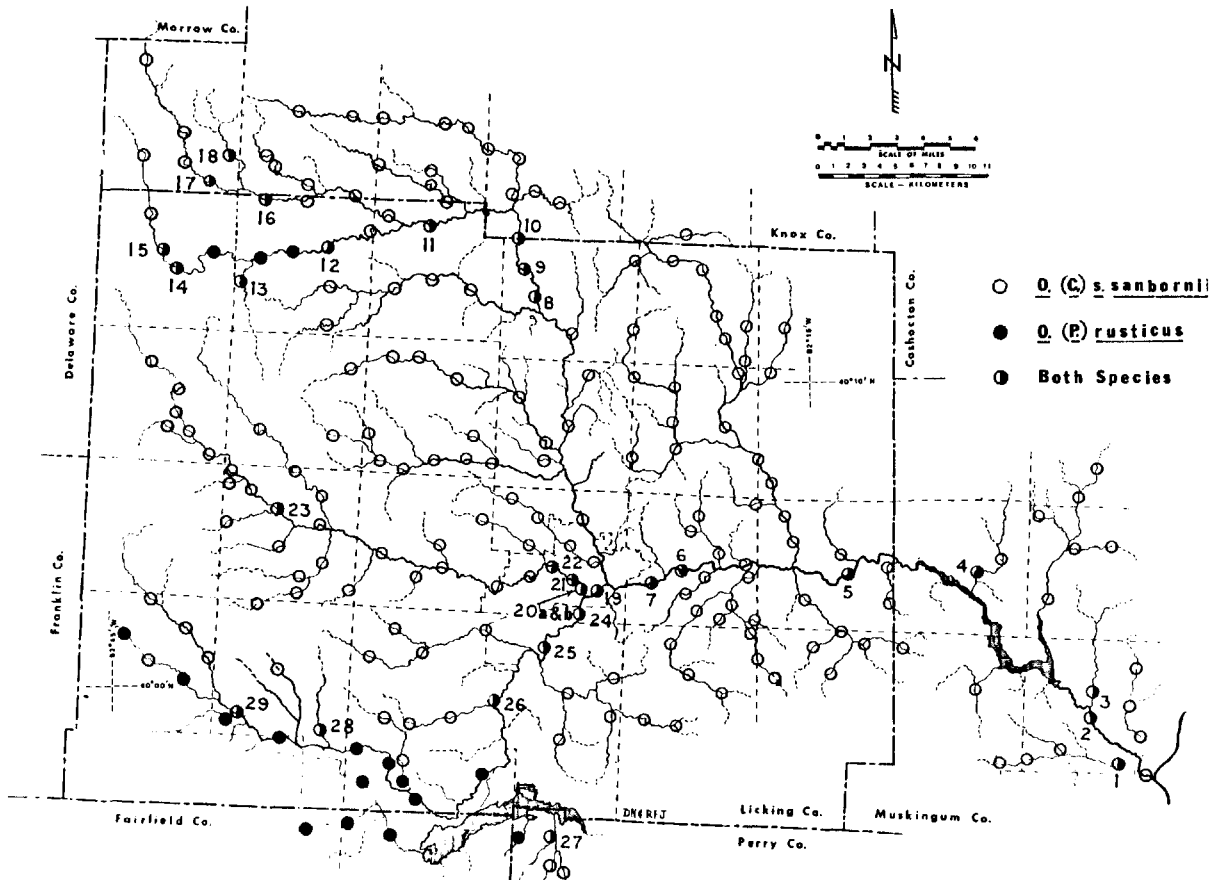


FIGURE 1. Sites in the Licking River watershed where *O. (C.) s. sanbornii* and *O. (P.) rusticus* were collected.

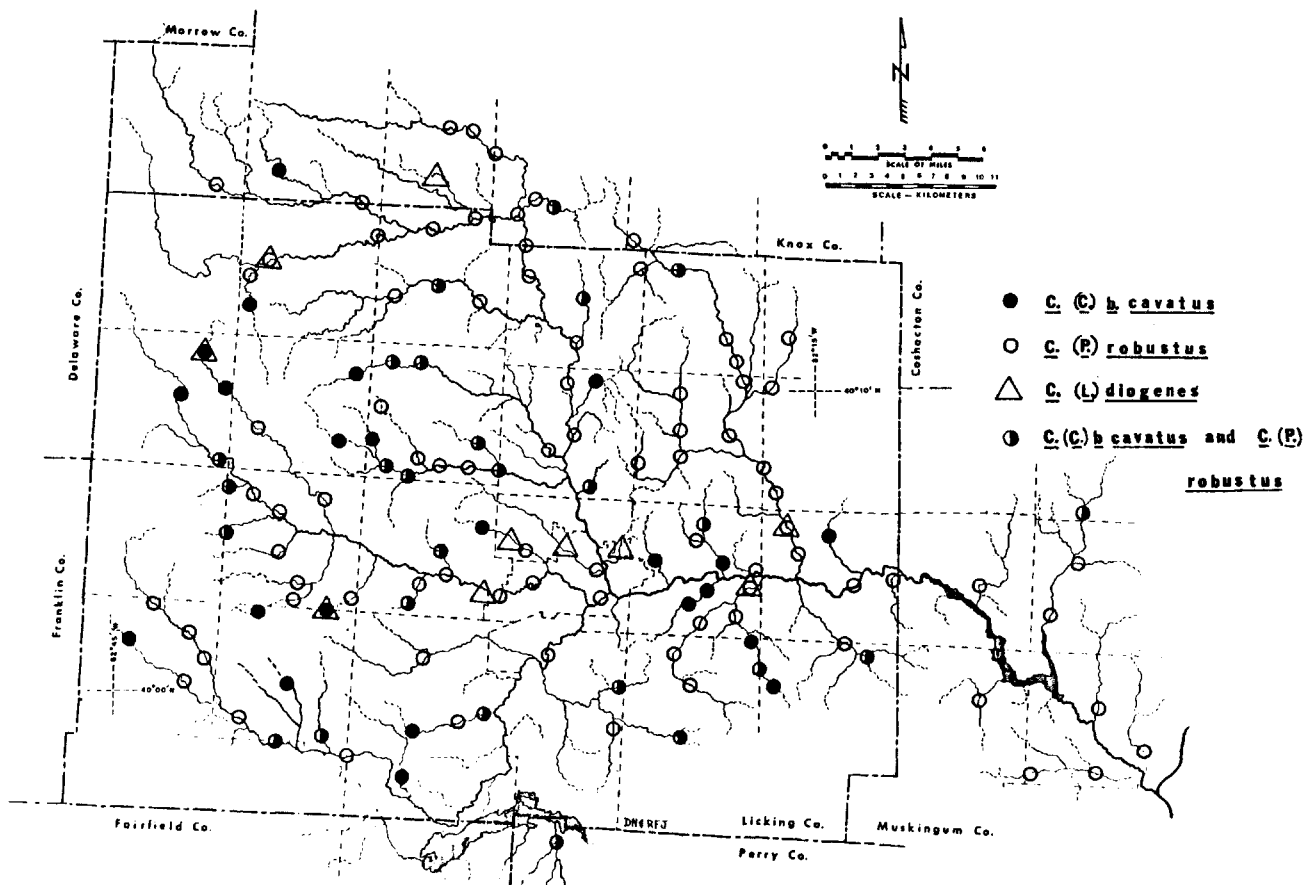


FIGURE 2. Sites in the Licking River watershed where *C. (C.) b. cavatus*, *C. (P.) robustus*, and *C. (L.) diogenes* were collected.

(Fish) Survey Party (Turner 1926). During the present survey, this species was the most widely distributed and numerically abundant crayfish in the river basin. *Orconectes (C.) s. sanbornii* is being replaced in a section of the North Fork and in most of the South Fork by the introduced species *O. (P.) rusticus*.

Orconectes (P.) rusticus was first recorded in the watershed by Butler and Stein (1985) who received their information on the presence of the species in the watershed from Jezerinac (unpublished) in 1982. Since the species' natural range is to the west of the Licking River basin (Turner 1926, Hobbs 1989), its presence in the watershed is thought to be from one or more introductions, probably from bait buckets. The species distribution in the Licking River suggests that it has been introduced in at least three locations: the North Fork, downstream from the town of Hartford; the Otter Fork, downstream from the town of Centerburg; and the South Fork, perhaps coming from Buckeye Lake or downstream from the town of Pataskala. *Orconectes (P.) rusticus* has completely replaced the native crayfish, *O. (C.) s. sanbornii*, at 14 localities in the South Fork and at three localities in the North

Fork. Both species occurred sympatrically at 30 sites (Table 1).

From April through November of 1981-1982, Butler and Stein (1985) studied populations of *O. (C.) s. sanbornii* and *O. (P.) rusticus* that were sympatric and allopatric in the North Fork of the Licking River. They concluded that *O. (P.) rusticus*:

"probably maintains greater population growth than *O. sanbornii*[sic], because (1) more gravid *O. rusticus* females occurred in sympatry, (2) *O. rusticus* produced more young than *O. sanbornii*, and (3) *O. rusticus* young grew faster. Reproductive interference, acting synergistically with differences in aggressive dominance and young-of-year susceptibility to predation, appears to serve as the major mechanism regulating replacement of *O. sanbornii* by *O. rusticus* in Ohio streams."

The introduction of *O. (P.) rusticus* into eastern Ohio streams, with the replacement of the native crayfish species, illustrates the need for base line data on the

TABLE 1

Numbers of *O. (C.) s. sanbornii* and *O. (P.) rusticus* captured at sympatric sites in the Licking River drainage.

Site	(Collection Number)	<i>O. (C.) s. sanbornii</i>			<i>O. (P.) rusticus</i>			Location
		I	II	F	I	II	F	
1	(77-49)	1	2	4	1	3	4	Timber Run
2	(77-83)	1			2	2	2	Licking R.
3	(77-57)	8	7	12	1	2	2	Barletts Run
4	(77-37)	3		2	1		2	Poverty Run
5	(77-6)		1	1			1	Licking R.
6	(77-5)		6	5		2	2	Licking R.
7	(77-78)	1		1			4	Licking R.
8	(74-40)	6	1	8			1	North Fk.
9	(74-41)	6	1	6			1	North Fk.
10	(73-10)	3	5	10		2	2	North Fk.
11	(73-11)	5	7	16		1	2	North Fk.
12	(73-14)	1		1		3	7	Otter Fk.
13	(74-53)	4	4	14		1	2	Bowls Fk.
14	(73-22)	2			2	4	10	Otter Fk.
15	(73-23)	8	3	4	1	1	1	Otter Fk.
16	(73-18)	8		3	7		5	North Fk.
17	(73-19)	6		7	2		1	North Fk.
18	(74-27)		11	7			1	Ford Cr.
19	(77-77)	1	2	5	4			South Fk.
20a	(72-10)*	9	1	11	1		2	Raccoon Cr.
20b	(72-11)	11	1	19		1	3	Raccoon Cr.
21	(72-12)	1	7	9		1	2	Raccoon Cr.
22	(72-8)	9		3	2	1	1	Raccoon Cr.
23	(72-13)	2	7	7		1		Raccoon Cr.
24	(77-76)	3	6	16			2	South Fk.
25	(76-35)	2	4	6	3	3	4	South Fk.
26	(75-26)	1	2	1	2	2	6	Raccoon Cr.
27	(76-29)			2			4	Honey Cr.
28	(76-10)		6	2		4		Unn. Trib. — S. Fk.
29	(76-32)	1	10	12	1	4	7	South Fk.

I = First form males; II = Second form males; F = Females; Cr. = Creek; Fk. = Fork; R. = River; Unn. Trib. = Unnamed Tributary; * = Collections 72-10 and 72-11 were so close together that only one dot on the map represents both.

distributions of crayfishes, and other aquatic animals, in all Ohio watersheds. To complicate matters in the Licking River watershed, *O. (G.) virilis* and *O. (G.) immunis* were collected at the Hebron State Fish Hatchery on 9 September 1990. Have these two species gained access to the South Fork of the Licking River and, if so, what has been their impact on *O. (C.) s. sanbornii* and *O. (P.) rusticus* populations and distributions?

The second most widely distributed species in the watershed was *C. (P.) robustus*. This species has a preference for larger (>2 m wide), fast flowing streams with substrates of bedrock, gravel, and sand where it excavates shallow burrows under large, flat, rocks. The species was not abundant along the northwestern edge of the watershed where the streams are small and head on the rather level Wisconsin Till Plain (Fenneman 1938, Forsyth 1966). Turner (1926) recorded a collection of *C. (P.) robustus* on his distribution map at one site in Rocky Fork in the vicinity of the town of Purity but does not identify the locality in his list of Ohio records.

Cambarus (C.) b. cavatus and *C. (L.) diogenes* are probably more numerous than the present records indicate because their preferred habitats were undersampled. Both species are found in first order headwater streams, springs, and roadside ditches with water. In these latter habitats, both species will burrow extensively. Turner (1926) sites one locality record on his distribution map for *C. bartoni* [sic] [= *C. (C.) b. cavatus*] in the North Fork of the Licking River in the vicinity of the town of Vanatta. He does not, however, identify the site in his list of Ohio records. Rhoades (1944) also listed the species (calling it *C. b. bartoni* [sic]) for Licking County. It was assumed by Rhoades (1944) and Thoma and Jezerinac (1982) that *C. diogenes* occurred in the Licking River drainage, and this study documents its presence.

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