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## Amphipods (exclusive of Pontoporeiidae) of Southeastern Wisconsin

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*Abstract:* Eight species of amphipods in the families Crangonyctidae (five species), Gammaridae (two species) and Hyalellidae (one species) are recorded here from a 21 county area in southeastern Wisconsin. Excluded from this survey were members of the family Pontoporeiidae, deepwater species previously collected in this region only from Lake Michigan and Green Lake (Juday and Birge 1927). In the species treatments we combine data from our fieldwork with information given in Bousfield (1958), Holsinger (1972), and other literature as cited.

### Introduction

Amphipods are among the most widely distributed aquatic crustaceans of our region. Most running water and still water habitats contain one or more species of these small scavengers, whose mature length seldom exceeds 15 mm. No carapace covers the laterally compressed segments of an amphipod's thorax and abdomen. Distinguishing features of genera are shown in Figure 1. Within this basic body plan are variations which reflect the life style of the species. Strong swimmers have powerfully developed appendages. The weaker swimmers or species that move chiefly by crawling have those appendages significantly reduced.

There are a number of reasons why amphipods have not become better known. The group has long been regarded as "taxonomically difficult" (Bousfield 1958). Except for one or two instances, the identification of species presents a series of difficulties. These range from the surgical skill needed to dissect appendages of these very small animals to confusion in the literature over what characteristics define a number of the species. In addition, only a few

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experts are currently working on clearing up this confusion by a careful process of reevaluating past records, encouraging new collecting, and seeking to revise the taxonomy of these genera. Each time one such study is done, the picture of our fauna is substantially changed. Thus, at this time, it is not possible for the nonspecialist to collect the amphipods of nearby freshwater habitats and use readily available references to identify those collections.

In our study, we were fortunate to have Dr. John Holsinger of Old Dominion University, the U.S. expert on these species, provide determinations for us. The five crangonyctids, the majority of amphipod species in our report, were the subject of a special 1994 project in which we focused our collecting efforts on this family. Our species treatments below reflect this collection focus, with the crangonyctid records being more detailed and revealing new distribution information; for the other three species we merely add our county records to information from the literature. These references were also our sources for life history and morphological data. We show county maps to summarize the distribution data.

With so little known about southeastern Wisconsin amphipods, it is difficult to evaluate the impact of potential habitat destruction and water pollutants on the fauna. Our hope is that, by presenting the information that is known to a wider audience, this report will encourage others to fill the gaps in our knowledge of these crustaceans which inhabit so many freshwater habitats in our region.

### Collection and Habitat Summary

Figures 2 and 3 and Table 1 summarize our southeastern Wisconsin county collection records. Eight species from three families, representatives from the four genera in Figure 1, were found. These amphipod species may be divided into two groups based on their habitat preferences, those occurring in warm, turbid waters and those preferring cool, clear water habitats (Bousfield 1958). *Crangonyx pseudogracilis*, *Crangonyx richmondensis*, *Gammarus fasciatus*, and *Hyalella azteca* belong to the first group while *Crangonyx gracilis*, *Crangonyx minor*, *Gammarus pseudolimnaeus*, and *Stygobromus putealis* belong to the second. However, a number of these amphipods display habitat tolerances which are a good deal more broad than is implied by this categorization. The broad tolerances of some species are shown in Table 2 which present species associations determined from our data and the literature.

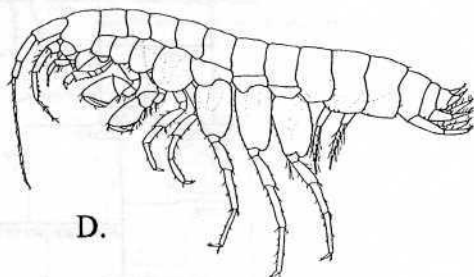
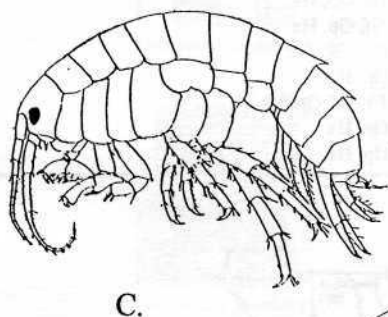
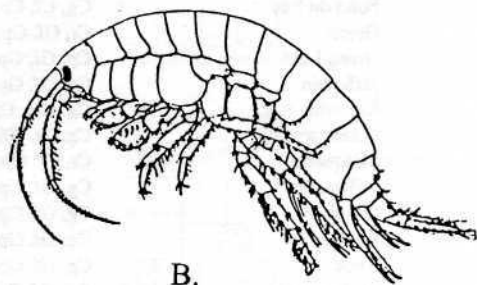
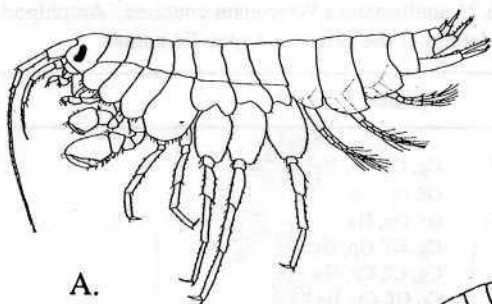


Figure 1. Distinguishing features of four amphipod genera illustrated by one representative of each genus (not drawn to scale).

- A. *Crangonyx* - smooth spine-free dorsal surface
- B. *Gammarus* - strong dorsal spines on posteriormost segments
- C. *Hyalella* - pointed extensions of posterior dorsal segments
- D. *Stygobromus* - eyeless and dorsal surface smooth

Table 1. Records of amphipods in 21 southeastern Wisconsin counties. Amphipod species are designated by the first letters of the genus and specific names.

County	Species
Calumet	Cg, Cf, Gp, Ha
Columbia	Gf, Gp, Ha
Dane	Gf, Gp, Ha
Dodge	Cg, Gf, Gp, Ha, Sp
Fond du Lac	Cg, Cf, Cp, Ha, Sp
Green	Cr, Gf, Gp, Ha
Green Lake	Cp, Gf, Gp, Ha, Sp
Jefferson	Cg, Gf, Gp, Ha
Kenosha	Cg, Cm, Cp, Gp, Ha
Manitowoc	Cg, Cr, Gf, Gp, Ha
Marquette	Cr, Gf, Gp, Ha
Milwaukee	Cg, Gf, Gp, Ha
Ozaukee	Cg, Gf, Gp, Ha
Racine	Cg, Gf, Gp, Ha
Rock	Cp, Gf, Gp, Ha
Sheboygan	Cg, Gf, Gp, Ha
Walworth	Gf, Gp, Ha
Washington	Gf, Gp, Ha
Waukesha	Cg, Cr, Gf, Gp, Ha
Waushara	Gf, Gp, Ha
Winnebago	Gf, Gp, Ha

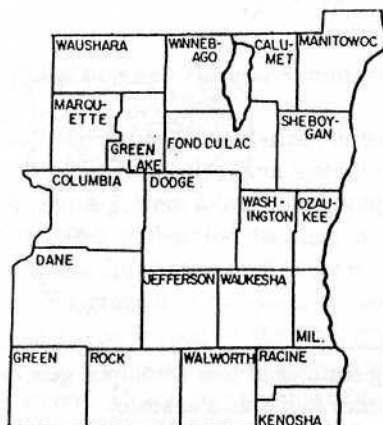
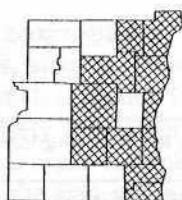


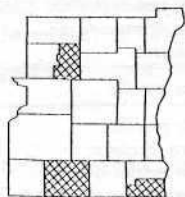
Figure 2. Locations of 21 southeastern Wisconsin counties in which amphipod collections were made for this study.



*Crangonyx gracilis*



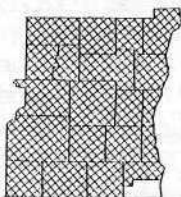
*Crangonyx minor*



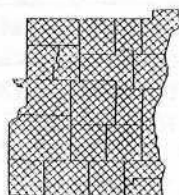
*Crangonyx pseudogracilis*



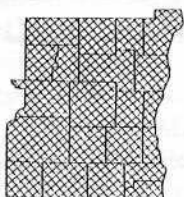
*Crangonyx richmondensis*



*Gammarus fasciatus*



*Gammarus pseudolimnaeus*



*Hyaella azteca*



*Stygobromus putealis*

Figure 3. Counties in which collections of eight amphipod species have been recorded.

Table 2. Associations among eight species of amphipods, found occurring together in our study or reported to occur together in the literature.

AMPHIPOD OCCURRING	SPECIES FOUND IN ASSOCIATION
<i>Crangonyx gracilis</i>	<i>Crangonyx minor</i> <i>Crangonyx pseudogracilis</i> <i>Crangonyx richmondensis</i> <i>Hyaella azteca</i>
<i>Crangonyx minor</i>	<i>Crangonyx gracilis</i>
<i>Crangonyx pseudogracilis</i>	<i>Crangonyx gracilis</i> <i>Gammarus fasciatus</i> <i>Gammarus pseudolimnaeus</i> <i>Hyaella azteca</i>
<i>Crangonyx richmondensis</i>	<i>Crangonyx gracilis</i> <i>Hyaella azteca</i>
<i>Gammarus fasciatus</i>	<i>Crangonyx pseudogracilis</i> <i>Gammarus pseudolimnaeus</i>
<i>Gammarus pseudolimnaeus</i>	<i>Crangonyx pseudogracilis</i> <i>Gammarus fasciatus</i> <i>Hyaella azteca</i>
<i>Hyaella azteca</i>	<i>Crangonyx gracilis</i> <i>Crangonyx pseudogracilis</i> <i>Crangonyx richmondensis</i> <i>Gammarus pseudolimnaeus</i>
<i>Stygobromus putealis</i>	NONE

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## Species Recorded

### *Crangonyx gracilis*, Crangonyctidae

Habitat and zoogeography: *Crangonyx gracilis* is reported from permanent ponds, pools, streams, swamps, and bog ponds and outflows, as well as temporary ponds (Kaestner 1970). The range limits of this species are still not known precisely (Holsinger 1972). On 3 June 1979 this species and *C. richmondensis* were collected at a Waukesha County marsh (T05N R17E Section 30), the first specimens of the genus *Crangonyx* from southeastern Wisconsin in our Milwaukee Public Museum (MPM) collections. On 12 May 1989 *C. gracilis* specimens were collected in a dipnet sample from the eastern edge of the University of Wisconsin-Milwaukee (UW-M) Field Station's Sapa Bog. Subsequently *C. gracilis* has been our most frequently collected member of the genus.

Data from 1994 *C. gracilis* sites (5 lentic, 9 lotic) follow:

1) Kenosha County, marsh north of jct Hwy F & JI, T01NR19E Section 13 SW, 6 May; 2) Kenosha County, pool south of Wheatland, Hwy W just north of jct Hwy 50, T01N R19E Section 01 NW, 6 May; 3) Kenosha County, Unnamed stream at Hwy AH, 2.2 miles east of jct Hwy 83, T01N R21E Section 07 SW, 6 May; 4) Racine County, grassy pool, north side 7 Mile Rd, just west of Root River Canal bridge, T04NR21E Section 3 SW, 13 May; 5) Racine County, pond at Hwy G & Waukesha Co. line, T04NR20E Section 03 NW, 13 May; 6) Racine County, Goose Lake Branch on Olson Road, 0.5mi E. of Hwy S south, T04NR20E Section 22 NE, 13 May; 7) Racine County, Root River at 7 Mile Road, just west of Hwy I94, T04NR21E Section 01 SE, 13 May; 8) Waukesha County, Bark River, near Dousman at Hwy 18 bridge, T07NR17E Section 34 SE, 3 June; 9) Ozaukee County, Sapa Spruce Bog, west of Saukville, T11N R21E Section 30 NE, 15 July; 10) Dodge County, Reeseville, pool of stream into Beaver Dam River tributary, T10N R14E Section 28 NE, 22 July; 11) Sheboygan County, Sheboygan River at Hwy M, <1 mile south of jct Hwy J, T15N R22E Section 07 SE, 5 August; 12) Manitowoc County, Mud Creek at Hwy J, 1.8 mile south of Valders, T18NR22E Section 18 NW, 9 September; 13) Milwaukee County, Menomonee River, just west of 70 St. bridge, T07N R21E Section 27 NW, 16 September; 14) Calumet County, W. branch Plum Creek at Hwy KK, T20N R20E Section 06 NW, 23 September. Water temperatures at these sites ranged from 10 to 22°C, the average being 15°C. The Kenosha County sample from an unnamed stream at Hwy AH contained *C. minor* with *C. gracilis*.

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Life history: Johansen (1920) reported that there seemed to be at least two broods each summer, one in May, the other in July. We collected mature males, females, and females with eggs in May, which would correspond to his earliest breeding period. He also hypothesized that there was probably a later brood in September. On 29 September 1989 we collected a female with young in Kenosha County from the Fox River near New Munster at Highway 50/83, confirming this hypothesis. According to Holsinger (1972) further specifics of the life cycle are unknown. Our earliest collection date: 31 March; the latest date: 29 September.

Mature length: Males, 4.5-6.5 mm; females, 6.0-10.5 mm.

*Crangonyx minor*, Crangonyctidae

Habitat and zoogeography: Bousfield described this as a new species in 1958, recording it from hard-water streams, ditches, drains, and sloughs. Our specimens were collected from an unnamed Kenosha County stream on Hwy AH, 2.2 miles east of its junction with Highway 83 (T01NR21E Section 07 SW), water temperature 11°C. This represents the only non-Canadian record, according to J.Holsinger, personal communication.

Life history: Bousfield (1958) found egg-bearing females from April to June; further life history data are unknown (Holsinger 1972). Our Wisconsin lot of two females was collected 6 May 1994.

Mature length: Males, 5.0-8.5 mm; females, 8.5-12.5 mm.

*Crangonyx pseudogracilis*, Crangonyctidae

Habitat and zoogeography: Widely distributed in the U.S. and southern Canada, this species was recorded by Bousfield (1958) from rivers, river mouths, lakes, sloughs, quarry ponds, and dams. He collected it from the mouth of Fish Creek near Ashland, Wisconsin. Our three samples are the first records from the southeastern part of the state: 1) Kenosha County, Fox River, park on Hwy F just west of town of Silver Lake, T01NR20E Section 18 SE, water temperature 12°C (8 specimens); 2) Rock County, small tributary of the Rock River at Gibbes Lake Road near Fulton, T04NR12E Section 30 NW, water temperature 16°C (1 specimen); 3) Green Lake County, marsh on east side of Highway 49,

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just south of Berlin, T17N R13E Section 10 SW, water temperature 18°C (4 specimens). Average water temperature: 15°C.

Life history: Adults breed in spring and throughout the summer; life span unknown (Bousfield 1958). Our Wisconsin samples were collected on 6 May, 10 June and 19 August; only the May sample included females with eggs.

Mature length: Males, 4.5-9.0 mm; females, 7.5-10.5 mm.

*Crangonyx richmondensis*, Crangonyctidae

Habitat and zoogeography: Prior to our studies, *Crangonyx richmondensis* had been recorded only as far west as central Michigan. The MPM collection contains specimens from Waukesha County, collected in 1979. A field trip to that locality on 23 June 1989 confirmed this species' occurrence there.

In 1994 we collected this species twice: 1) Marquette County, large pond at Hwy E & Y south, T17N R10E Section 30 SW, water temperature 24°C on 23 August (15 females); 2) Manitowoc County, pond at Marken Road, 0.2 miles south of Hwy C, T18N R22E Section 29 NE, water temperature 17°C on 09 September (30 specimens). Average water temperature: 21°C.

Life history: Females with eggs may be found from January to June, after which only immature specimens occur throughout summer and fall; life span is about one year (Holsinger 1972). Our Wisconsin collections yielded specimens mature enough to bear species-identifying characteristics from 3 June through 29 September.

Mature length: Males, 9.0-11.0 mm; females, 14.0-18.0 mm.

*Gammarus fasciatus*, Gammaridae

Habitat and zoogeography: The characteristic habitats of this species include lakes and large rivers that are slow-flowing, relatively turbid, and warm in summer. The range of *Gammarus fasciatus* cuts a broad swath through central and eastern Wisconsin. Here, within the distance of approximately 200 miles, we have both a western (mid Crawford County) and an eastern (western Racine County) border of the range of this amphipod that also occurs in southeastern Canada and along the U.S. East Coast to southern North Carolina. While Bundy

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(1882) states that he never failed to find this species, we have not been able to collect any specimens during our recent southeastern Wisconsin fieldwork. Although in this work we report records from the literature, early confusion in separating this species from the extremely common *G. pseudolimnaeus* (see below) indicates that these older records for *G. fasciatus* may not be reliable.

Life history: Females with eggs are found from May through September; two generations per year, life cycle of less than one year.

Mature length: Males, 13.0-14.0 mm; females, 8.0-12.0 mm.

*Gammarus pseudolimnaeus*, Gammaridae

Habitat and zoogeography: This species characteristically lives in larger rivers and lakes, moving into tributary streams and springs that are cool in summer in order to breed. *Gammarus pseudolimnaeus* is the most commonly occurring species of its genus throughout its Wisconsin range, which excludes only the northwestern quarter of the state (Holsinger 1972). Temperature data from a small series of southeastern Wisconsin Department of Natural Resources samples deposited in the MPM collection are: the low 11°C, the high 18°C, the average 15°C.

Life history: Females with eggs are found from April through July; life span is approximately 16 months.

Mature length: Males, 14.0-17.0 mm; females, 6.0-14.0 mm.

*Hyalella azteca*, Hyalellidae

Habitat and zoogeography: The habitat of this species may be defined broadly as any permanent fresh water that reaches a monthly mean temperature of more than 10°C. *Hyalella azteca* is distributed throughout North America and is the most common amphipod in southeastern Wisconsin. Specimens from the UWM Field Station in the MPM collection include samples dipnetted from a man-made pond at C5E-C6W on the Field Station grid system, as well as from Mud Lake, on 14 June 1978 as part of a survey of Field Station invertebrates conducted that year. This species, collected from 70% of our 1994 study sites, was found at temperatures ranging from 2°C to 29°C, with an average of 19°C.

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Life history: Females with eggs are found throughout the spring and summer months; life cycle approximately annual.

Mature length: Males, 2.3-3.3 mm; females, 3.0-5.3 mm.

*Stygobromus putealis*, Crangonyctidae

Habitat and zoogeography: *Stygobromus putealis* was originally discovered and described by Holmes (1909). It is an eyeless, unpigmented amphipod that lives permanently in subterranean groundwater, brought to the surface only when that source is tapped by wells. It has a remarkably restricted distribution; the world range of this species is the Wisconsin counties of Dodge, Fond du Lac, and Green Lake. Hubricht (1943) contains the only collecting records in the literature other than those of Holmes.

In 1986 the Wisconsin Department of Natural Resources' Natural Heritage Inventory and Dr. John Holsinger requested that an attempt be made to re-document this species' existence. A collecting site was found after the *Waupun Leader News* ran a front page request for information. From a 148-foot well drilled in "blue rock," which was pumped by an electric motor and used to fill stock tanks, a total of 13 specimens was retrieved from a Fond du Lac County farm. The specimens were gathered at three different times:

1) 2 July 1986, 2) 16 July 1986 early A.M. and, 3) one final specimen between 10:30-11:30 A.M. on the 16th. Batches 1 and 2 were kept alive by being refrigerated until they were turned over to the Milwaukee Public Museum. The pumped well water had a temperature of 10°C. The specimens were loaned to Dr. John Holsinger of Old Dominion University who is preparing a taxonomic revision of the genus.

A 1994 collection of *Stygobromus putealis* was made on 20 May. Although the motor on the electric pump had been broken for over a year, it was able to be operated by hand. Two specimens appeared in a collecting sieve (U.S. Standard mesh 18) after about a half hour of pumping and were transferred to a thermos. Another half hour of pumping yielded only one additional animal. The specimens were preserved in 70% ethanol. Their length, from base of first antennae to base of telson, averaged 3.5 mm. They were shipped to Dr. Holsinger who determined that there were two males and one female.

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It is not known what food is used by subterranean groundwater dwellers such as *Stygobromus putealis*. In the ecologically similar habitat of caves, the few bacteria living there that can manufacture food in the absence of light are not thought to be significant contributors to the food supply. However, there was orange-brown matter in the mouthparts of the living specimens observed and photographed under the microscope on 20 May 1994. The orange-brown "iron" particles, which the owners indicated was typical of their well water, did not produce the distinctive odor usually associated with iron bacteria.

All our data on this unique species have been forwarded to Dr. Holsinger as well as included in a 1994 final report to the Lois Almon Small Grants Program. The area of this single collection site may be impacted by the relocation of Highways 26/151 by the Wisconsin Department of Transportation. The information gathering phase for this project is to last until 1996, after which it will be decided whether the new route is to go through or around the site. Highway construction is scheduled for 1998.

Life history: Unknown. Dates collected: 20 May [1994], 2 July [1986], and 16 July [1986].

Mature length: Males, 3.5-4.0 mm; females, 4.5-6.0 mm.