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The Arthropods of an Early Sand Prairie Sere

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ABSTRACT

An inventory of ground-dwelling arthropods was conducted from March to August of 1999 on a recovering sand prairie near Edwardsville, IL. Drift fences and pitfall traps were utilized and arthropods were collected approximately once every month. We identified 81 different species represented by the following Orders (number of different species): Spirobolida (1), Hymenoptera (6), Hemiptera (7), Isopoda (1), Coleoptera (50), Homoptera (1), Orthoptera (2), Lepidoptera (3), Opilionida (1), and Araneae (10). *Anisodactylus harrissi*, *Lycosa spp*., *Geopinus incrassatus*, and *Microporus obliquus* were the most common arthropod species captured. Results suggest that there were no systemic spatial variation between drift fences and species caught, whereas there were temporal differences in the species caught.

INTRODUCTION

Approximately 75% of the organisms occupying earth are invertebrates (White, 1983; Borror et al., 1989). This includes spiders, insects, crustaceans, centipedes, and millipedes. Many are directly beneficial to humans providing pollination, food, wax, and silk. Invertebrates are also indirectly important as a key component of the food web, assisting in the decomposition of organic material, and foraging or parasitizing harmful organisms. Many are also viewed as important pests damaging agricultural crops and livestock. Unfortunately, they are probably the least understood of all organisms. In particular, knowledge of what, when and how many invertebrate species occupy a habitat is generally lacking.

Sand Road is a 43-acre wetland/sand prairie mitigation site recently purchased by the Illinois Department of Transportation (Figure 1). The site includes an abrupt change from a xeric sand prairie to a mesic wetland and provides habitat for many rare and uncommon species of plants, invertebrates, reptiles, and amphibians, including the threatened Illinois chorus frog (*Pseudacris streckeri illinoensis*) (Tucker, 2000). The reptiles and amphibians rely heavily upon the invertebrates (mostly ground-dwelling arthropods) as forage. Studies of the food habits of six species of reptiles and amphibians occupying this site have been or are currently being determined (Tucker, 1997). The purpose of this project is to provide a partial inventory of ground-dwelling arthropods and to describe the changes in arthropod abundance throughout the warm season (April-August).

MATERIALS AND METHODS

Arthropods were sampled from a site located near Edwardsville, IL (Figure 1). Sampling was conducted on March 28, April 3, April 17, May 1, May 17, July 6, and August 9, in 1999. Thirteen drift fences (25 cm metal siding), each thirty meters in length with six pitfall traps, were utilized (Tucker, 1995). The number of drift fences sampled varied according to the available time that the authors had to collect and process the samples (ranged from 6 to13 transects sampled every period). Several pitfall traps (1 to 2) were removed from the study each sample period due to silting in (wind blown sand). The data was analyzed by species using a General Linear Model (Statistical Analysis System, 1996) to determine if fence, pit, and period had any influence on variation in distribution and on the number of individuals captured. The average number of individual species captured per pit was then calculated to show changes in species density and frequency throughout the seven sampling periods.

RESULTS

Fence and pit location did not significantly ($p<0.05$; $F < 1$) predict the number of individuals captured by species. However, period was a significant predictor indicating that variation in season partially determined the number of individuals captured. Arthropod abundance peaked during the April 17th and May 1st sampling periods (12.0 and 11.7 individuals per pit, respectively; Table 2).

Ground beetles (Coleoptera) were the most abundant arthropod in all sampling periods (ranging from 25 to 73%) except in the first sampling period (Table 1). The first sampling period was dominated by Lepidoptera larvae (Family Noctuidae (cutworm); Table 1). Araneae (spiders) abundance increased following the first sampling period, peaked around May 1st and then declined throughout the rest of the study. Hemipteran (true bugs) relative abundance increased throughout the study (Table 1).

Other than the first sampling period, *Anisodactylus harrisii* was the most frequent arthropod sampled throughout the study (Table 2). Average number of individuals captured per pit was relatively low during the first period (0.1) but increased by 39-fold in one-weeks time. *Lycosa spp*. (four different species) were also abundant occurring in 9.6% of the pits and having an average capture of 3.5 individuals per pitfall throughout all time periods (Table 2). Density and frequency peaked during the April 3rd sampling period. *Geopinus incrassatus* was frequent from March 28 to July 6 (frequency ranged from 3.1 to 20.0) but dropped to no captures by August 9 (Table 2). Our sampling indicated that *Microporus obliquus* had low abundance during the early sampling periods but increased to about 17% by May 17 (Table 2).

DISCUSSION

Determining species presence and abundance is an important step in describing the rarity and importance of a habitat and understanding the relationship of organisms to that habitat. This particular site is interesting because it is a zone where a disturbed sand prairie and a wetland meet. Many of the invertebrate species sampled by this study only occupy

areas with large sand deposits (e.g., *Bembidion spp*., *A. harrisii*, *Euryderus grossus*, *G. incrassatus*, *Cicindela spp*., and *M. obliquus*) (Arnett, 1963; Slater and Baranowski, 1978; White, 1983). Invertebrates are also attracted by a particular vegetation type or prey whereas others are generalists. The invertebrates sampled could be classified into four groups based on feeding habits and habitat use, 1) herbivores, 2) predators, 3) scavengers/decomposers, and 4) transients.

Many of the invertebrates occupying the site are herbivores and likely feed upon the dominant vegetation which includes yellow sweetclover (*Melilotus officianalis*), daisy (*Aster spp*.), cheatgrass brome (*Bromus tectorum*), and mouse-eared chickweed (*Cerastium pumilum*) (unpublished data). Herbivorous arthropods included *Cerotoma trifurcata*, *Apion griseum*, *Hypera spp*., *Languria trifasciata*, *Calligrapha bidenticola*, *Sphenophorus spp*., *Microporus obliquus*, *Sehirus cinctus*, Elateridae (click beetle Family), *Feltia spp*., *Stenolophus conjunctus*, *Harpalus spp*., *Amara spp*., *A. harrisii*, *Euryderus grossus, G. incrassatus*, and Formicidae (ants) (Blatchley and Leng, 1916; Arnett, 1963; Kissinger, 1964; Slater and Baranowski, 1978; Ross et al., 1982; White, 1983; Borror et al., 1989; Hölldobler and Wilson, 1990; Haarstad, 1999). The great numbers of herbivorous arthropods provides important forage for numerous predaceous arthropods as well as vertebrates.

There were numerous predators at this site and included species that were highly specialized in mode of capture and consumption of prey, as well as generalists. Predaceous arthropods included *Scaphinatus elevatus*, *Dicaelus elongates*, *Pasimachus spp*., *Scarites substriatus*, *Calleida spp*., *Adalia spp*., *Plegaderus spp*., *Nicrophorus spp*., Mutillidae (velvet ant), *Bembidion spp*., *A. harrisii*, *Agonum spp*., *Calathus spp*., *Evathrus spp*., *Odontonyx spp*., *Pterostichus spp*., *Cicindela spp*., *Ceratocapsus spp*., *Geocoris spp*., *Nabicula spp*., *Nabis spp*., *Florinda spp*., Micryphantidae (dwarf spider family), *Zelotes spp*., *Lycosa spp*., *Pardosa spp*., *Oxyopes spp*., and *Habrocestum spp*., and *Misumenops spp*. (Katson, 1972; Slater and Baranowski, 1978; Ross et al., 1982; White, 1983; Borror et al., 1989; Moulder, 1992; Haarstad, 1999).

Several of the species that were captured were scavenger/decomposers. *Acaromimus spp*. feeds upon fungus that occupies dead or dying trees or on the smut in grasses, while the Eucnemidae Family (false click beetle) feeds upon rotting wood (Dillon and Dillon, 1961; Arnett, 1963; White, 1983; Borror et al., 1989). The Gryllacrididae (camel cricket) are scavengers and *Anomala binotata*, *Nicrophorus spp*. and species of Tenebrionidae (darkling beetle) feed upon dead plant material, dung, carrion and, or fungi (Arnett, 1963; Ross et al., 1982; White, 1983; Borror et al., 1989; Haarstad, 1999).

Both *Cybister spp*. and *Hydrophilus spp*. are water beetles that were more than likely transient catches rather than actually utilizing the sand prairie area (White, 1983; Borror et al., 1989; Haarstad, 1999). Both species have the ability to fly and were probably in the process of relocating from the nearby wetland. *Ornithocoris spp*. is a parasite of birds (Slater and Baranowski, 1978). Occasional killdeer and bobwhite quail chicks were captured in the pits and may explain the capture of this parasite.

The most common species at this site was *A. harrisii*. This species apparently transforms from a grub stage to an adult beetle form around the first of March. In addition to being

the most common species on the sand prairie site, *A. harrisii* is also commonly consumed by the reptiles and amphibians occupying this site making it an important component of the food web (unpublished data). However, being a ground-dwelling insect that prefers an open habitat, it is likely that the abundance of *A. harrisii* will decline as the sand prairie matures and plant cover increases. This raises the question of whether *A. harrisii* is a preferred forage species by a declining herp population, or if it is utilized by these vertebrates simply because it is the dominant ground-beetle.

Wetland and sand prairie are rare vegetative communities in Illinois. We show that a wide variety of ground-dwelling arthropods occupy and utilize the Sand Road site. Even so, our study only examined the mobile, ground-dwelling arthropods occupying this site. The complexity and lack of understanding increases with the addition of invertebrates prone to flight or that are stationary. The arthropod species composition is also likely to change as the sand prairie becomes more established.

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Figure 1. Study site near Edwardsville, Illinois.

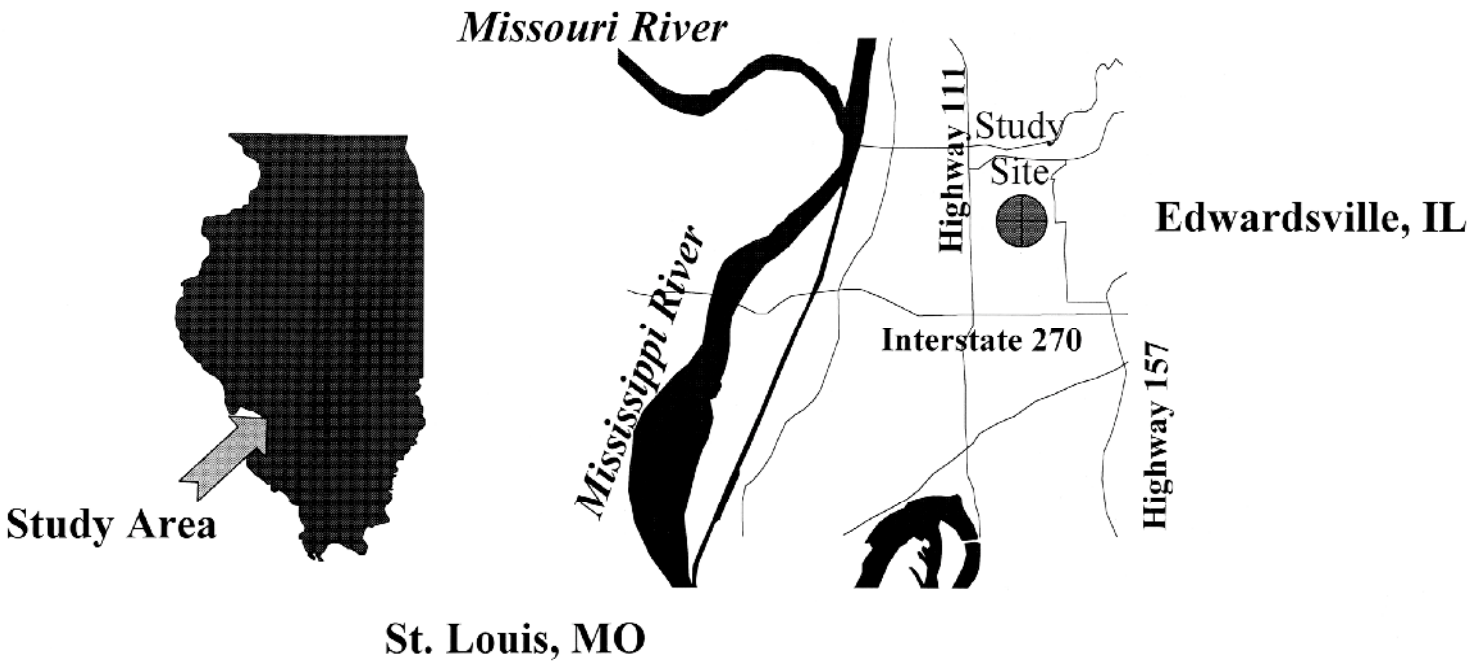

Table 1. Changes in frequency by arthropod order and sampling period.

	Sampling Dates															
	3/28		**4/03**		**4/17**		**5/01**		**5/17**		**7/06**		**8/09**		**Total**	
Order	**F**	**A**	**F**	**A**	**F**	**A**	**F**	**A**	**F**	**A**	**F**	**A**	**F**	**A**	**F**	**A**
Araneae	3.1 (1)	0.0	18.1 (124)	1.6	10.0 (24)	1.0	26.9 (110)	3.7	2.3 (6)	0.2	3.1 (5)	0.1	2.1 (2)	0.0	**15.2 (274)**	**6.9**
Coleoptera	25.0 (8)	0.3	69.3 (471)	6.2	73.4 (213)	8.7	58.7 (194)	6.4	71.2 (192)	7.9	70.5 (94)	2.6	71.3 (68)	3.0	**67.1 (1240)**	**34.6**
Hemiptera	0.0	0.0	1.0 (7)	0.1	7.9 (23)	1.0	6.0 (20)	0.7	17.4 (46)	1.9	14.0 (18)	0.5	21.3 (30)	1.3	**8.1 (144)**	**5.4**
Homoptera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4 (1)	0.0	0.8 (1)	0.0	0.0	0.0	**0.1 (2)**	**0.1**
Hymenoptera	0.0	0.0	0.0	0.0	1.4 (4)	0.2	3.0 (10)	0.3	3.0 (8)	0.3	7.8 (10)	0.3	5.3 (5)	0.2	**2.1 (37)**	**1.2**
Isopoda	0.0	0.0	0.0	0.0	2.1 (6)	0.3	1.8 (6)	0.2	0.0	0.0	0.0	0.0	0.0	0.0	**0.7 (12)**	**0.5**
Lepidoptera	59.4 (19)	0.6	8.1 (55)	0.8	5.2 (15)	0.6	1.5 (5)	0.2	4.5 (12)	0.5	3.9 (5)	0.1	0.0	0.0	**6.1 (111)**	**2.8**
Opilionida	0.0	0.0	0.0	0.0	0.7 (2)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.1 (2)**	**0.1**
Orthoptera	6.3 (2)	0.1	3.2 (24)	0.3	0.0	0.0	2.1 (7)	0.2	1.1 (3)	0.1	0.0	0.0	0.0	0.0	**1.9 (34)**	**0.7**
Spirobolida	6.3 (2)	0.1	0.3 (2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.2 (4)**	**0.1**
Total	**100.1 (32)**	**1.0**	**100.0 (683)**	**9.0**	**99.7 (289)**	**11.9**	**100.0 (352)**	**11.7**	**99.9 (268)**	**10.9**	**100.1 (133)**	**3.6**	**100.0 (105)**	**4.5**	**101.6 (1860)**	**52.4**

Table 2. Species frequency and average capture per pit by sampling period.

Order / Species	Sampling Dates															
	3/28		4/03		4/17		5/01		5/17		7/06		8/09		Total	
	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A
Araneae																
Cicurina spp.	0.0	0.0	0.1 (1)	0.0	0.0	0.0	6.0 (20)	0.7	0.0	0.0	0.8 (1)	0.0	0.0	0.0	**1.2 (22)**	**0.7**
Lycosa spp.	0.0	0.0	17.2 (117)	1.5	8.6 (24)	1.0	8.1 (24)	0.8	0.8 (2)	0.1	2.3 (3)	0.1	1.1 (1)	0.0	**9.6 (171)**	**3.5**
Oxyopes spp.	0.0	0.0	0.0	0.0	0.0	0.0	7.8 (26)	0.9	0.0	0.0	0.0	0.0	0.0	0.0	**1.4 (26)**	**0.9**
Pardosa spp.	0.0	0.0	0.0	0.0	0.0	0.0	6.9 (23)	0.8	0.0	0.0	0.8 (1)	0.0	0.0	0.0	**1.3 (24)**	**0.8**
Zelotes spp.	0.0	0.0	0.1 (1)	0.0	0.0	0.0	3.0 (10)	0.3	0.4 (1)	0.0	0.0	0.0	0.0	0.0	**0.7 (12)**	**0.4**
Other[1]	3.1	0.0	0.6 (5)	1.1	0.0	0.0	2.1 (7)	0.2	1.1 (3)	0.1	0.0	0.0	1.1 (1)	0.0	**1.0 (19)**	**0.6**
Opilionida																
Phalangidae	0.0	0.0	0.0	0.0	0.7 (2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.1 (2)**	**0.1**
Coleoptera																
Anisodactylus harrisee	12.5 (4)	0.1	49.3 (335)	4.3	33.1 (96)	4.0	28.7 (96)	3.2	54.9 (145)	6.0	46.5 (60)	1.7	55.3 (52)	2.2	**43.2 (788)**	**21.5**
Calathus gregarious	0.0	0.0	4.3 (29)	.04	9.0 (26)	1.1	2.4 (8)	0.3	1.9 (5)	0.2	2.3 (3)	0.1	4.3 (4)	0.2	**4.1 (75)**	**2.2**
Callida spp.	0.0	0.0	3.1 (21)	0.3	4.5 (13)	0.5	1.2 (4)	0.1	1.1 (3)	0.1	0.0	0.0	0.0	0.0	**2.2 (41)**	**101**
Cicindela hirticollis	0.0	0.0	2.9 (20)	0.3	1.3 (1)	0.0	0.9 (3)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	**0.7 (24)**	**0.4**
Cicindela punctulata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8 (1)	0.0	2.1 (2)	0.1	**0.2 (3)**	**0.1**
Geopinus incrassatus	6.3 (2)	0.1	5.7 (39)	0.5	20.0 (58)	2.4	5.7 (19)	0.6	3.8 (10)	0.4	3.1 (4)	0.1	0.0	0.0	**7.2 (132)**	**4.1**
Harpalus testaceus	0.0	0.0	0.0	0.0	0.0	0.0	0.3 (1)	0.0	1.1 (3)	0.1	2.3 (3)	0.1	0.0	0.0	**0.3 (7)**	**0.2**
Patrobus septentrionis	0.0	0.0	0.0	0.0	0.0	0.0	5.1 (17)	0.6	0.0	0.0	0.0	0.0	0.0	0.0	**0.9 (17)**	**0.6**
Scarites substriatus	0.0	0.0	0.0	0.0	0.3 (1)	0.0	8.4 (28)	0.9	1.5 (4)	0.2	9.3 (12)	0.3	6.4 (6)	0.3	**2.8 (51)**	**1.7**
Other[2]	6.3 (2)	0.1	3.8 (27)	0.4	5.9 (18)	0.7	5.4 (18)	0.6	9.6 (22)	0.9	8.8 (11)	0.3	4.4 (4)	0.2	**5.5 (102)**	**2.7**

Table 2. continued

Order / Species	Sampling Dates															
	3/28		4/03		4/17		5/01		5/17		7/06		8/09		Total	
	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A
Hemiptera																
Geocoris spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.6 (2)	0.1	0.0	0.0	0.0	0.0	2.1 (2)	0.1	**0.2 (4)**	**0.2**
Microporus obliquus	0.0	0.0	1.0 (7)	0.1	7.2 (21)	0.9	4.5 (15)	0.5	17.4 (46)	1.9	13.2 (17)	0.5	17.0 (16)	0.7	**6.7 (122)**	**4.5**
Nabis ssp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8 (1)	0.0	11.0 (10)	0.4	**0.7 (11)**	**0.4**
Other[3]	0.0	0.0	0.0	0.0	0.7 (2)	0.1	0.9 (3)	0.1	0.0	0.0	0.0	0.0	2.1 (2)	0.1	**0.5 (7)**	**0.3**
Homoptera																
Cicadellidae	0.0	0.0	0.0	0.0	0.0	0.0			0.4 (1)	0.0	0.8 (1)	0.0	0.0	0.0	**0.1 (2)**	**0.1**
Hymenoptera																
Acropyga spp.	0.0	0.0	0.0	0.0	0.0	0.0	2.1 (7)	0.2	1.1 (3)	0.1	2.3 (3)	0.1	0.0	0.0	**0.7 (13)**	**0.4**
Hypoclinea spp.	0.0	0.0	0.0	0.0	0.7 (2)	0.1	0.6 (2)	0.1	0.8 (2)	0.1	3.1 (4)	0.1	2.1 (2)	0.1	**0.7 (12)**	**0.4**
Other[4]	0.0	0.0	0.0	0.0	0.7 (2)	0.1	0.3 (1)	0.0	1.2 (3)	0.1	2.4 (3)	0.1	3.3 (3)	0.1	**0.7 (12)**	**0.4**
Isopoda	0.0	0.0	0.0	0.0	2.1 (6)	0.3	1.8 (6)	0.2	0.0	0.0	0.0	0.0	0.0	0.0	**0.7 (12)**	**0.5**
Lepidoptera																
Noctuidae	59.4 (19)	0.6	8.1 (55)	0.8	5.2 (15)	0.6	1.5 (5)	0.2	4.5 (12)	0.5	3.9 (5)	0.1	0.0	0.0	**6.1 (111)**	**2.8**
Orthoptera																
Gryllacrididae	6.3 (2)	0.1	3.2 (24)	0.3	0.0	0.0	2.1 (7)	0.2	1.1 (3)	0.1	0.0	0.0	0.0	0.0	**1.9 (34)**	**0.7**
Spirobolida	6.3 (2)	0.1	0.3 (2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.2 (4)**	**0.1**
Total	**100.1 (32)**	**1.0**	**100.0 (683)**	**9.0**	**99.7 (289)**	**11.9**	**100.0 (352)**	**11.7**	**99.9 (268)**	**10.9**	**100.1 (133)**	**3.6**	**100.0 (105)**	**4.5**	**101.6 (1860)**	**52.4**

Other[1] (n) includes: *Gnaphosa spp.* (3), *Habrocestum spp.* (1), Micryphantidae (5), and *Misumenops spp.* (10); Other[2] includes: *Acaromimus spp.* (2), *Acupalpus spp.* (2), *Adalia spp.* (7), *Agonoderus spp.* (1), *Agonum spp.* (4), *Amara interpunctatus* (3), *Anadaptus spp.* (2), *Anomala binotata* (1), *Apion spp.* (1), *Bembidion spp.* (2), *Calathus advena* (1), *Calligrapha bidenticola* (1), *Cerotoma trifurcata* (3), *Cicindela repanda* (1), *Cicindela scutellaris* (2), *Cybister spp.* (2), *Dicaelus elongatus* (1), Elateridae (3), Eucnemidae (2), *Euryderus grossus* (1), *Evathrus spp.* (5), *Harpalus caliginosus* (5), *Harpalus pleuriticus* (6), *Hydrophilus spp.* (2), *Hypera spp.* (1), *Languria trifasciata* (2), *Nicrophorus spp.* (5), *Odontonyx spp.* (2), *Oedionychus quercata* (2), *Oedionychus vians* (1), *Pasimachus spp.* (5), *Plegaderus spp.* (7), *Pseudomorpha spp.* (2), *Pterostichus spp.* (4), *Scaphinotus elevatus* (5), *Sphenophorus spp.* (1), *Stenolophus conjunctus* (1), Tenebrionidae (2), and *Trichotichnus spp.* (2); Other[3] includes: *Ceratocapsus spp.* (3), *Nabicula spp.* (1), *Ornithocoris spp.* (1), and *Sehirus cinctus* (2); and Other[4] includes: *Leptothorax spp.* (6), Mutillidae (2), and *Tetramorium spp.* (4).