

Composition and Biogeography of Small Mammals In Northwestern Illinois Based On Pitfall Trapping

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ABSTRACT

A subset of the terrestrial small mammal fauna of northwestern Illinois was sampled with pitfall traps from October through December 1984. A total of 7808 trapnights (182 traps at ten sites) resulted in the capture of 132 specimens of five species. The near ubiquity of these species across significantly different habitats, and the complete absence of more boreal species which might be expected to associate with the Driftless Area, underscores the importance of local ecological processes in determining faunal composition in this portion of the Midwest, and the lesser importance of historical factors. The absence of *Sorex haydeni* east of the Mississippi River agrees with recent reports demonstrating that this species does not reach eastern Iowa.

INTRODUCTION

The present terrestrial small mammal fauna of Illinois generally reflects current patterns of land use. Regional (beta) diversity often is moderate to high (10 to 35 species), whereas point (alpha) diversity generally is much lower (personal observation). This reflects the fact that over 99% of the state has been grazed, cultivated, or otherwise altered from its pristine condition (Illinois Nature Preserves Commission 1983). In north-central Illinois a typical line of live- or kill-traps will yield some combination of *Sorex cinereus*, *Blarina brevicauda*, *Peromyscus maniculatus*, *P. leucopus*, and *Microtus pennsylvanicus* (unpublished data). Yet over 20 species of small terrestrial mammals (including

Insectivora and Rodentia) are known to occur in the northwest portion of the state (Hoffmeister 1989; Table 1). Most of these are shared with adjacent portions of Iowa, Minnesota, and Wisconsin, although the Mississippi River forms a subspecific boundary for many species (Table 1).

The Wisconsin Driftless Area reaches its southern extent in northwest Illinois. This is a region of rugged terrain in southwestern Wisconsin and adjacent parts of Illinois, Iowa, and Minnesota which escaped Pleistocene glaciation (Trowbridge, 1921), and contains some of the most maturely developed land surface in Illinois (Illinois Nature Preserves Commission, 1983), as well as retaining floristic elements with more northerly affinities (Jones, 1963). The other main natural division found in northwest Illinois is the Rock River Hill Country, located east and southeast of the Driftless Area (Illinois Nature Preserves Commission, 1983).

Six species of long-tailed shrews (*Sorex*, including *Microsorex*), and two species of short-tailed shrew (*Blarina*), are known to occur within roughly 100-150 km of the Illinois portion of the Driftless Area (Jackson, 1961; Bowles, 1975; George et al., 1982; Hazard, 1982; Jones and Birney, 1988; Hoffmeister, 1989; Table 1). Additionally *Scalopus aquaticus machrinus*, *Condylura cristata cristata*, and *Cryptotis parva parva* are known or suspected to occur in northern Illinois and southern Wisconsin. These latter three genera are all monotypic in northern Illinois (Hoffmeister, 1989).

Precise distributional information for these species is lacking because of the absence of sampling with appropriate methods. Pitfall traps have been demonstrated to be superior to snap-traps for securing non-visually orienting species, such as moles (Talpidae), shrews (Soricidae), and long-tailed voles (*Microtus*) (French, 1980; Williams and Braun, 1983; Bury and Corn, 1984; Dowler et al., 1984). Recent studies using such traps have demonstrated shrews (especially *Sorex*) to be more widely distributed and abundant than previously believed (Wrigley et al., 1979; French, 1980; Rose, 1980, 1981; Caldwell et al., 1982; Rose and Seegart, 1982; Williams, 1984). Whether additional soricines are absent from northern Illinois or have remained unnoticed due to inappropriate trapping methodology is not clear. In view of the results with pitfall trapping elsewhere it is tempting to speculate that the latter may be true. The geological history and contemporary flora of the Driftless Area especially suggests that such speculation is reasonable. Because small mammal distributions often are influenced strongly by microhabitat and local climate, it is feasible that more northern species (e.g. *Sorex arcticus*, *S. haydeni*, *S. palustris*) may extend into northwest Illinois by way of the Driftless Area.

Although *Sorex cinereus cinereus* and *S. haydeni* have until recently been considered synonymous (Junge and Hoffmann, 1981), these species have been shown to be morphologically distinct based upon canonical analysis (van Zyll de Jong, 1980; van Zyll de Jong and Kirkland, 1989). Although *S. haydeni* has until recently been considered to occur throughout Iowa and Nebraska (Bowles, 1975; Hall, 1981) a recent morphometric analysis of the *S. cinereus* group (van Zyll de Jong and Kirkland, 1989) found the eastern extreme of *S.*

haydeni to occur in east-central Iowa. An intriguing zone of intergradation between *S. haydeni* and *S. cinereus* was found, however, across a parallel through northern Iowa and southern Wisconsin, and extending east and south of Lake Michigan through much of Michigan and eastern Ohio. The similarity of these species makes identification difficult in the field, and the actual status of shrews from the northwest corner of Illinois has not been addressed. They are readily distinguished from cleaned skeletal materials however, using characteristics of the unicuspid teeth, and relative position of the infraorbital and lacrimal foramina (van Zyll de Jong, 1980).

Because of the interest in the Driftless Area and especially in characterizing the soricine fauna of northwestern Illinois, a survey of the northwest extreme of Illinois was conducted during Autumn 1984 with the goal of documenting the species present.

METHODS

Trap-lines were placed in suitable habitat at ten localities in northwest Illinois (Appendix 1). Traps (No. 10 food cans) were placed at least 2 m apart and buried with their rims flush with the soil surface, and disturbed litter was replaced to reflect natural conditions around the trap. Two to three inches of water was added to each trap to limit escapes, and water was added as needed during subsequent visits. Traps were checked weekly until the water froze over (mid-December), at which time traps were closed by covering with wooden planks and soil. Dominant tree species were recorded (Appendix 1), and general habitat characteristics were noted during weekly checks.

Specimens retrieved from traps were stored on dry ice and subsequently frozen. Specimens were prepared either as standard skin plus skeleton, or skeleton only. All specimens were deposited with the mammal collection of the Department of Biological Sciences, Northern Illinois University, DeKalb.

RESULTS

A total of 182 pitfall traps were placed at ten localities in northwest Illinois between 27 October and 17 November 1984. The duration of sampling at each locality varied from 29 to 50 days and all traps were closed after 16 December 1984 (Table 2). A total of 132 small mammals of five species was collected in 7808 trap-nights (Table 2). These were the insectivores, *Sorex cinereus cinereus* (n = 81) and *Blarina brevicauda brevicauda* (n = 15), and the rodents *Peromyscus leucopus novaeboracensis* (n = 21), *Microtus pennsylvanicus pennsylvanicus* (n = 14), and *Mus domesticus* (n = 1). Based upon cranial and dental characteristics, all *Sorex* were readily assigned to *S. cinereus*.

The number of captures per trap ranged from two to 22 individuals. Regressions of number of individuals captured (by species or total) with either number of days of effort, number of traps, or total trap-nights at each location, employing the sequential Bonferoni criterion (Holm, 1979; Rice, 1989), failed to produce any

significant explanatory relationships (all $r^2 < 0.416$). Only the first order polynomial regression of *Blarina* captures with number of days of sampling was significant ($F = 7.85$, $P = 0.0172$; $P_{.05} = 0.0125$ with the Bonferoni criterion). Hence the results from all trap-lines can be considered as approximately equivalent estimates of local population density and species diversity for those species prone to pitfall captures.

DISCUSSION

The area of northwest Illinois lies within the range of roughly 23 small terrestrial mammals (Table 1), although the insectivorous component has remained poorly documented. Although concurrent trapping with more conventional methods was not conducted for comparison, the results reported here corroborate the bias of pitfall traps towards *Sorex*; this genus accounted for a significant majority of captures at all sites, and for almost twice as many captures as all other species combined (Table 2). More interestingly these data demonstrate the near ubiquity of *Sorex* in all habitats sampled. These ranged from reclaimed prairie to deciduous and mixed-coniferous woodlands, and represent a relatively complete sample of the major habitat types in northern Illinois (Appendix 1). The high number of captures of *Peromyscus* is at first surprising. Many of these individuals were juvenile, however, and may have been emigrating from their natal home ranges. Such individuals may be less wary than post-dispersal and adult individuals.

The distribution of species captures appears not to follow any expected macro-level scale. The two less commonly captured species (*Peromyscus* and *Microtus*) were often collected together, but these displayed no geographical pattern. The two soricines also were rather evenly distributed across all sites. Four sites collected only one species; three of these collected only *Sorex*, and the final site collected only *Blarina*. The sites that collected only *Sorex* lacked a developed understory; one of these was adjacent to a *Pinus* plantation, while another had abundant downed wood.

It appears that the geographic boundary demarcating the Driftless Area has little if any effect on the abundance and distribution of these species. A number of additional species occur here however (Table 1), and it is important to reassert that total diversity here is substantially greater than five species. Nevertheless the anticipated diversity of the groups represented was not found. Evidently environmental parameters in addition to those characterizing the Driftless Area regulate distributions of the remaining soricines. *S. palustris* for example, requires clear water bodies which are generally lacking in northwest Illinois. *S. arcticus* in Wisconsin were recorded in wet spruce, and tamarack swamps, and in alder or willow marshes (Jackson, 1961), although in Minnesota most specimens were from non-forested sites or clearings in forested areas (Jones and Birney, 1988). The only site I found in northwest Illinois that was close to Jackson's (1961) description was Thomson Causeway, although this area frequently floods in autumn, and hence is not comparable to Wisconsin sites.

A number of species known from the Driftless region were not encountered in this study. Many of these were not expected *a priori* because they employ relatively more visual means of orientation. Yet this study did not encounter any species not known to be common in this region. The most conspicuous of these was *Sorex haydeni*, known to occur in eastern Iowa and north into Canada (Bowles, 1975; van Zyll de Jong, 1980; Hall, 1981), where it is sympatric with *S. cinereus*. In Canada these two *Sorex* are distinct where sympatric (van Zyll de Jong, 1980), and several areas of morphological intergradation have been well documented in the Midwest. Although the analyses conducted here do not allow for an investigation of intergradation, the specimens examined showed no signs of intergradation towards *S. haydeni*, in agreement with van Zyll de Jong (1980).

The mammalian fauna of the Illinois portion of the Driftless Area, and especially the soricines, evidently is influenced more by ecological characteristics and emigration of locally available species than by historical habitat associations and corridor-regulated access. The boreal influence observed in the flora (Jones, 1963) either is nonexistent in the mammalian fauna, or this is swamped by recruitment from local faunas. Northwest Illinois is dominated by a more southern fauna whose composition is filtered to some degree by the Mississippi River.

ACKNOWLEDGEMENTS

Funding for transportation was provided by the Max McGraw Wildlife Foundation (Elgin, Illinois). Brian Lang assisted with plant identifications, and Peter Meserve provided moral and vehicular support when needed, as well as valuable comments on an earlier draft of the manuscript.

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Table 1. Small terrestrial mammal species present in the region of northwest Illinois. Subspecies are given where they differ between geographic areas¹.

Taxon	SE Minn ²	NE Iowa ³	SW Wisc ⁴	NW Ill ⁵
Insectivora				
<i>Sorex arcticus</i>	x	-	x	-
<i>S. cinereus</i>	-	-	x	x
<i>S. fumeus</i>	-	-	x ⁶	-
<i>S. haydeni</i>	x	x	-	-
<i>S. palustris</i>	x	-	x	-
<i>S. (Microsorex) hoyi</i>	x	-	x	x
<i>Blarina brevicauda brevicauda</i>	x	x	x	-
<i>B. b. kirklandi</i>	-	-	-	x
<i>Cryptotis parva</i>	x	x	x	x
<i>Scalopus aquaticus machrinus</i>	-	-	x	x
<i>S. a. machrinoides</i>	x	x	-	-
Rodentia				
<i>Tamias striatus</i>	x	x	x	x
<i>Marmota monax</i>	x	x	x	x
<i>Spermophilus tridecemlineatus</i>	x	x	x	x
<i>S. franklini</i>	x	x	x	x
<i>Sciurus carolinensis carolinensis</i>	-	-	-	x
<i>S. c. hypophaeus</i>	-	-	x	-
<i>S. c. pennsylvanicus</i>	x	x	-	-
<i>S. niger</i>	x	x	x	x
<i>Tamiasciurus hudsonicus loquax</i>	-	-	-	x
<i>T. h. minnesota</i>	x	x	x	-
<i>Glaucomys volans</i>	x	x	x	x
<i>Geomys bursarius majusculus</i>	x	x	-	-
<i>G. b. illinoiensis</i>	-	-	-	x
<i>G. b. wisconsinensis</i>	-	-	x	-
<i>Heithrodontomys megalotis dychei</i>	x	x	-	x
<i>H. m. pectoralis</i>	-	-	x	-
<i>Peromyscus maniculatus bairdii</i>	x	x	x	x
<i>P. leucopus</i>	x	x	x	x
<i>Clethrionomys gapperi gapperi</i>	-	-	x	-
<i>C. g. loringi</i>	x	-	-	-
<i>Microtus pennsylvanicus</i>	x	x	x	x
<i>M. ochrogaster</i>	x	x	x	x
<i>M. pinetorum nemoralis</i>	x	x	x	-
<i>M. p. scalopsoides</i>	-	-	x	x
<i>Synaptomys cooperi</i>	x	x	x	x
<i>Zapus hudsonicus</i>	x	x	x	x

1-- x = present, - = absent; 2 -- Hazard, 1982; 3 -- Bowles, 1975; 4 -- Jackson, 1961; 5 -- Hoffmeister, 1989, this study; 6 -- Known from a single specimen collected at Racine, WI, in 1853.

Table 2. Trapping dates and small mammal specimens collected during a small mammal survey of northwestern Illinois during 1984. The single *Mus musculus* is not considered here.

Location	Sampling Dates	Number of traps	Number of trap-nights	<i>Sorex</i>	<i>Blarina</i>	<i>Peromyscus</i>	<i>Microtus</i>
Apple River Canyon	27 Oct. - 15 Dec.	13	663	3	2	1	0
Bowle's Prairie	15 Nov. - 15 Dec.	16	492	4	1	0	8
Freeport Prairie	4 Nov. - 15 Dec.	9	378	0	1	0	0
Hanover Bluff	28 Oct. - 15 Dec.	18	913	18	4	3	0
Lake Le-Aqua-Na	4 Nov. - 15 Dec.	20	840	8	0	0	0
Mississippi Palisades	28 Oct. - 15 Dec.	22	1100	18	4	7	2
Mississippi Palisades	28 Oct. - 15 Dec.	5	25	3	1	0	0
Morrisson-Rockwoods	17 Nov. - 15 Dec.	18	522	2	0	0	0
Oakdale Nature Preserve	10 Nov. - 15 Dec.	20	720	9	0	0	0
Thomson Causeway	3 Nov. - 15 Dec.	11	484	2	0	3	1
Thomson Causeway	3 Nov. - 15 Dec.	12	528	5	1	0	0
Ward's Grove	27 Oct. - 15 Dec.	18	918	9	1	7	3

Appendix 1. Locations of trapping areas with brief ecological characterizations.

- Apple River Canyon State Park -- JoDavieess Co., T28N, R4E, 6.25 mi N, 2.5 mi W, Stockton, 900 ft. Traps on S side of bluff with *Quercus alba* and *Q. borealis*, *Fraxinus pennsylvanica*, lesser amount of *Acer rubrum* and *A. saccharum* in overstory. Understory of same species plus *Ostrya virginiana*. Considerable litter, contributing to rich soil and thick duff layer. Abundant logs of ca. 10-30 cm diameter.
- Boyle's Prairie -- Ogle Co., T23N, R2E, 6 mi N, 2.5 mi E, Rochelle, off Mulford Rd., 770 ft. Traps on deep soiled section of prairie supporting 30-60 cm tall grass flora dominated by *Phalaris arundinacea*, *Polygonum* sp., and *Leersia* sp. Portions flood each spring (not trapped).
- Freeport Prairie Nature Preserve -- Stephenson Co., T26N, R8E, Freeport, on Walnut Rd., ca. 0.25 mi S, South St., 800 ft. Dry dolomite prairie dominated by *Andropogon scoparius*, *Sporobolus heterolepis*, *Bouteloua curtipendula*. Traps at southern end of prairie near small group of deciduous trees.
- Hanover Bluff Nature Preserve -- JoDavieess Co., T26N, R2E, 2 mi S, 1 mi W, Hanover, S. Whitton Rd., 0.2 mi S Whitton Station, 900 ft. Diverse woods of *Q. alba* and *Q. borealis* and *Juniperus virginiana* in overstory, and lesser contributions of *Aesculus glabra* and *Betula papyrifera*. Understory of *O. virginiana*, *Ribes* sp., *Rubus* sp., some *Prunus serotina* and *Cornus florida*. Traps along E-W running bluff, on rich, loamy soils, with thick layer of duff.
- Lake Le-Aqua-Na State Park -- Stephenson Co., T28N, R6E, 2.75 mi. N, 0.5 mi W, Lena, 900 ft. Traps on S side of bluff directly SW lake Le-Aqua-Na dam (near Sweet Gum trail). Vegetation here deciduous, not recorded.
- Mississippi Palisades State Park Site I -- Carroll Co., T25N, R3E, 4.5 mi. N, 1 mi. W, Savanna, ca. 80 m from end of High Point Trail, 800 ft. Sparse understory and thick duff layer. Overstory deciduous, but species not recorded.
- Mississippi Palisades State Park Site II -- Carroll Co., T25N, R3E, 4.5 mi. N, 1 mi. W, Savanna, ca. 0.5 km from end of High Point Trail, 800 ft. Vegetation as in Mississippi Palisades I.
- Mississippi Palisades State Park Site III -- Carroll Co., T25N, R3E, 3.5 mi. N, 1 mi. W, Savanna, N marina, 580 ft. Seasonally flooding pasture adjacent to Mississippi R., located N marina, W of main entrance to the Park. Vegetation not recorded.
- Morrisson-Rockwoods State Park -- Whiteside Co., T21N, R5E, 2.5 mi N Morrison. Site dominated by *Q. alba*, *P. serotina*, *F. pennsylvanica*, with some *Robinia pseudacacia* and *Q. borealis*. Understory sparse, with *C. florida* and *O. virginiana*.
- Oakdale Nature Preserve -- Stephenson Co., T26N, R8E, 3.5 mi S, 0.5 mi E, Freeport, 255 ft. Dominated by *Q. alba* and *Q. borealis*, some *P. serotina* and *Carya ovata*. Understory of *P. serotina*, *O. virginiana*, some *Rubus* sp. Abundant logs and litter, and thick duff layer.
- Thomson Causeway Day Use Area Site I -- Carroll Co., T23N, R3E, 0.5 mi S, 0.5 mi W, Thomson, 600 ft. Located ca. 200 m from Mississippi R., but this site evidently does not flood. Overstory of *Q. borealis* and *Morus rubra* (abund.), *Gymnocladus dioicus*, some *Populus deltoides*, occasionally *C. ovata*. Understory of *Carpinus caroliniana*, *Crataegus*, *M. rubra*.

Thomson Causeway Day Use Area Site II -- located as above. Overstory almost exclusively *B. papyrifera*, with some *B. nigra*. Understory predominantly *B. papyrifera*, with thickets of *Rubus* sp. and *Acer* sp. Thin duff layer. This site evidently floods annually.

Wards Grove Nature Preserve -- JoDaviess Co., T27N, R5E, 0.5 mi N, 2.5 mi W, Kent, off Kent School Rd., 940 ft. Traps on the N side of a bluff with overstory dominated by *Q. alba* and *Q. borealis*, *A. saccharum*, and lesser amounts of *Q. virginiana* and *P. serotina*. Site contains abundant downed wood, rich soil, and rich soil.