

## SMALL MAMMALS OF THE WABASH RIVER BOTTOMS

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**ABSTRACT.** The most abundant terrestrial small mammals in the Wabash River bottomlands in Vigo County, Indiana, in the early 1960's were the house mouse, the white-footed mouse, the prairie deer mouse, and the meadow vole. The white-footed mouse, house mouse and meadow vole were taken at greater rates in the bottoms than in the uplands. The prairie deer mouse and the short-tailed shrew were taken at greater rates in the uplands than in the bottoms. The swamp rabbit (state-endangered) once occurred in several southwestern Indiana counties, but currently occurs along the Wabash River mainly in the north and south portions of Gibson County. The population of swamp rabbits in the state seems to be relatively stable at about 80 animals. The bat community of the lower Wabash River from southern Vigo County south to the Ohio River is particularly interesting. Through 1999, there were 1439 bats, including nine of the 10 species of bats that currently occur in Indiana, captured in the Prairie Creek region of southern Vigo County. By decreasing abundance, the bats are the evening bat (state-endangered), big brown bat, northern myotis, red bat, little brown myotis, eastern pipistrelle, Indiana myotis (federally-endangered), silver-haired bat, and hoary bat. All of these species occur south to the Ohio River. Only female and young evening bats occur in Vigo County, but adult males also occur in Posey County near the Ohio River.

**Keywords:** Bats, rabbits, rodents, shrews, Wabash River bottoms

Starting in 1962, a series of randomly selected 25 × 25m plots in Vigo County was used to learn about the small mammals of the county (Table 1) (Whitaker 1967). However, the Wabash River flows through Vigo County from north to south, and the data from the river bottoms were not examined separately from the data for the entire county.

In addition, we undertook a study of the bats of the Wabash and Ohio drainages in southwest Indiana (Whitaker & Gummer 2001). As part of this latter study, on 25 July 1994, we mist-netted for bats on lower Prairie Creek in the Wabash River bottoms (Whitaker 1997, 2004) and captured 15 bats of six species, as follows: evening bat (*Nycticeius humeralis*, 6), red bat (*Lasiurus borealis*, 2), big brown bat (*Eptesicus fuscus*, 2), eastern pipistrelle, (*Pipistrellus subflavus*, 2), northern myotis (*Myotis septentrionalis*, 2), and Indiana myotis (*Myotis sodalis*, 1). This proved to be one of the most productive localities for bats in Indiana, and led to much more study of the bats of the Prairie Creek area.

Twelve species of bats occur or did occur in Indiana, although one species, the southeastern myotis (*Myotis austroriparius*) is apparently extirpated, and the big-eared bat

(*Corynorhinus rafinesquii* occurs only accidentally in the state. In addition, the only gray bat maternity colony in the state is at Sellersburg, just north of Louisville. Therefore, it might occur along the Ohio River, but would not be likely along the Wabash River. No evening bats or Indiana myotis were taken along the Ohio (Table 2). The silver-haired bat is not present in summer in Indiana, as it has its young to the north of the state, and it occurs in Indiana only during the spring and fall migrations. No silver-haired bats were captured in the Ohio or lower Wabash valley. Because netting was done in summer, few if any silver-haired bats were expected.

The objectives of this paper are to present information on the Wabash River Bottoms and to compare it with the small mammals (Insectivora, Rodentia) of the uplands of Vigo County, Indiana, and also to compare data on the bats of the Wabash River bottoms from the Prairie Creek area of southern Vigo County, on the lower Wabash River south to the Ohio River, and to those of the Ohio River Valley of southern Indiana. These data can serve as baseline data for future studies.

### METHODS

For the small mammal study, a series of 500 randomly-selected, 25 × 25 m plots was

Table 1.—Small mammals trapped in 1962–65 in 54 randomly-selected plots (4050 trap-nights) from the Wabash River bottoms compared to 375 plots (28,125 trap-nights) from the uplands of Vigo County, Indiana.

|                                       | Wabash bottoms    |                            | Uplands and Vigo County |                            |
|---------------------------------------|-------------------|----------------------------|-------------------------|----------------------------|
|                                       | Number of animals | Number per 100 trap-nights | Number of animals       | Number per 100 trap-nights |
| <i>Mus musculus</i>                   | 116               | 2.9                        | 425                     | 1.5                        |
| <i>Peromyscus leucopus</i>            | 77                | 1.9                        | 237                     | 0.8                        |
| <i>Peromyscus maniculatus bairdii</i> | 46                | 1.1                        | 449                     | 1.6                        |
| <i>Microtus pennsylvanicus</i>        | 21                | 0.5                        | 5                       | 0.01                       |
| <i>Microtus ochrogaster</i>           | 9                 | 0.2                        | 62                      | 0.2                        |
| <i>Blarina brevicauda</i>             | 3                 | 0.07                       | 23                      | 0.08                       |
| <i>Sorex cinereus</i>                 | 3                 | 0.07                       | 1                       | 0.03                       |
| <i>Zapus hudsonius</i>                | 1                 | 0.02                       | 3                       | 0.01                       |
| <i>Microtus pinetorum</i>             | 0                 | 0                          | 12                      | 0.04                       |
| <i>Cryptotis parva</i>                | 0                 | 0                          | 6                       | 0.02                       |
| <i>Synaptomys cooperi</i>             | 0                 | 0                          | 1                       | 0.002                      |
| Total                                 | 276               |                            | 1224                    |                            |

used. They were chosen from among the 1,640,331 possible plots of that size in Vigo County using a random number table. Of these 500 plots, traps were actually set in 429 plots (Whitaker 1967). Most of the other 71 plots could not be studied because they happened to occur where buildings, roads, railroads, bodies of water, or barnyards were located. In three cases, permission to trap was denied. Fifty-four of the plots were in the Wabash River bottomlands, including land in and near the floodplain (Table 1, Fig. 1).

In each plot, 25 snap-back mousetraps baited with peanut butter were set in five lines of five traps, with 5 m between each trap, and

2.5 m between the outer traps and the edge of the plot. Traps were checked each day for three consecutive days, then removed, hence each plot was represented by 75 trap-nights (TN) of effort. Plot sampling occurred between 1962 and 1965 and throughout the year, about four plots per week. Traps in plots were checked for three days after they were set.

The plots were chosen completely at random, and habitats were divided into 15 categories assessed at the time of trapping: upland woods, river bottom woods, brush, brushy field, weedy field, grassy field, pasture, corn, corn stubble, soybeans, soybean stubble, winter wheat, wheat stubble, plowed field, and

Table 2.—Bats of Prairie Creek, the Wabash River basin south of Vigo County, and the Ohio River basin of southwestern Indiana. Posey County was included in the Wabash basin, not the Ohio basin. Actual numbers are given first, the number per netting in parentheses.

|                                  | Prairie Creek | Wabash basin | Ohio basin | Total       |
|----------------------------------|---------------|--------------|------------|-------------|
| Number nettings                  | 176           | 36           | 37         | 249         |
| <i>Nycticeius humeralis</i>      | 558 (3.17)    | 38 (1.06)    | 0          | 596 (2.39)  |
| <i>Eptesicus fuscus</i>          | 254 (1.44)    | 30 (0.83)    | 31 (0.84)  | 315 (1.27)  |
| <i>Myotis septentrionalis</i>    | 237 (1.34)    | 39 (1.08)    | 26 (0.7)   | 299 (1.20)  |
| <i>Lasiurus borealis</i>         | 131 (0.74)    | 32 (1.17)    | 45 (1.22)  | 208 (0.88)  |
| <i>Myotis lucifugus</i>          | 114 (0.64)    | 36 (1.0)     | 13 (0.35)  | 162 (0.65)  |
| <i>Pipistrellus subflavus</i>    | 92 (0.52)     | 21 (0.58)    | 39 (1.05)  | 151 (0.61)  |
| <i>Myotis sodalis</i>            | 49 (0.28)     | 9 (0.25)     | 0          | 58 (0.23)   |
| <i>Lasionycteris noctivagans</i> | 3 (0.20)      | 0            | 0          | 3 (0.01)    |
| <i>Lasiurus cinereus</i>         | 1 (0.006)     | 3 (0.08)     | 1 (0.03)   | 5 (0.02)    |
| <i>Myotis grisescens</i>         | 0             | 0            | 9 (0.24)   | 9 (0.04)    |
| Totals                           | 1439 (8.15)   | 208 (5.78)   | 164 (4.43) | 1811 (7.26) |

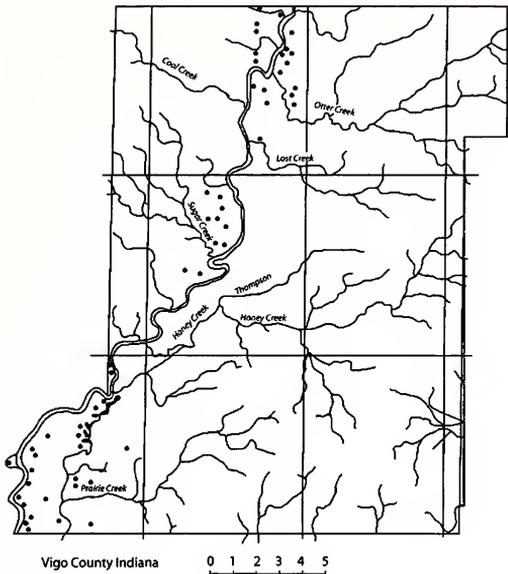


Figure 1.—Randomly-selected small mammal plots ( $n = 54$ ) in the Wabash River bottoms of Vigo County.

other cultivated fields. Cover was assessed separately for each plot at the time of trapping. In poor cover, the ground was open. A mouse would be exposed all or most of the time it was on the surface. Fair cover was assessed if a mouse would be exposed much of the time but would have some hiding places. In good cover, the ground was generally covered with vegetation and a mouse would be hidden most of the time it was on the surface. Corn, soybean, and wheat stubble, along with plowed ground, normally had poor cover. Corn, wheat, and soybeans might have had poor, fair or good cover depending on the time of year of trapping and also the amount of other vegetation present.

The individual cover assessments were applied in determining the relationship of small mammals to cover. All species showed a positive relationship to herbaceous ground cover except the prairie deer mouse which uses the soil as cover and showed a negative association with cover. There were 54 plots in the Wabash River bottoms as defined by the glacial Wabash River bottoms. Most of these plots were flooded when the Wabash River flooded. There were 375 plots in the rest of Vigo County which were termed the "up-

lands." More details may be found in Whitaker (1967).

Mist nets were used for bats (Fig. 1), usually over streams, but sometimes in old roads or other areas which might have served as flyways. Nets were normally used for 5 h starting at dusk. Netting occurred in the lower Wabash and Ohio river basins from 1992 to 1999 (Whitaker & Gummer 2001). Netting at Prairie Creek occurred from 1993 through 1997 (Whitaker 1997, 2004). Netting generally occurred one night per site, and between 15 May and 15 August.

## RESULTS

**Small terrestrial mammals.**—The most abundant small mammals in the Wabash bottomlands of Vigo County were the house mouse (*Mus musculus*), the white-footed mouse (*Peromyscus leucopus*), the prairie deer mouse (*Peromyscus maniculatus bairdii*), and the meadow vole (*Microtus pennsylvanicus*) (Table 1). The house mouse, white-footed mouse and meadow vole were taken at significantly greater rates in the bottoms than in the uplands ( $\chi^2 = 34.7, 36.3$  and  $154.1$  df). The prairie deer mouse occurred at a significantly greater rate on the uplands than in the bottoms ( $\chi^2 = 6.01, 1$  df). The short-tailed shrew (*Blarina brevicauda*) was taken at similar rates on the uplands and the bottoms, but the sample size was too small to test. The prairie vole (*Microtus ochrogaster*) was taken at a similar rate in the bottoms and in the uplands. The masked shrew (*Sorex cinereus*) and the meadow jumping mouse (*Zapus hudsonius*) were taken sparingly in the bottoms and in the uplands. The woodland vole (*Microtus pinetorum*), least shrew (*Cryptotis parva*), and the bog lemming (*Synaptomys cooperi*), were taken in low numbers in the uplands, but none were taken in the bottoms. It is noteworthy that three masked shrews were taken in the bottoms and only one was taken in a much greater amount of trapping in the uplands. French (1980) found the masked shrew (*Sorex cinereus*) on the lowlands of Vigo County, and the southeastern shrew (*Sorex longirostris*) on the uplands. This is particularly interesting since to the southeast of Vigo County in the unglaciated hill country—the only part of the state where the masked shrew does not occur—the southeastern shrew occurs mostly on the lower part of the ravines (Cudmore &



Figure 2.—Localities where mist-netting for bats occurred at Prairie Creek ( $n = 176$ ) in the lower Wabash River Valley ( $n = 36$ ) and in the Ohio River Valley ( $n = 37$ ). Large black circles indicate more than one netting occurred.

Whitaker 1984). The unglaciated hill country is the only part of the state where the pygmy shrew (*Sorex hoyi*) and smoky shrew (*Sorex fumeus*) occur, and they are mainly on the upper parts of the ravines.

The most abundant species of small mammal in Vigo County in the early 1960's was the house mouse (Table 1) (totalling 541), followed by the prairie deer mouse ( $n = 495$ ). However, the prairie deer mouse occurred at a slightly greater rate in the uplands than in the bottoms. Nearly all of the house mice were taken in weedy or grassy fields or corn or soybeans (Table 3), where there was much herbaceous ground cover (often of grasses, especially foxtail grass, *Setaria faberi*). As soon as the ground cover was removed by mowing or harvesting, the house mice were gone, as indicated by their absence in areas with little ground cover (Whitaker 1967). Presumably they moved to other areas with adequate

ground cover. One major change has occurred in farming methods since this study was carried out. In the late 1960's and early 1970's, farmers began to use herbicides in many of the cultivated fields. This has greatly reduced the grassy and weedy plants in the corn and soybeans. We hope to repeat the earlier studies to determine if there have been changes in the small mammal community, and particularly if the house mouse has been reduced as a result of the use of herbicides. All species except the prairie deer mouse were more abundant in greater amounts of cover. The prairie deer mouse occurred at greater rates in less herbaceous ground cover, 1.24/100 trap nights (TN) in good cover, 1.95/100 TN in plots with fair cover, and 2.50/100 TN in plots with poor cover (Whitaker 1967). Deer mice use the soil, rather than vegetation, as cover.

The main species of small mammals were compared by habitat as they occurred in the

Table 3.—Occurrence of the main small mammals in the major habitats of the Wabash River bottoms and uplands in Vigo County, Indiana. (TN = trap-night, 1 trap per 1 night) The data in this table do not agree with those in Table 1 because only plots the major habitats are included.

|                                | River bottoms |           |          | Uplands      |           |          |
|--------------------------------|---------------|-----------|----------|--------------|-----------|----------|
|                                | # Plots (TN)  | # Animals | #/100 TN | # Plots (TN) | # Animals | #/100 TN |
| <i>Peromyscus leucopus</i>     |               |           |          |              |           |          |
| Woods                          | 12 (900)      | 38        | 4.2      | 54 (4050)    | 65        | 1.6      |
| Weedy field                    | 8 (600)       | 18        | 3.0      | 21 (1575)    | 19        | 1.2      |
| Grassy field                   | 5 (525)       | 20        | 5.3      | 28 (2100)    | 10        | 0.1      |
| Corn                           | 12 (900)      | 0         | 0        | 26 (1950)    | 31        | 1.6      |
| Corn stubble                   | 6 (450)       | 1         | 0.2      | 44 (3300)    | 1         | 0.03     |
| Soybeans                       | 1 (75)        | 0         | 0.0      | 15 (1125)    | 4         |          |
| Plowed field                   | 6 (450)       | 0         | 0        | 42 (3150)    | 5         | 0.2      |
| <i>Peromyscus maniculatus</i>  |               |           |          |              |           |          |
| Woods                          | 12 (900)      | 0         | 0        | 54 (4050)    | 0         | 0        |
| Weedy field                    | 8 (600)       | 10        | 1.7      | 21 (1575)    | 28        | 0.6      |
| Grassy field                   | 5 (525)       | 2         | 0.5      | 28 (2100)    | 24        | 0.2      |
| Corn                           | 12 (900)      | 13        | 1.4      | 26 (1950)    | 22        | 1.1      |
| Corn stubble                   | 6 (450)       | 6         | 1.3      | 44 (3300)    | 38        | 1.2      |
| Soybeans                       | 1 (75)        | 1         | 1.3      | 15 (1125)    | 34        | 3.0      |
| Plowed field                   | 6 (450)       | 12        | 2.7      | 42 (3150)    | 74        | 2.3      |
| <i>Mus musculus</i>            |               |           |          |              |           |          |
| Woods                          | 12 (900)      | 2         | 0.2      | 54 (4050)    | 0         | 0        |
| Weedy field                    | 8 (600)       | 49        | 8.2      | 21 (1575)    | 14        | 0.9      |
| Grassy field                   | 5 (525)       | 12        | 3.2      | 28 (2100)    | 62        | 0.6      |
| Corn                           | 12 (900)      | 38        | 4.2      | 26 (1950)    | 101       | 5.2      |
| Corn stubble                   | 6 (450)       | 0         | 0        | 44 (3300)    | 25        | 2.2      |
| Soybeans                       | 1 (75)        | 10        | 2.2      | 15 (1125)    | 68        | 2.1      |
| Plowed field                   | 6 (450)       | 0         | 0        | 42 (3150)    | 1         | 0.03     |
| <i>Microtus ochrogaster</i>    |               |           |          |              |           |          |
| Woods                          | 12 (900)      | 0         | 0        | 54 (4050)    | 0         | 0        |
| Weedy field                    | 8 (600)       | 0         | 0        | 21 (1575)    | 20        | 1.3      |
| Grassy field                   | 5 (525)       | 7         | 1.9      | 28 (2100)    | 18        | 0.2*     |
| Corn                           | 12 (900)      | 0         | 0        | 26 (1950)    | 3         | 0.2      |
| Corn stubble                   | 6 (450)       | 2         | 0.4      | 44 (3300)    | 0         | 0        |
| Plowed field                   | 6 (450)       | 0         | —        | 42 (3150)    | 0         | —        |
| <i>Microtus pennsylvanicus</i> |               |           |          |              |           |          |
| Woods                          | 12 (900)      | 1         | 0.1      | 54 (4050)    | 0         | 0        |
| Weedy field                    | 8 (600)       | 3         | 0.5      | 21 (1575)    | 1         | 0.06     |
| Grassy field                   | 5 (525)       | 14        | 3.7      | 28 (2100)    | 2         | 0.02     |
| Corn                           | 12 (900)      | 0         | —        | 26 (1950)    | 0         | —        |
| Corn stubble                   | 6 (450)       | 2         | 0.4      | 44 (3300)    | 0         | —        |
| Plowed field                   | 6 (450)       | 0         | 0.0      | 42 (3150)    | 0         | 0.0      |
| <i>Blarina brevicauda</i>      |               |           |          |              |           |          |
| Woods                          | 12 (900)      | 2         | 0.2      | 54 (4050)    | 17        | 0.42     |
| Weedy field                    | 8 (600)       | 0         | 0        | 21 (1575)    | 0         | 0        |
| Grassy field                   | 5 (525)       | 0         | 0        | 28 (2100)    | 2         | 0.02     |
| Corn                           | 12 (900)      | 1         | 0.1      | 26 (1950)    | 0         | 0.0      |
| Corn stubble                   | 6 (450)       | 0         | 0.0      | 44 (3300)    | 0         | 0.0      |
| Plowed field                   | 6 (450)       | 0         | 0        | 42 (3150)    | 0         | 0        |

bottoms and in the uplands (Table 3). The house mouse was more abundant (number per 100 TN) in weedy fields and grassy fields in the bottoms, but was slightly more abundant in corn fields in the uplands than in the bottoms. The white-footed mouse was far more abundant in its main habitats (woods, grassy field, and weedy field) in the bottoms than in the uplands. The prairie deer mouse was more abundant on the uplands (number per 100 TN) than on the bottoms, and this was primarily due to effects from soybeans, as this species occurred at greater rates in the bottoms in all other habitats. There was only one soybean plot in the bottoms.

**Bats.**—All nine species of bats that were likely to occur in the Prairie Creek area and in the lower Wabash did occur there (Table 2). Of particular interest is the evening bat (*Nycticeius humeralis*). Some 40 years ago there were 10 colonies of evening bats in Indiana and one in adjacent Illinois (Whitaker & Gummer 2003). All were in buildings, and they were spread over southern Indiana. We checked all of the roosts; and, also, we netted near all of them. We located one colony in 1987 in a church in Clay County (Whitaker & Gummer 2003; Clem 1992). All these colonies appeared to be gone as of 1993, and we knew of no evening bats in Indiana. However, on 25 July 1994, we netted 15 bats of six species at Prairie Creek, and these included six evening bats and one Indiana bat, indicating this locality was worthy of more sampling. Since then we have sampled on many more evenings there. The evening bat is the most abundant bat in that community. We radio-tagged one of the first ones captured, and checked every building in the area without success. Finally we checked the woods (this is probably the largest woods in the lower Wabash River Valley at about 650 contiguous ha) and found the roost tree. About 350 evening bats came out of the tree that night. From then on, we have not found any more evening bats roosting in buildings in Indiana. It is possible that the big brown bat has out-competed the evening bat for roosts in buildings. Numerous evening bats occur at Prairie Creek, but we netted only females and juveniles there. The evening bat also occurs along the Wabash south to Posey County where it is quite common. However, in Posey County in extreme southern Indiana, there are both male and fe-

male adults. It is suspected that extreme southern Indiana, where adults of both sexes occur, is the northern edge of the hibernating range of this species, and we further suspect that they may hibernate in trees there. After the evening bat, the most common species of bat at Prairie Creek was the big brown bat. The big brown bats lived in buildings in the town of Prairie Creek about 5 km to the south. Adults flew from the town to the study area daily, and after the young became volant they established a postmaternity colony there. The third, fourth and fifth most abundant bats in the Prairie Creek community were the northern myotis, the red bat, and the little brown myotis, all relatively common species over much of the state. These were followed by the eastern pipistrelle and Indiana myotis, both of which roosted in the study area. Only three silver-haired bats were captured, along with one hoary bat.

**Larger mammals.**—Little work has been done specifically on the larger mammals of the Wabash River bottoms. However, mention must be made of swamp rabbits (*Sylvilagus aquaticus*), one of our most endangered mammals in Indiana. The swamp rabbit once occurred in six southwestern Indiana counties; but, currently, nearly all of them occur in the northern (Long Pond) and southern (Pearl Island) portions of Gibson County (Whitaker & Abrell 1986). They used to be a favorite animal for hunting, but the season has been closed for several years. Terrel (1972) found that their main populations were in the vicinity of Cane Ridge (Gibson County). However, those populations were mostly eliminated by the construction of Gibson Lake. In winter, this species often defecates on logs, and Terrel (1972) found populations of about one swamp rabbit per 10 acres (4 ha) of area with rabbit pellets on logs. Using this value the current population appears approximately stable at about 80 rabbits in the state, mostly in Gibson County.

Coyotes (*Canis latrans*) are commonly heard during mist-netting studies at Prairie Creek; beavers (*Castor canadensis*), white-tailed deer (*Odocoileus virginianus*) and raccoons (*Procyon lotor*) are commonly observed in the Wabash River bottoms in the Prairie Creek area.

## DISCUSSION

Included in the Wabash Valley are at least 40 (70.2%) of the 57 mammal species occurring in Indiana: the opossum, 5 species of insectivores, 9 species of bats, both species of rabbits, 16 species of rodents, and 7 species of carnivores. Included are one federally-endangered bat (the Indiana myotis) and two state-endangered species (the evening bat and the swamp rabbit). The evening bat has the core of its Indiana population in the woods of the lower Wabash valley, and the entire Indiana swamp rabbit population (an estimated 80 rabbits) occurs along the Wabash mostly in Gibson County.

The study of small mammals from Vigo County using randomly-selected plots was done over 40 years ago. It thus forms baseline data, prior to the widespread use of herbicides, which can be compared to later data. We hope to repeat that study using the same plots to learn of changes since the early 1960's, particularly in view of the use of herbicides. Additional work can be done in the Prairie Creek area and along the entire lower Wabash. For example, we hope to determine whether southwestern Indiana is the northern part of the range of the evening bat, and where the Prairie Creek evening bats spend the winter. Also, we wish to determine if other bat species, such as the red bat, might winter there.

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