

MAMMALS OF WILLOW SLOUGH FISH AND WILDLIFE AREA, NEWTON COUNTY, INDIANA

John O. Whitaker, Jr.: Department of Life Sciences, Indiana State University, Terre Haute, Indiana 47809 USA

ABSTRACT. Forty-one of the 57 species of mammals known to occur in Indiana were documented at Willow Slough during these studies. The western harvest mouse (*Reithrodontomys megalotis*), not previously known from the state, apparently entered Indiana from Illinois at or near Willow Slough in 1969. Species not previously collected in Newton County were the least shrew (*Cryptotis parva*), the woodland vole (*Microtus pinetorum*), and the little brown myotis (*Myotis lucifugus*).

Keywords: Mammals, Willow Slough Fish and Wildlife Area, Indiana, Newton County

The Indiana Biological Survey of the Indiana Academy of Science is encouraging biological surveys of all public (state and federal) natural areas in the state. There is some previously published information on mammals of Willow Slough Fish and Wildlife Area in Mumford & Whitaker (1982); and, also, Whitaker & Mumford (1972) did a study on the western harvest mouse there. The author has taken his mammalogy classes to Willow Slough for many years. The purpose of this paper is to summarize our knowledge of the mammals currently inhabiting Willow Slough Fish and Wildlife Area in Newton County, Indiana, a preserve covering 4032 hectares (9956 acres) (Fig. 1).

METHODS

Indiana State University mammalogy classes have visited the Willow Slough Fish and Wildlife Area in alternate years for two-night sessions of small mammal trapping from 1967 through 2001. Most trips were in late April, but one (1971) was in May, and one (1969) was in August. Much of the trapping was in certain selected areas and was relatively similar from year to year. Favored trapping areas were 1) just north of parking area 4 along the west side of Northwinds Road, 2) a field ("rye" old-field) south of county road 100 N, about 1.7 mi. east of the Service Area, 3) east of parking area 2, the area of the old silo, and 4) the ditches along the patrol road. Most of the data for this paper came from those trips. During every trip, snap-traps were set for small mammals, with trap-nights numbering

from 900–3000 per trip. In addition, pocket gopher traps were set for pocket gophers (*Geomys bursarius*) which are common on the area, and mole traps were sometimes used. Observations were made of larger mammals during our trips, and the Willow Slough area manager, David Spitznagle, supplied some information on larger mammals. Additional data came from work in 1969 and 1970 on the western harvest mouse after it entered the area (Whitaker & Mumford 1972). Much of the harvest mouse trapping was done in the field mentioned above which had been planted to rye. This work yielded 10 species of small mammals. Also, five nights of bat mist-netting were done on the area in the summer of 1982.

RESULTS

Forty-one of the 57 species of mammals currently occurring in Indiana were recorded from Willow Slough Fish and Wildlife Area, Newton County, Indiana during studies from 1967 through 2001. Included was one state-endangered species, Franklin's ground squirrel, and one species of special concern, the plains pocket gopher. A total of 2025 mammals of 22 species was taken during our trapping efforts (Table 1), 1464 during the 18 class trips and 561 during the study on harvest mice (*Reithrodontomys*) in 1969–70 (Whitaker & Mumford 1972). Most of the bats were captured in mist-nets, and notes were taken on the larger species.

DIDELPHIMORPHIA

Didelphidae (opossums).—Virginia opossums, *Didelphis virginiana*, were common or

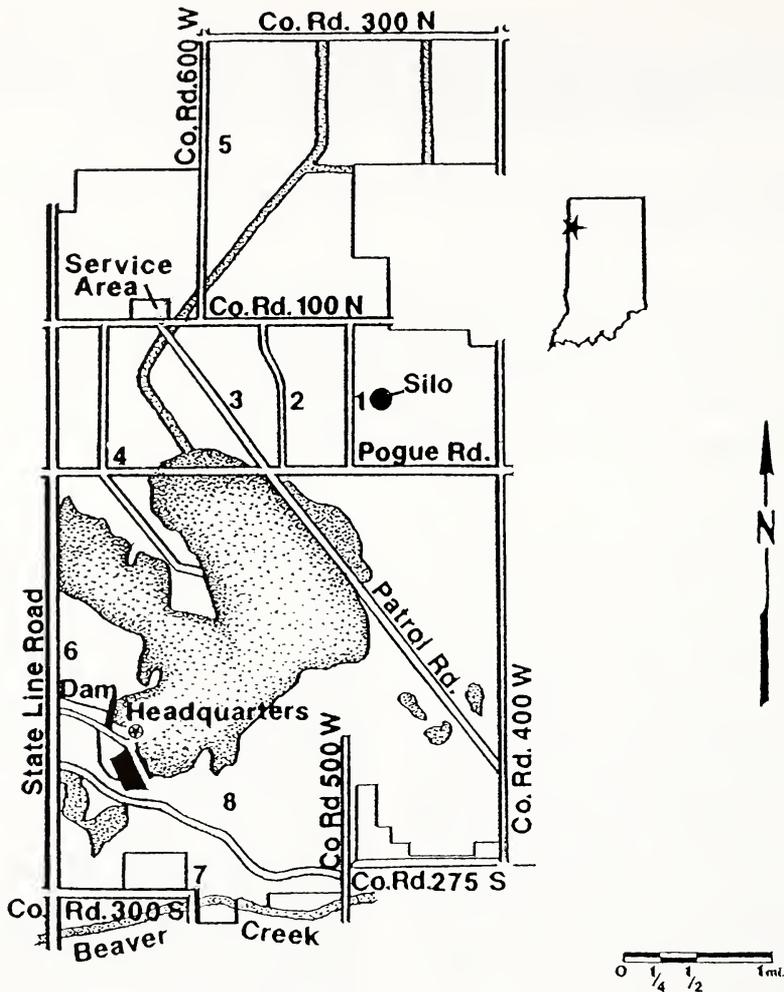


Figure 1.—Willow Slough Fish and Wildlife Area, in Newton County, Indiana, covers 4032 hectares. Stippled areas indicate major bodies of water. Numbers indicate some of the parking areas as reference points.

abundant at Willow Slough. They were often seen at night along roadsides.

INSECTIVORA

Soricidae (shrews).—Three species of shrews were collected at Willow Slough: 166 masked shrews (*Sorex cinereus*), 83 short-tailed shrews (*Blarina brevicauda*), and one least shrew (*Cryptotis parva*). The maximum number of masked shrews trapped during any one trip was 22, and masked shrews were trapped every trip but three. Most of the masked shrews were from moist old-fields, and along the edges of the numerous ditches and ponds; and some were from woods. Soil

moisture was critical, and a ground covering of moss often occurred where masked shrews were found. Although the soil was dry in the rye old-field where most of the harvest mice were trapped, 17 additional masked shrews were captured during that work. There is always the possibility that the pygmy shrew will occur in this part of the state, so the unicuspid of every long-tailed shrew were checked to be sure all were actually masked shrews and not pygmy shrews. The short-tailed shrew was one of only four species that was collected during every class trip. Like the masked shrew, the short-tailed shrew was taken mostly in moist habitats. The least shrew is less

Table 1.—Small mammals of Willow Slough Fish and Wildlife Area, Newton County, Indiana taken during 18 class field trips (3 per period) and during study of western harvest mouse, 1969–1970.

| | Harvest mouse study 1969–70 | Years of class field trips | | | | | | Class trip total | Grand total |
|----------------------------------|--------------------------------------|----------------------------|--------|-------|-------|-------|-------|------------------------|----------------|
| | | 67–71 | 73–77 | 79–83 | 85–89 | 91–95 | 97–01 | | |
| <i>Sorex cinereus</i> | 17 | 9 | 35 | 31 | 40 | 26 | 8 | 149 | 166 |
| <i>Blarina brevicauda</i> | 15 | 19 | 11 | 10 | 7 | 7 | 14 | 68 | 83 |
| <i>Cryptotis parva</i> | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| <i>Scalopus aquaticus</i> | 0 | 3 | 1 | 5 | 0 | 7 | 3 | 19 | 19 |
| <i>Peromyscus leucopus</i> | 53 | 63 | 157 | 75 | 80 | 78 | 46 | 499 | 552 |
| <i>Peromyscus maniculatus</i> | 194 | 15 | 41 | 25 | 8 | 35 | 27 | 151 | 345 |
| <i>Reithrodontomys megalotis</i> | 170 | 15 | 45 | 11 | 19 | 7 | 6 | 103 | 273 |
| <i>Microtus pennsylvanicus</i> | 14 | 33 | 72 | 44 | 36 | 26 | 25 | 236 | 250 |
| <i>Microtus ochrogaster</i> | 64 | 13 | 15 | 5 | 13 | 4 | 5 | 55 | 119 |
| <i>Microtus pinetorum</i> | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 2 | 2 |
| <i>Ondatra zibethicus</i> | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| <i>Synaptomys cooperi</i> | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| <i>Mus musculus</i> | 32 | 9 | 0 | 4 | 1 | 0 | 0 | 14 | 46 |
| <i>Zapus hudsonicus</i> | 0 | 10 | 2 | 0 | 2 | 2 | 3 | 19 | 19 |
| <i>Geomys bursarius</i> | 0 | 17 | 31 | 18 | 16 | 11 | 8 | 101 | 101 |
| <i>Glaucomys volans</i> | 0 | 0 | 0 | 5 | 4 | 13 | 10 | 32 | 32 |
| <i>Tamiasciurus hudsonicus</i> | 0 | 0 | 0 | 1 | 1 | 0 | 2 | 4 | 4 |
| <i>Tamias striatus</i> | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 2 |
| <i>Spermophilus franklinii</i> | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| <i>Sylvilagus floridanus</i> | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 5 | 5 |
| <i>Myotis lucifugus</i> | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 |
| <i>Eptesicus fuscus</i> | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 |
| Total | 561 | 211 | 413 | 234 | 230 | 217 | 159 | 1464 | 2025 |
| Trap-nights | 14,484 | 6688 | 11,870 | 5782 | 6850 | 5510 | 3625 | 40,325 | 54,809 |

common in northern than in southern Indiana and was rather uncommon at Willow Slough. Unlike most shrews, it occurs in drier open fields. No least shrews were taken during the class field trips (Table 1). However, one was taken 5 December 1970 in the rye old-field during the *Reithrodontomys* study. It constitutes a new county record.

Talpidae (moles).—One species of mole, the eastern mole *Scalopus aquaticus*, occurs at Willow Slough. Only 17 individuals were caught, but the species is common. Numerous fresh burrows were seen every trip, and we could have taken any number if we had trapped for them regularly. Burrows were common in open sandy fields, and were especially obvious across the plowed fire lanes, and some burrows extended into the woods.

CHIROPTERA

Vespertilionidae (mouse-eared bats).—Four species of bats were caught by mist-netting at Willow Slough: 27 little brown myotis,

17 big brown bats, 6 red bats, and 1 hoary bat. These are the first records of the little brown myotis in Newton County.

LAGOMORPHA

Leporidae (rabbits and hares).—The eastern cottontail (*Sylvilagus floridanus*) is the only rabbit occurring at Willow Slough and is very common. Hunters harvested 13,755 rabbits there between 1955, the first rabbit season at Willow Slough, and 2002.

RODENTIA

Sciuridae (squirrels).—All eight species of squirrel known from Indiana have been found at Willow Slough. Eastern chipmunks (*Tamias striatus*) are not very common (only two taken during our work, Table 1). However, they are becoming more common in woodlots as the amount of woods increases. We have not seen any woodchucks (*Marmota monax*) during our work. Willow Slough personnel stated that woodchucks have declined

and are now rare, and that sometimes years go by without a single observation. The apparent decline is probably because of the increase of the coyote. The thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*) is common along roadsides in the general area of Willow Slough, but it is not very common at Willow Slough itself. There are a few in the southeast corner of the property. We have seen two individuals, but have not captured any. Franklin's ground squirrel (*Spermophilus franklinii*) is considered as endangered in Indiana, but we captured two at Willow Slough, both in 1971 and both by hand. One was in a large grassy old-field north of the Enos Road, the other was in a brush pile in the north end of the property. Another was seen by Willow Slough personnel in the southeastern part of the property in the 1980s. It is not known whether this species still exists at Willow Slough.

The fox squirrel (*Sciurus niger*), is the common tree squirrel at Willow Slough. A total of 24,670 squirrels was harvested from 1956, the first open season on squirrels at Willow Slough, through 2002. Nearly all were fox squirrels. The gray squirrel (*Sciurus carolinensis*) is rare at Willow Slough, although several were seen in the campground in 2002. Seldom more than one or two are harvested in a year. Red squirrels (*Tamiasciurus hudsonicus*) are common at Willow Slough. We have collected only four during our class trips, but they are frequently seen around the headquarters area and can be found in many of the pine plantings. Southern flying squirrels (*Glaucomys volans*) are quite common. We captured 24 during class trips (Table 1). Also, we often saw flying squirrels at dusk moving about in the black oaks across the road north of the rye field. In a separate study on flying squirrels, we found many by tapping on dead tree stumps. Most stumps were about 2–4 m high, and nearly all contained woodpecker holes. When a snout would protrude after the tapping we would allow the squirrel to go back inside while we determined how to capture it. Often we were able to cover the opening, then cut off the top of the stump and retrieve nest and squirrel.

Geomysidae (pocket gophers).—The plains pocket gopher (*Geomys bursarius*) is listed as special concern in Indiana. However, it reaches its greatest abundance in Indiana in the Willow Slough area (Mumford & Whitaker

1982; Thorne 1989). Numerous mounds were always present, although only the freshest ones yielded gophers in our traps. We trapped 101 gophers during the 18 class trips (Table 1). Plains pocket gophers seldom leave their burrows, thus are presumably seldom caught by predators. We did find one individual which had apparently been taken by a predator. Only its skin was present, and it was on top of the ground. In another case a gopher snake (*Pituophis melanoleucas*) was stretched out next to a fresh gopher mound, with its nose and about 15 cm of its body burrowed into the mound.

Castoridae (beavers).—On several occasions, American beavers (*Castor canadensis*) were seen in the ditches. Trappers take up to 15–20 beavers at Willow Slough in some years. Once I dug into two lodges. There was a ledge inside with an opening to the water on one side, but I was surprised to find no nesting material.

Muridae: Sigmodontinae (New World mice).—Three species of New World mice occur at Willow Slough. The white-footed mouse (*Peromyscus leucopus*) is probably the most abundant mammal there. A total of 552 was taken during our studies, most in woods and brushy areas; but a number, especially younger individuals, were taken in open fields. The prairie deer mouse (*Peromyscus maniculatus bairdii*) in Indiana is most common in open areas – it is the only small mammal that is significantly more abundant in open areas than in areas with more ground cover such as cultivated fields, dunes, and early seral stage strip-mined areas (Whitaker 1967). It is not as common as *P. leucopus* except in such areas, but 151 individuals were taken during the class trips; and 194 were taken during the harvest mouse work. Many of these were taken in cultivated areas or dry open field. In the rye old-field, two prairie deer mice were taken early, while the field was still densely vegetated; but more were taken later as the rye, which served as the cover, died out.

The most interesting capture during our work was the western harvest mouse (*Reithrodontomys megalotis*). None had ever been captured in Indiana until we captured four at Willow Slough on 16–17 August 1969, at three different sites (Whitaker & Sly 1970). Previous records were 185 km to the west in

Whiteside, Stark and Carroll counties, in northwestern Illinois (Whitaker & Mumford 1972). It seems clear that this species had recently entered Indiana from Illinois, as a great deal of trapping had occurred at Willow Slough prior to this work; and none were caught earlier. However, after this, 103 were caught in 18 class trips. The largest numbers were taken in 1971, 1973 and 1975, and then numbers were generally lower, with none being taken in five of the following years. The decrease in numbers occurred as the rye disappeared and the field changed from a field containing excellent cover to a dry old-field with much less cover. Another 170 harvest mice were trapped in 1969 and 1970 and examined for food, parasites and reproductive data (Whitaker & Mumford 1972).

Muridae: Arvicolinae (voles).—Counting the muskrat, all five species of voles of Indiana occur at Willow Slough. The meadow vole (*Microtus pennsylvanicus*) is common in northern Indiana in lush grassy habitats, and was taken on every trip. The little criss-crossed piles of grass stems left by this species were common in some years. A total of 250 individuals was taken. The prairie vole (*Microtus ochrogaster*) is much more abundant in southern than northern Indiana; and, accordingly, only 55 individuals were taken during class trips (Table 1). We only captured two woodland voles (*Microtus pinetorum*) during our studies, but we did not often take the time to sink traps into their underground burrows. This is the first record of the woodland vole in Newton County. No southern bog lemmings (*Synaptomys cooperi*) were taken during the class trips, but one was taken during the harvest mouse study.

The muskrat (*Ondatra zibethicus*) is common in ditches and marshes at Willow Slough. Some individuals living along the ditches use bank burrows, but the larger marshy areas contain numerous muskrat lodges. The highest muskrat populations occurred with increased cattails soon after a large shallow lake was built in 1951 (Fig. 1). Thousands were taken by trappers. Over the years cattails and muskrats have declined, although after each lake renovation, cattails are restored and muskrats abound.

Muridae: Murinae (Old World rats and mice).—Relatively few (46) house mice (*Mus musculus*) were collected. The house mouse is

common in cultivated fields, especially when much ground cover is present (Whitaker 1967); but few of our traps were in cultivated fields. Most house mice were taken in the rye when it still formed ample cover. We took no Norway rats (*Rattus norvegicus*), but we did not often use rat traps in areas where rats were likely to occur. However, area personnel have seen relatively few.

Dipodidae: Zapodinae (jumping mice).—The meadow jumping mouse (*Zapus hudsonius*) is quite common in grassy fields at Willow Slough. Only 14 were caught because most of the trips were in April. The species does not start emerging from hibernation until about April 20, so the small number of captures is not surprising. Later in the season (May 1971) five were taken on one trip.

CARNIVORA

Canidae (dogs, foxes and coyotes).—The coyote (*Canis latrans*) has become abundant at Willow Slough which parallels the situation in the state over the past 15 years. Coyotes are frequently encountered by deer and turkey hunters, who harvest about 15–20 coyotes per year. We saw the den and pups of a red fox (*Vulpes vulpes*) in a large dirt mound just southeast of the junction of the Patrol Road and Pogue Road, and Willow Slough personnel have seen several dens. However, it appears that red foxes have mostly been replaced by the coyote, as has occurred elsewhere in the state. The gray fox (*Urocyon cinereoargenteus*) is very infrequent. I have not seen any, and Willow Slough personnel have seen very few.

Procyonidae (raccoons).—Raccoons (*Procyon lotor*) are very common at Willow Slough. They were often seen crossing the road or dead on the road. About 400 are harvested each year.

Mustelidae (weasels and allies).—The least weasel (*Mustela nivalis*) appears to be rare at Willow Slough. None were seen during this study, and Willow Slough personnel have seen only two there, one west of the Service Area and one dead on the road on 100 N. It would seem that long-tailed weasels (*Mustela frenata*) would be fairly common at Willow Slough, but we have seen only three. The mink (*Mustela vison*) is relatively common. One year one was seen in late afternoon carrying a muskrat it had apparently just killed.

The mink population may rise and fall with the cattail population, along with muskrats, a common food of the mink. At another time, after much rain, several minks were seen in late afternoon. We felt that they had been flooded out of their burrows. Badgers (*Taxidea taxus*) are uncommon at Willow Slough, although they have been seen several times, mostly on the north end of the property, and several have been killed on Highway 41 within 10 km of Willow Slough.

Mephitidae (skunks).—We saw a striped skunk (*Mephitis mephitis*) walk across the field near where we had found the red fox den, but skunks are not common at Willow Slough. Roadkills are rarely seen, and hunters rarely report them.

ARTIODACTYLA

Cervidae (deer).—The first hunting season for white-tailed deer (*Odocoileus virginiana*) was held in 1962, when relatively few deer were present, and only 9 were taken. The number of deer killed over the years indicates the population buildup. The average numbers killed per year were 11 from 1962–65, 27 from 1966–70; 48 from 1971–75; 102 from 1976–80; 176 from 1981–85; and 249 from 1986–90. It then dropped to 205 from 1991–95, and 149 from 1996–2002.

DISCUSSION

Willow Slough contains a variety of habitats and at least 41 of the 57 species of mammals known in the state. Four species were taken on every class trip: the short-tailed shrew (*Blarina brevicauda*), eastern meadow vole (*Microtus pennsylvanicus*), plains pocket gopher (*Geomys bursarius*), and white-footed mouse (*Peromyscus leucopus*). The most abundant species taken was the white-footed mouse, with a total of 552 individuals. Other common species at Willow Slough taken or observed on most trips were the masked shrew (*Sorex cinereus*), prairie deer mouse (*Peromyscus maniculatus bairdii*), white-tailed deer (*Odocoileus virginiana*), red squirrel (*Tamiasciurus hudsonicus*), muskrat (*Ondatra zibethicus*), and cottontail rabbit (*Sylvilagus floridana*). Although not often sampled, the eastern mole (*Scalopus aquaticus*) is very common at Willow Slough, as evidenced by its numerous burrows. One southern bog lemming (*Synaptomys cooperi*)

and one least shrew (*Cryptotis parva*) were taken during the class trips. All species of squirrels of Indiana are present; although the woodchuck is rare, and Franklin's ground squirrel may be extirpated.

The most interesting capture was of the western harvest mouse. It had never been taken in the state previously, although much prior trapping had occurred at Willow Slough. It appears that the species first moved into the state from Illinois at or near Willow Slough in 1969, and found a large rye field there to be excellent habitat. It then probably dispersed out in large numbers from this center.

The two common voles in grassy fields of Indiana are the meadow vole (*M. pennsylvanicus*) and the prairie vole (*M. ochrogaster*). The meadow vole is more abundant in the northern part of the state and in more lush, moist habitats, whereas the prairie vole is more abundant in the southern part of the state and in drier, more sparsely vegetated grassy fields. The meadow vole was by far the most abundant of the two voles at Willow Slough because of the lush grassy vegetation, and since Newton County is in the northern part of the state. Pine voles and bog lemmings are present, but their abundance is not known.

The beaver, the deer and the coyote were all in low numbers earlier, but all have increased dramatically at Willow Slough as they have in other parts of the state since the 1980s. The red fox, and probably the gray fox as well, appears to be decreasing.

The bobcat has been increasing in the state in recent years, and the otter has been reintroduced. Neither of these species has been found at Willow Slough. The pygmy shrew (*Sorex hoyi*) has been taken to the west in northern Illinois, thus could occur in Indiana. To date we have taken only four bat species. Bats that likely occur at Willow Slough, but that have not been taken, are the Indiana myotis (*Myotis sodalis*), the northern myotis (*M. septentrionalis*), and the silver-haired bat (*Lasiorycteris noctivagans*).

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staff who have helped with our work and our accommodations. David Pistole mist-netted for five nights for bats at Willow Slough, and he allowed use of his data.

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