

PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON

NOTES ON MAMMALS OF THE MIDDLE MISSISSIPPI
VALLEY, WITH DESCRIPTION OF
A NEW WOODRAT.

BY ARTHUR H. HOWELL.

The field work of the Biological Survey in 1909 included a survey of southeastern Missouri, southern Illinois and Indiana, and parts of Kentucky. This trip, accomplished between April 20 and July 15, resulted in the accumulation of much new information on the distribution of the mammals of the region, and since very little has been published concerning the mammals of any of the States visited, excepting Indiana,* it is considered desirable to place on record the more important results of the season's work.

Missouri was the first State visited, and after a few days spent near St. Louis—at Horseshoe Lake, St. Charles County (April 21, 22)—I proceeded to the interesting "sunken lands" of southeastern Missouri. Collections were made principally on the St. Francis River, west of Senath (April 25-30) and at Kennett (May 1, 2), Portageville (May 3, 4), and Cushion Lake (May 5-7). Short stops at Marble Hill (May 8-10) and at Cape Girardeau (May 11, 12) resulted in determining the upper limits of Lower Austral Zone in the State.

After crossing the Mississippi at Cape Girardeau, investigations were continued in Illinois at the following localities: McClure (May 13), Olive Branch (May 14-21), Cobden and Lick Creek (May 22), Wolf Lake (May 23-25), Riehl Station, near Alton (May 29, 30), Odin (June 4, 5), Olney (June 6-9), Kansas (June 10, 11), St. Francisville (June 12), Shawnee-

* See a valuable contribution by W. L. Hahn, on "The Mammals of Indiana," < 33d Ann. Rep. Dept. Geol. & Nat. Resources of Indiana, 1909, pp. 417-663.

town (June 17, 18), Golconda (June 19-21), and Reevesville (June 22).

In Indiana short stops were made at Cypress, Knox County (June 12), New Harmony (June 13-15), and Mt. Vernon (June 16).

In Kentucky collections were made at the following localities: Rockport (June 23, 24), Hawesville (June 25-28), Mammoth Cave (June 29-July 5), Midway (July 6-11), and Jackson (July 12-14).

The region visited during this trip forms the meeting place for Upper-and-Lower Austral Zones, and an effort was made to determine with some exactness the boundary between them. Lower Austral occupies the "sunken lands" and swampy river bottoms of southeastern Missouri and western Kentucky, extending north in Missouri as far as Whitewater and Cape Girardeau. A line drawn diagonally across the State through Poplar Bluff and Cape Girardeau will mark quite accurately the upper limit of Lower Austral in Missouri. In Illinois this zone covers the whole of the southern portion of the State from East Cape Girardeau to Golconda, with a narrow tongue along the Mississippi as far north as Grand Tower. In Kentucky the eastern limits of Lower Austral were not definitely determined, but it doubtless includes the greater part of the counties bordering the Mississippi River, and extends in a narrow belt along the Ohio as far as Berry Ferry (opposite Golconda, Illinois). All the rest of Kentucky is in Upper Austral Zone, excepting a few isolated mountain summits in the extreme eastern part of the State, where small areas of Transition appear.

Following is a list of the most characteristic Lower Austral species occurring in southern Illinois:

MAMMALS OF LOWER AUSTRAL ZONE.

<i>Peromyscus gossypinus</i>	<i>Sylvilagus aquaticus</i>
<i>Oryzomys palustris</i>	<i>Blarina brevicauda carolinensis</i>
	<i>Nycticeius humeralis.</i>

BIRDS OF LOWER AUSTRAL ZONE.

<i>Catharista urubu</i>	<i>Helinaia swainsoni</i>
<i>Antrostomus carolinensis</i>	<i>Protonotaria citrea</i>
	<i>Peucea aestivalis bachmani</i>

PLANTS OF LOWER AUSTRAL ZONE.*

<i>Taxodium distichum</i>	<i>Ulmus alata</i>
<i>Nyssa aquatica</i>	<i>Celtis mississippiensis</i>
<i>Quercus lyrata</i>	<i>Gleditsia aquatica</i>
	<i>Arundinaria tecta</i>

LIST OF MAMMALS.

Sciurus niger rufiventer Geoffroy.

FOX SQUIRREL.

Fox squirrels are fairly common locally over the whole of the region traversed.

Records were secured of their occurrence at the following localities:

Missouri: Horseshoe Lake, St. Charles County; Marble Hill; Cushion Lake (4 specimens).

Illinois: Wolf Lake; Olive Branch; Kansas; Golconda.

Indiana: New Harmony (1 specimen).

Kentucky: Hawesville; Mammoth Cave; Midway; Jackson.

Tamias striatus (Linnaeus).

CAROLINIAN CHIPMUNK.

Occurs in moderate numbers nearly everywhere excepting in the big swamps.

They were reported to me at the following localities:

Missouri: Marble Hill.

Illinois: Olive Branch; Wolf Lake (1 specimen); Woodlawn; Olney.

Indiana: New Harmony.

Kentucky: Rockport; Mammoth Cave (2 specimens); Midway; Jackson.

Marmota monax (Linnaeus).

WOODCHUCK; GROUND HOG.

The woodchuck occurs in the hilly portions of the Mississippi Valley States as far south at least as southern Illinois, southern Missouri, and western Kentucky.

Records were secured of their occurrence in the following localities:

Missouri: Meramec Highlands (15 miles southwest of St. Louis); Marble Hill.

Illinois: Shelbyville (specimen from there seen in a St. Louis taxidermist shop); Rich Station, near Alton; Woodlawn; Golconda; Olive Branch.

Indiana: New Harmony.

Kentucky: Mammoth Cave (1 specimen); Berry Ferry; Midway; Jackson.

* In this connection, see papers by Robert Ridgway on the native trees of the lower Wabash Valley, in Proc. U. S. N. M., V, pp. 49-88, 1882, and XVII, pp. 409-421, 1894.

Citellus tridecemlineatus (Mitchill).

STRIPED SPERMOPHILE; GROUND SQUIRREL.

This small ground squirrel is a prairie dweller, and is distributed locally over the northern parts of Illinois and Indiana. Hahn records it from various places in northern Indiana as far south as Terre Haute.* Its southern limit in Illinois was found to be close to the town of Kansas, where a small colony was located in a cemetery. Inquiries for the animal at Casey and Greenup, a little farther south, indicated that it does not occur there.

Specimens have been identified in the Biological Survey from the following localities:

Illinois: Hickory, Lake County; Sunbeam, Mercer County; Saxon, Henry County; Kishwaukee; Kansas; Argenta; Warsaw (specimen in U. S. Nat. Mus.).

Peromyscus gossypinus megacephalus (Rhoads).

WESTERN COTTON MOUSE.

This species is common in the swamps of the Lower Austral Zone and is frequently taken, also, in wooded bluffs in the same zone. It ranges north to southern Illinois and southeastern Missouri.

Specimens were collected at the following localities:

Missouri: St. Francis River (west of Senath), 8; Portageville, 1; Cushion Lake, 1.

Illinois: Olive Branch, 2; Wolf Lake, 1; Goleconda, 3.

Peromyscus maniculatus bairdi (Hoy & Kennicott).

PRAIRIE WHITE-FOOTED MOUSE.

Although mainly confined to prairie regions, this species has been taken occasionally in bottomland timber. Its range extends south to extreme southern Illinois.

Specimens were taken at the following localities:

Missouri: Horseshoe Lake, St. Charles County, 1.

Illinois: Riehl Station, near Alton, 1; Kansas, 3; Olive Branch, 1; McClure, 1.

Oryzomys palustris (Harlan).

RICE RAT.

This species is found throughout the Anstroriparian Fauna and its range extends also well into the Carolinian along streams.

It was taken for the first time in Missouri and Illinois and may be looked for as well in southern Indiana and Ohio.

Specimens were collected at the following localities:

Missouri: Kennett, 2; Portageville, 1; Marble Hill, 1.

Illinois: Olive Branch, 4.

*Thirty-third Ann. Rep. Dept. Geol. of Indiana, pp. 475-478, 1909.

Neotoma pennsylvanica Stone.

ALLEGHENY CAVE RAT.

This species may be found in suitable situations throughout the eastern part of Kentucky at least as far west as Mammoth Cave, and as far north as the Ohio River. It probably occurs, also, in the cliffs on the Indiana side of the river.

At Mammoth Cave they are numerous, both in the main cave and in a small cave known as the White Cave, but I found no signs of their presence about the cliffs and large rocks on the Green River hillside at this place. In the Mammoth Cave they are found as far back as one can penetrate. Two specimens were trapped at a point about $2\frac{1}{2}$ miles from the entrance, and others at the mouth of the cave. The rats enter the cave through the main entrance (which is the only known entrance) and possibly also through small crevices leading down from the cliffs or small caves on the Green River hillside. At various points in the cave their tracks are very abundant in the sand on the floor and there are numerous hard-packed trails running close to the walls and into side crevices. The great number of tracks doubtless gives an exaggerated idea of the abundance of the rats, for since there is nothing except human footsteps to obliterate the tracks, they may remain intact for a long period. Several large piles of rat excrement were noticed, but comparatively little rubbish had been brought in by the animals. Quite a few nut shells (hickory, acorns, and hazel nuts) were seen, but no green vegetation and no piles of sticks.

The guides frequently see the rats while in the cave, and as they are never disturbed they are very gentle and unsuspecting. They occasionally come about the tables in the dining hall in the cave and instances are reported of their having come regularly to be fed by the guides. The former manager of the Mammoth Cave estate once had a cave rat in captivity, and he discovered accidentally that not only could he handle it with impunity, but it actually enjoyed being stroked and seemed to become drowsy under the operation. This rat always chose vegetable food in place of meat when both were offered it.

In the White Cave, which is only about 200 yards long, and near the surface, I found the rats numerous and was able to observe their peculiar mode of living. In this cave they make small nests or "forms" of finely shredded cedar bark, just about the size and shape of a meadow lark's nest, though not arched over at all. These resemble closely the "forms" of the cottontail rabbit. I found five or six of these nests placed on the floor of the cave, close to the wall, and on a narrow ledge of rock near the ceiling. Some of them were occupied by the rats at the time, and several specimens were secured here. The only other material brought into this cave by the rats are small tips of cedar branches; these are strewn quite thickly around their nests and one large rock was completely covered with them. A few old nut shells were found also, but no leaves or branches of any tree but cedar (*Juniperus virginiana*). The cedar may have been brought in to be used as food, but none of it was found in the

stomachs of the rats taken here which have been examined. They were found to be filled with a finely chewed mass of fresh green vegetation, not identifiable, but certainly not cedar. The stomachs of the two individuals taken $2\frac{1}{2}$ miles back in Mammoth Cave contained fragments of apple, leaves, sorghum seeds and onion, a few small beetle larvae, fly larvae and bits of beetle.

At Hawesville, Kentucky, I found this species fairly numerous about the wooded cliffs along the river, and here, as at Mammoth Cave, very few sticks had been carried into the crevices, but freshly cut leaves and plants were observed in several places.

In the vicinity of Jackson, Kentucky, these rats are well known to the inhabitants and are apparently common about rocky ledges all through that region. They often come down about farm buildings located near the cliffs and are reported to do some damage in corn cribs. One specimen was trapped along a cliff close to a house at Lost Creek, Breathitt County.

***Neotoma floridana illinoensis* subsp. nov.**

ILLINOIS WOODRAT.

Type from Wolf Lake, Illinois. Adult female, No. 167,752, U. S. National Museum, Biological Survey Collection, January 12, 1910. John Johnson.

General characters.—Similar in color to *N. f. baileyi* but with longer and darker tail; skull nearest to that of *N. f. rubida* but slightly smaller.

Color.—Upperparts mixed buff and black, varying in some specimens to ochraceous buff; fore part of head and face gray; tail distinctly bicolor, blackish above, grayish-white below; feet pure white; underparts grayish-white with a tinge of yellow.

Cranial characters.—Skull slightly smaller than that of *rubida*; zygomata more widely spreading anteriorly, their sides nearly parallel; palate more deeply notched (the interpterygoid fossa less evenly rounded); sphenopalatine vacuities reduced to narrow slits.

From *baileyi* and *attwateri* the present form differs cranially in the same characters that distinguish it from *rubida* and in addition the rostrum and nasals are longer and slenderer.

Measurements.—Average of eight adults from type locality: total length, 430 (390–435); tail vertebrae, 195 (187–205); hind foot, 38 (36–40).

Remarks.—Woodrats of this group have not previously been taken in the Mississippi Valley bottomlands at any point north of Louisiana. It was quite a surprise, therefore, to find the animals in southern Illinois at the upper edge of the Lower Austral Zone. A few old signs and deserted nests of woodrats were found in the heavy timber along the St. Francis River, Missouri, but all efforts to trap specimens proved unsuccessful. The cliffs along the Mississippi River north of Alton, Illinois, and south of St. Louis, Missouri, were explored for signs of these animals, but no indications of their presence were discovered. They were also looked for unsuccessfully in the cliffs at Golconda, Illinois.

The animals are common at Wolf Lake, inhabiting the high rocky bluffs

which border the east side of the lake. They live in crevices and caves into which they carry large quantities of sticks, leaves, and other rubbish. Their habits in this locality are thus like those of *N. pennsylvanica* and unlike those of *rubida* in the Southern States where this species lives in swamps and builds its nests in hollow logs or trees and in the branches of trees some distance from the ground. The swamp conditions were present at this northern station, but the adjacent cliffs evidently proved more attractive to them, as is usually the case with the members of this genus.

Three adults and one young, all in worn pelage, were captured at Wolf Lake May 24, 25, and in January, 1910, eight more adults in full fresh pelage were secured by a local trapper.

***Microtus pennsylvanicus* (Ord).**

EASTERN MEADOW MOUSE.

The common meadow mouse occupies the bluegrass region of Kentucky, but was not found in other sections of the State. It was rather common at Midway, where specimens were taken, and Dr. Mearns has also taken them at Lexington. Their range probably does not extend much farther south or west than this. None were found in southern Illinois or in the Wabash Valley in Indiana. Hahn records the species, however, from Bloomington and Bascom, Indiana.*

***Microtus ochrogaster* (Wagner).**

PRAIRIE MEADOW MOUSE.

This is the common meadow mouse of the upper Mississippi Valley, at least as far south as southern Illinois and Missouri. Unlike the eastern species (*M. pennsylvanicus*) they prefer dry situations, and are frequently found in matted grass along roadsides and in old meadows. They have not as yet been taken in Kentucky, but in a grass field at Mammoth Cave I found a few mouse signs which I believe were made by this species. Hahn records the species from various points across the State of Indiana,† and Langdon speaks of them as common in the vicinity of Cincinnati.‡

Specimens were taken at the following localities:

Missouri: Horseshoe Lake, 6; Marble Hill, 3.

Illinois: Olive Branch, 3; Wolf Lake, 1; McClure, 1; Odin, 2; Olney, 2;

Kansas, 2.

***Fiber zibethicus* (Linnaeus).**

MUSKRAT.

Musk rats are common on all the streams in the region visited, particularly in the St. Francis River, Missouri, and on Horseshoe Lake (near Olive Branch), Illinois. Many thousands are trapped here every winter, but at the time of my visit (April and May) their numbers had been greatly reduced and they were very shy and difficult to secure. A few breeding

* Mammals of Indiana, 33d Ann. Rep. Dept. Geol. & Nat. Resources of Indiana, pp. 506, 507, 1909.

† Mammals of Indiana, l. c. pp. 509, 510.

‡ Journ. Cincinnati Soc. Nat. Hist., III, p. 307, 1880.

dens built under the roots of large tupelos or eypresses growing in deep water, were examined, but only one young muskrat was caught. During the winter the rats build numerous large houses in the lakes or marshes, but by spring these dens are usually all destroyed or carried away by high water.

Five specimens, taken in Horseshoe Lake, Illinois, in December, agree very closely with September specimens of *zibethicus* from Massachusetts.

Muskrats were reported to occur at the following localities:

Missouri: Horseshoe Lake, St. Charles County; St. Francis River; Cushion Lake; Marble Hill.

Illinois: Olive Branch; Wolf Lake; Woodlawn; Olney; Kansas; Shawneetown.

Kentucky: Midway; Mammoth Cave; Jackson.

Synaptomys gossi Merriam.

GOSS LEMMING MOUSE.

This species, previously known only from Kansas, was found in numbers at Horseshoe Lake, St. Charles County, Missouri, April 21 and 22, and a good series of specimens was secured. A large colony had occupied a low marshy meadow close to the Mississippi River. At the time of my visit the water in the river was very high, and the meadow was overflowed to a depth of 12 to 18 inches. The mice had been driven from their burrows by the high water, and were hiding as well as they could on tussocks and under patches of floating debris. When disturbed they ran rather slowly over the submerged vegetation and swam freely, but were easily overtaken. Many had been killed by dogs or other predatory animals, and I was able to get as many specimens as I needed by catching them in my hands. The burrows in this meadow were on the little hillocks, the entrances near the top. Thus they are probably dry except in times of very high water. The entrances are perfectly open and not concealed under vegetation as is the habit of *Synaptomys cooperi* in the eastern States. Well-beaten runways extended out from the burrows and under the dead vegetation. A single specimen taken June 5 in an old dry meadow at Odin, Illinois, is provisionally referred to this form. It agrees with *gossi* in color, but its skull is too young to be positively identified.

At the time this species was described, only a few specimens were in existence and no skins were available. Since then the skins collected at the type locality by Goss have come to light and the Biological Survey has received six specimens from Fort Leavenworth, Kansas, collected by Dr. B. H. Dutcher. In view of the scarcity of this species and the lack of any description of its external characters, the following brief synopsis has been prepared:

Specific characters.—Size large and stocky—the largest of the genus; skull massive, larger than that of *helaletes* (much larger than *cooperi*) but with rostrum both actually and relatively narrower; colors dark.

Color.—Adults in full pelage (Kansas, April and June): rich reddish brown above, with an admixture of black hairs; sides paler; underparts

grayish, sometimes with a slight buffy or rufous tinge; feet and tail clothed with grayish hairs. A slightly worn April specimen is considerably paler than the rest.

The series of 12 specimens (mostly adults) from Horseshoe Lake, Missouri (April 21), average a little paler and less reddish than typical Kansas specimens, but agree with them in size and cranial characters.

Measurements.—Five adults from Fort Leavenworth, Kansas: total length, 132 (123–141); tail vertebrae, 21.4; (19–24); hind foot, 20 (19–21). Skull (3 adult males): occipito-nasal length, 29.9; zygomatic breadth, 17.9; interorbital breadth, 3.4; breadth of rostrum, 5.8; length of nasals, 8.2; maxillary toothrow, 7.5. Nine adults from Horseshoe Lake, Missouri: total length, 134 (131–138); tail vertebrae, 20.7 (20–22); hind foot, 19.5 (19–20). Skull (10 adults): occipito-nasal length, 28.6; zygomatic breadth, 17.6; interorbital breadth, 3.4; breadth of rostrum, 6; length of nasals, 7.6; maxillary toothrow, 7.8.

***Geomys bursarius* (Shaw).**

POCKET GOPHER.

Efforts were made to trace the southern limit of this species in Illinois. It had been previously recorded from Belleville* and was found to occur very sparingly at Coulterville, Woodlawn, and Odin, and a few miles north of Olney. It does *not* occur on the prairie about Duquoin, so that Coulterville is considered to be about its southern limit in the State.

***Sylvilagus aquaticus* (Bachman).**

SWAMP RABBIT.

This rabbit is numerous in the swampy bottoms of southeastern Missouri, western Kentucky, and southern Illinois. Its upper limit in Missouri is a few miles south of Cape Girardeau. In Illinois it ranges slightly farther north in a narrow belt of swamp close to the Mississippi River, to within a few miles of Grand Tower. In the Ohio Valley it is found in the swamps on both sides of the river to a point about five miles below Golconda, Illinois, and Berry Ferry, Kentucky, and is reported, also, from Gilbertsville, Kentucky, in the Tennessee Valley. Careful inquiries were made in the lower Wabash Valley to ascertain if this species occurred there, and I was positively assured by well-informed residents that it never was known in that region. With the exception of a few isolated areas of swamp land there is no country there suited to their habits.

***Sylvilagus floridanus alacer* (Bangs).**

SOUTHWESTERN COTTONTAIL.

This form of the cottontail ranges north to southeastern Missouri and western Kentucky.

Specimens were taken at the following localities:

Missouri: Cushion Lake.

Kentucky: Berry Ferry.

* N. Am. Fauna, No. 8, p. 120, 1895.

Sylvilagus floridanus mearnsi (Allen).

NORTHWESTERN COTTONTAIL.

Specimens of this form were taken at the following localities:
Missouri: Horseshoe Lake, St. Charles County; Marble Hill.
Illinois: Kansas; Olive Branch.

Urocyon cinereoargenteus (Schreber).

GRAY FOX.

Gray foxes were reported to me as occurring at Midway, Kentucky, and Lick Creek, Illinois.

Vulpes fulvus (Desmarest).

RED FOX.

This species was reported to occur at the following localities:
Kentucky: Midway; Big Black Mountain, Harlan County (1908).
Illinois: Wolf Lake; Lick Creek (den of young found about May 20).

Canis sp.?

WOLF.

A few wolves are reported in the region about Cushion Lake, Missouri, and one was killed near there in the winter of 1908-9.

Canis latrans Say.

COYOTE.

I was informed by a resident of Kansas, Illinois, that several prairie wolves had been seen and one killed a few miles south of Kansas two or three years ago.

Spilogale putorius (Linnaeus).

ALLEGHENIAN SPOTTED SKUNK.

The spotted skunks undoubtedly range north as far as southern Illinois. They were reported to be fairly common at Golconda, Illinois, and Berry Ferry, Kentucky. Hahn gives a record from Knox County, Indiana,* and they are said to occur at New Harmony.

Putorius noveboracensis Emmons.

NEW YORK WEASEL.

This weasel is fairly common in southern Illinois and Kentucky. Records were secured of its occurrence at the following localities:
Illinois: Golconda (3 specimens); Lick Creek.
Kentucky: Hawesville (1 specimen); Midway (1 specimen); Jackson.

Blarina brevicauda carolinensis (Bachman).

CAROLINIAN BLARINA.

Specimens of this form were taken at the following localities:
Illinois: Olive Branch, 2; Cypress Junction, near Shawneetown, 1; Golconda, 1.
Kentucky: Jackson, 1.

* Mamm. of Indiana, *loc. cit.*, pp. 575-577.

Scalopus aquaticus machrinus (Rafinesque).

PRAIRIE MOLE.

Moles are quite generally distributed in the Mississippi Valley, and in some sections are abundant. Records or specimens were obtained at the following localities:

Missouri: St. Francis River, west of Senath (a few occur); Portageville (common); Marble Hill (common; 1 specimen).

Illinois: Riehl Station, near Alton (common; 1 specimen); Olive Branch (common); Woodlawn (numerous); Olney (numerous; 1 specimen); Goleonda (numerous).

Kentucky: Mammoth Cave (scarce); Hawesville (uncommon); Midway (abundant; 3 specimens).

Pipistrellus subflavus (F. Cuvier).

GEORGIAN BAT.

Generally distributed in the Mississippi Valley; very numerous in southern Illinois. Four small caves near Lick Creek, Illinois, were explored on May 22, but only about six bats of this species were found all told, all hanging singly. They were sluggish, cold, and very loath to move, even after being handled. All were males. No bats of any kind were found in Mammoth Cave at the time of my visit, although large numbers of *Myotis lucifugus* are known to live there in the winter. Nor were any of the latter species shot in the vicinity.

Specimens of *P. subflavus* were collected at the following localities:

Illinois: Olive Branch, 2 (May 14); Lick Creek, 4 (May 22); Olney, 1 (June 8); Reevesville, 1 (June 22).

Kentucky: Mammoth Cave, 1 (June 30).

Lasiurus borealis (Müller).

RED BAT.

Not very common; specimens were taken as follows:

Illinois: Olive Branch, 1 (May 14).

Kentucky: Mammoth Cave, 1 (July 1; two seen).

Nycticeius humeralis (Rafinesque).

RAFINESQUE BAT.

Specimens of this southern species were taken at the following localities:

Missouri: Cushion Lake, New Madrid County, 1 (May 6).

Illinois: Olive Branch, 4 (May 17, 18).

Kentucky: Mammoth Cave, 1 (June 30).