THE HERPETOLOGICAL FAUNA OF THE PIGEON LAKE REGION, MIAMI COUNTY, KANSAS*

HOWARD K. GLOYD

SINCE so much of the formerly heavily wooded areas of eastern Kansas has been cleared for crop raising during the last fifty or sixty years, any section of this territory, even though small, in which primitive conditions have been disturbed relatively little, has many points of interest for a student of the natural history and distribution of animals. Such a region is found in southern Miami County, approximately ten miles west of the Kansas-Missouri state line, and the amphibian and reptilian fauna of that region forms the subject of this report.

The area under consideration is characteristically river-bottom swamp land, with occasional rocky bluffs and prairie of an elevation of somewhat more than one thousand feet. The average annual rainfall is between thirty-five and forty-five inches and the principal surface rocks consist of a "variety of shales and intercalated sandstones, with some thin, discontinuous beds of limestone," the La Cygne shale of the Pennsylvanian system (Moore, 1920, p. 28). The forests bordering the streams are dominantly oak, hickory and walnut.

The central point from which collecting activities were carried on is a small, shallow body of water known locally as "Pigeon Lake" and "Black's Lake," which is situated in the edge of the flood-plain of the Marais des Cygnes (Osage) River about equidistant from the small towns of Fontana and La Cygne (see Map 3 and Pl. XXX, Figs. 1-2). Its area is almost twenty acres, its long axis lies approximately east and west, and its elevation is

* Contribution from the Zoological Laboratory of the University of Michigan.
between seven and eight hundred feet. During the spring floods it is completely inundated to a depth of six or eight feet above summer water-level. A low bluff confines it on the north side, but on the east, south and west it is limited only by a slight rise


of ground in the timbered area. It is narrowly bordered on these three sides by an open marsh which is abruptly terminated by second-growth timber, gradually followed by older stands of oak, hickory, elm and walnut, with relatively little undergrowth. Throughout the spring and early summer nearly two hundred
acres of this wooded lowland presents true swamp conditions, being covered with water from a few inches to a foot or two.

The west bank of the Marais des Cygnes River in this region is relatively level and is under cultivation, but the east bank is heavily wooded for a distance of more than five miles northward upstream from the lake, and for at least two miles downstream to the southeast. The width of this timbered area varies from less than one half to about three quarters of a mile and only about ten acres have been partially cleared during the past ten years. A sawmill is located in this cleared region, but it had not been in operation for some time when the observations here described were being made. To the eastward the woods give way to a gently rolling prairie some two hundred feet higher than the river. This has been utilized for stock grazing during recent years.

Both banks of Middle Creek, a tributary a few miles to the east paralleling the general course of the river, are rocky and narrowly bordered with trees. Conditions there in general resemble those near the river, although the woods are more open. A second creek, Sugar Creek, farther to the east, was not investigated.

Most of the collections and observations on which this report is chiefly based were made by the writer and associates during the spring months of 1926, 1927, 1928, and 1929. Additional specimens and information were supplied by residents of the vicinity, to whom acknowledgment is given below. Our first visit was made on May 15, 1926, at which time the region was approached from the west side of the river near Fontana. Some collecting was done in the lowlands there and in the neighborhood of Pigeon Lake; the river was crossed by boat. On the succeeding trips (except that of August 31, 1928, which was a short visit) several hours were spent each night in the marsh and swamp in collecting frogs and toads with the aid of acetylene head lamps. The night collecting was very satisfactory and successful, for amphibians were most easily taken by this method and in addition numerous snakes were secured. During the day activities were carried on along the lake shore and in the woods.
and uplands. After the first visit the lake was found more easily accessible from the Paola-La Cygne road on the east, from which entrance was made by way of a large prairie pasture a short distance south of the home of Mr. Paul W. Keith. Four trips ranging in duration from one to three days were made in March and April, 1927; in 1928 three days were spent there in late March (24–26) and two days in April (21–22). A brief stop was made on August 31, 1928, and a three-day visit on September 22–24 of the same year. In 1929 the region was visited once, April 6–7.

For assistance in collecting the writer is indebted to numerous friends who accompanied him during the time spent in that locality; to some who made special trips independently; and to others who sent specimens at other times. Mr. Wilbur Doudna was directly responsible for my becoming interested in the region and gave valuable assistance as a member of the party on several occasions. Messrs. Wesley Clanton, Clarence R. Collins, Hobart M. Smith, Philip D. Evans and Dr. W. B. Wilson shared in the field work at different times, and Dr. Minna E. Jewell and several members of her class in field zoology from the Kansas State College, Manhattan, were of great assistance on the trip of September 22–24, 1928. Mr. Alfred J. Black, owner of the land, gave us permission to use a cabin near the lake as a base of operations and was otherwise helpful in many ways. Mr. Paul W. Keith collected and sent specimens from the vicinity of Pigeon Lake and Middle Creek, and Mr. Vernen Mann secured for me a large series of copperheads and timber rattlesnakes. In connection with the entire project Mrs. Leonora K. Gloyd has given invaluable aid, and Dr. Frank N. Blanchard of the Department of Zoology, University of Michigan, has made helpful suggestions during the preparation of the manuscript.

HABITAT DISTRIBUTION OF SPECIES

Five fairly distinct and well-defined types of habitats were observed: (1) the lake (Pl. XXX, Figs. 1–2) and that part of its shore on the north side which is neither marsh nor swamp; (2) the marsh (Pl. XXXI, Figs. 1–2) between the open water of
the lake and the woods; (3) the wooded swamp beyond the marsh (Pl. XXXII, Fig. 1); (4) the upland slopes and hillsides, more or less wooded and rocky (Pl. XXXII, Fig. 2); and (5) the upland prairie grassland. In most places in the region the transition from one habitat to another was abrupt and clearly marked, and our collections indicate a characteristic fauna for each, with relatively little overlapping, except with certain semiaquatic forms such as *Natrix sipedon transversa* and *Natrix rhombifera*, which were found in all three types of aquatic situations.

In the following list of habitats the most characteristic species in each are placed in the approximate order of their greatest abundance.

(1) The lake and lake shore:
- *Acris gryllus*
- *Natrix sipedon transversa*
- *Natrix rhombifera*
- *Pseudemys elegans*
- *Thamnophis sauritus proximus*
- *Chelydra serpentina*
- *Natrix grahamii*
- *Triturus viridescens viridescens*
  - (adult)
- *Natrix sipedon sipedon*

(2) The marsh:
   (a) Deeper water near lake:
- *Rana catesbeiana*
   (b) Shallow water among sedges near swamp:
- *Hyla crucifer*
- *Pseudacris triseriata*
- *Hyla versicolor versicolor*
- *Bufo americanus*
- *Natrix sipedon transversa*
- *Natrix rhombifera*
- *Thamnophis sauritus proximus*

(3) The wooded swamp:
- *Rana pipiens*
- *Hyla versicolor versicolor*
- *Bufo americanus*
- *Acris gryllus*
- *Natrix sipedon transversa*

(4) Upland slopes and hillsides:
- *Eumeces fasciatus*
- *Leioplosia laterale*
- *Carphophis amoenus vermis*
- *Coluber constrictor flaviventris*
- *Elaphe obsoleta obsoleta*
- *Agkistrodon mokasen*
- *Crotalus horridus*
- *Storeria dekayi*
- *Diadophis punctatus arnyi*
- *Eumeces anthracinus*
- *Ophisaurus ventralis*
- *Heterodon contortrix*
- *Storeria occipito-maculata*
- *Lampropeltis triangulum syphila*
- *Elaphe laeta*
- *Ambystoma texanum (adult)*
- *Thamnophis sirtalis parietalis*

(5) The prairie grassland:
- *Terrapene ornata*
- *Terrapene carolina triunguis*
- *Thamnophis sirtalis parietalis*
- *Pituophis sayi sayi*
- *Tropidoclonion lineatum*
The finding of *Triturus viridescens viridescens* makes a new record for the state and extends the known range of that species considerably to the westward. Another unusual occurrence is that of *Hyla crucifer*. Although the type locality of this frog is "Cantonment Leavenworth, 'Kansas'" (Wied, 1838), I know of no other records of its presence in the state.

**ANNOTATED LIST OF SPECIES**

The specimens secured in this region have been deposited in various museums, retained in the personal collection of the writer, or exchanged with various correspondents. The location of as large a series as is available has been given at the close of the remarks on each species. Catalog numbers have been given in practically every case. The initials O. U. M. refer to the Museum of Ottawa University, Ottawa, Kansas; U. M. M. Z., the University of Michigan Museum of Zoology; and H. K. G., the writer's collection. A number in parentheses following a catalog number of the U. M. M. Z., for example, "U. M. M. Z. 68389 (2)," indicates the number of individuals (when more than one) of the series entered under that number.

1. *Triturus viridescens viridescens* (Rafinesque). Newt

This species did not appear to be common in the Pigeon Lake region. The first of the two specimens secured is a terrestrial juvenile found in a piece of decaying wood among leaves, bark and débris about ten yards from the north shore of the lake, August 31, 1928. At this time no water collecting was done, but on September 22 and 23 of the same year Dr. Minna E. Jewell, several zoology students and myself used a thirty-foot minnow seine along nearly a hundred yards of the north shore with no success, so far as this species was concerned. Hand dip-nets were used at the water's edge and where vegetation made efficient operation of the seine impossible. The following day nearly two thirds of the entire shore-line of the lake, on the north, west and south sides, was covered by the use of hand nets without securing newts.
It was not until April 6, 1929, that an aquatic adult was obtained. This was found in the wooded swamp at the west end of the lake and was caught by hand in water a foot deep by H. M. Smith about 10:30 P.M. while collecting with the aid of an acetylene head lamp.

U. M. M. Z. 68385, 68386.

2. *Ambystoma texanum* (Matthes). Texan salamander

Two adult specimens of this salamander were secured. Both were found in wet earth beneath stones on April 6, 1929. One was near the top of the low bluff on the north side of the lake, the other at a lower level beside a small brook which contained water only during the season of spring rains.

U. M. M. Z. 68389 (2).

3. *Bufo americanus* Holbrook. Common toad

To judge from the few individuals usually singing when the region was visited, toads were by no means as common there as in other localities in adjoining territory. The species was collected in daylight among damp leaves in the woods on May 15, 1926, but during the spring of 1927, when night collecting was done on March 6, 15 and 19 and April 26, no specimens were obtained and the voice of the species was not heard. On March 24, 1928, two toads were calling about 11:00 P.M. in the marsh at the east end of the lake. These were secured, but no others were heard that night. Two were found in fairly moist woods some distance from the lake on August 31, 1928, but when the place was visited about a month later, September 22–24, none were seen. The following spring, however, a series of twenty was collected on April 7. On that date toad voices formed a conspicuous element in the amphibian chorus. Clasping pairs were among those secured, but no egg-masses were noticed.


4. *Acris gryllus* (Le Conte). Cricket frog

With the possible exception of the leopard frog, *Rana pipiens*, no species was more abundant in the region than the cricket frog.
It was secured at each visit to the swamp except those of May 15, 1926, and March 6, 1927. It was collected on March 15, 1927, but was not singing. More specimens were taken on March 19 and April 26, 1927; on the latter date others were singing generally throughout the swamp and along the lake shore. In the spring of 1928 specimens were collected on March 24 and 25 and April 21. The night of April 21 was very cool and a light, intermittent rain fell most of the time from late afternoon till about 2:00 A.M. the following morning. Only a few frogs, *Hyla crucifer* and *Rana pipiens*, sang during the night. The morning brought sunshine and a marked rise in temperature and *Acris gryllus* sang at intervals throughout the day. Other collecting dates for the species were August 31, September 22 and 23, 1928, and April 6 and 7, 1929.


5. *Pseudacris triseriata* (Wied). Swamp tree frog

Swamp tree frogs were collected in marshy spots at the edge of the lake during March and April in 1927, 1928 and 1929. This species was never present in very large numbers and its part in the frog chorus was always obscured by the jingling notes of the spring peepers and the chuckling of the leopard frogs. Unlike the cricket frog, *Acris gryllus*, it was seldom seen or heard during the day and no specimens were secured in the late summer or fall. Collecting dates for the region were March 6, 15 and 24 and April 6 and 21.


The spring peeper was first discovered by us in the Pigeon Lake region in the late afternoon of March 15, 1927, when its chorus, mingled with the voices of hundreds of leopard frogs, produced a steady, roaring din audible for a distance of a mile and a half. Closer approach made it possible for us to distinguish between the jingling, sleigh-bell-like notes of large numbers of
peepers and the deeper gutturals of the leopard frogs. The peepers were difficult to locate individually since close approach to one caused it to cease calling, although it usually kept its place until actually disturbed. Those secured on the date noted above were all males. They sang from perches upon fallen rushes and sedges a few inches above the water and appeared to be more abundant in the open marsh (Pl. XXXI, Fig. 2) than among the trees farther back from open water. Considerable variation in the pitch of their cries was noticed, and a trilled call was occasionally heard. They were still singing in vigorous choruses on March 19, but after that date their vocal activity diminished. Clasping pairs were secured on March 24, 1928, and individuals were collected on April 21 and September 23 of the same year. An additional series was obtained on April 6, 1929.


7. Hyla versicolor versicolor (Le Conte). Common tree frog

Our first experiences with tree frogs of this species in the vicinity of Pigeon Lake occurred when Mr. Wilbur Doudna and I made a trip to the lake on April 26, 1927. The night was extremely dark and the air warm and humid, although no storm appeared imminent. Between 8:00 and 9:00 P.M. widely scattered tree frogs were singing at the edge of the open water near the northwest end of the lake. Their calls varied considerably in pitch, with an occasional cry so different as to lead one to suspect the presence of another species. Three of these unusual voices were carefully traced until the frog responsible for the song was definitely located. In each case it proved to be the ordinary form.

After nearly two hours of collecting in the western extremity of the lake, we had traversed an irregular semicircle and had reached the south side, where the steady roar of a different frog chorus first became distinguishable from the sounds produced by scattered individuals closer at hand. It appeared to come from the depths of the swamp woods between the lake and the river and somewhat downstream toward the east. After allowance
had been made for the deceptiveness of distances under such conditions, the location of this breeding group was later estimated as slightly less than a half mile from the lake and approximately the same distance from the river.

When we reached the spot, we found ourselves in the midst of an amazingly large aggregation of breeding tree frogs concentrated in a small area to all appearances no different from any other acre of wooded swamp near by. The water among the large trees ranged between six inches and two feet in depth, probably much deeper than usual, since there was evidence of recent heavy rains and flooding from the river. There was practically no undergrowth of small trees or shrublike plants, but fallen trees and brushwood from dead branches were plentiful in the water.

It was impossible to estimate the number of singing individuals with any approach to accuracy, but it was very large. The noise from the undiminished chorus was deafening and single cries, even from individuals but a few feet distant from us, were practically indistinguishable. Our communications to each other had to be shouted although we were almost close enough together to touch hands.

Singing males seemed to be taking advantage of any convenient location, calling from the water, from the tops of wet logs, from perches in partly submerged fallen branches, and from bases of tree trunks a few inches above the water. Wherever our lights turned, from two to fifteen individuals were visible within their range. Females were less conspicuous, but they seemed to occur in each of the locations mentioned. Numerous mating pairs were found in the water and now and then a male embracing a female was carried by her from the water to a floating stick or fallen log. Our presence produced no disturbance of their activities and nothing seemed to be capable of reducing the vigor of their cries. Singing males picked up and allowed to sit in the palm of the hand continued calling with unabated zeal. Their notes were repeated with greater energy and at more rapid intervals than those of the frogs singing at the edge of the open lake earlier in the evening.
This species was not collected when we were in the region during March and April, 1928. The season that year was less advanced and the temperature was lower. Presumably the frogs had not begun to breed. A few specimens were taken, however, on September 23, 1928, and April 6, 1929.


8. *Rana catesbeiana* Shaw. Bullfrog

The bullfrog was fairly abundant and was frequently collected. It kept to the deeper water at the edge of the marsh (Pl. XXXI, Fig. 1) and was never found in the wooded swamp farther from the lake. On our early spring visits to the region (March 6, 15 and 19) we noticed that adult bullfrogs had not yet appeared, although small, immature individuals were collected on March 15, 1927. The earliest singing date noted was on March 24, 1928. The species was either heard or secured on each of the following dates: April 26, 1927; March 24, April 21, September 22, 1928; April 7, 1929.


9. *Rana pipiens* Schreber. Leopard frog

The leopard frog was by far the most abundant species of amphibian in the swamp. None of our specimens were collected in the marsh and only a very few along the lake shore. In the 1927 season this species seemed to be at the height of breeding activity on March 15. Very large numbers were singing in the wooded swamp areas on three sides of the lake. In many small open spaces among the trees (Pl. XXXII, Fig. 1) several hundred breeding individuals were gathered together. Some of these open spaces observed in detail were roughly circular in outline and about ten or twelve feet in diameter. At a distance of thirty yards such areas appeared closely stippled with sparklike luminous dots as the eyes of the singing frogs reflected the rays from our head lamps. When we approached, even though slowly and carefully, the eyes disappeared a few at a time as the frogs submerged, for they appeared to detect disturbances in the water at a much
greater distance than do toads, bullfrogs, and some other amphibi­ans. Some of the breeding grounds were already covered with egg-masses. By counting those in about half of such an area, the total number of egg-masses was estimated at one hundred and fifty. In spite of the thousands of eggs already laid, the breeding activity appeared undiminished, for clasping pairs were extremely common and many were secured.

Numerous individuals were singing in the swamp on each date on which we visited the region during March and April. A few were collected on May 15, 1926, and September 22–23, 1928.

The majority of the leopard frogs breeding in that lowland, river-bottom swamp appeared in general to be smaller, and more brilliantly green, and to have relatively smaller spots than those breeding in upland ponds and streams in other eastern Kansas localities during the same seasons.


10. *Ophisaurus ventralis* (Linn.). "Glass-snake"; "joint-snake"

Only one specimen of this species of legless lizard was secured. It was collected on April 21, 1928, by Clarence R. Collins, in a pile of leaves on the lower slope of the bluff north of the lake (Pl. XXXII, Fig. 2). It sought to escape by backing into a hole in the soft ground.

U. M. M. Z. 66930.

11. *Leiolopisma laterale* (Say). Ground lizard

This little skink was most abundant on the wood hills of the vicinity after the first of April. It was found under stones, logs and bark, and was often seen in the open among dead leaves in the higher areas near the lake and along Middle Creek. In the autumn it appeared to be more secretive and was rarely seen. Four were taken on August 31, 1928, but none were secured on September 22–24 of the same year.


A total of nine specimens of this comparatively rare species was obtained. None were found in localities other than the hillside on the north shore of the lake (Pl. XXXII, Fig. 2) and all were collected by lifting loose stones and raking among mats of fallen leaves. Collecting dates for this species were May 15, 1926; March 19, 1927; March 25 and August 31, 1928; April 6, 1929.

O. U. M. 201; U. M. M. Z. 65450, 68451, 68452 (5).

13. *Eumeces fasciatus* (Linn.). Five-lined skink

In wooded areas of sufficient elevation to be out of the river flood-plain this lizard was abundant. It was found beneath stones, in crevices, under bark and leaves and in trees; and occurred in the higher woods near the lake, along the west bank of Middle Creek, near the river north of the sawmill and on the west bank of the river near Fontana. Mr. Paul Keith obtained a considerable number for us on April 22, 1928, from a lower point on Middle Creek near the Miami-Linn county line.


A more or less constant but unsuccessful search was made in the upland areas of this region for the sonoran skink, *Eumeces obsoletus* (Baird & Girard). It is known to occur commonly in Franklin and Anderson counties, which respectively adjoin Miami and Linn counties on the west, and in Bourbon County, next to Linn on the south. Its apparent absence may be due to its habit of frequenting higher country than that of the vicinity of Pigeon Lake.

14. *Carphophis amoena vermis* (Kennicott). Western worm snake

Worm snakes were frequently collected on the hillside north of the lake, along the low bluffs of Middle Creek, and in the more open country north of the sawmill. All specimens were found in fairly moist places beneath stones or among closely packed leaves. Collecting dates were May 15, 1926; March 25, April 21, 22, August 31 and September 23, 1928; April 6, 1929.
15. *Diadophis punctatus arnyi* (Kennicott). Ring-neck snake

The ring-neck snake was not common near Pigeon Lake. Two were found beneath stones on an open hillside near Middle Creek, September 23, 1928. The following spring, April 6, 1929, two more were obtained; one adult beneath a stone in the same locality, and one young, probably of the previous year’s brood, under a small stone in the pasture between the La Cygne road and the lake.

H. K. G. 1444, 1445.

16. *Heterodon contortrix* (Linn.). Hog-nosed snake; "spreading adder"

No hog-nosed snakes were secured on any of our regular collecting trips, but one was caught on May 14, 1928, by Mr. Paul W. Keith on his farm between Middle Creek and Pigeon Lake. Since it was a gravid female it was kept under observation in the laboratory for the next two months. During this period it fed upon medium-sized toads, *Bufo woodhousii* Girard, but refused to eat frogs and mice.

One sterile egg was expelled on June 23. Nine eggs, of which one proved to be abnormal, were deposited on June 26. On this date the female was observed at 8:30 A.M., at which time two good eggs and the second sterile one had been deposited. Six more normal eggs were laid at intervals ranging from ten to sixty minutes, the last being deposited between 12:15 and 1:00 P.M. In the two cases in which the process was observed, about one minute was required for the act of expulsion. The freshly laid eggs were soft, moist and almost transparent. After exposure to the air for about ten minutes the tough outer membranes became opaque and cream white.

The eight eggs were placed in a metal container with a mixture of finely crumbled sphagnum and rotting wood and kept slightly moist by an occasional sprinkling with water. All the
Fauna of Pigeon Lake Region

eggs hatched on August 23 and 24, within sixty days after being laid. At 8:00 A.M., August 23, three had been slit for a short distance by the egg tooth of the young snake. One emerged about noon. During the afternoon three more were cut and two young emerged between 8:00 and 10:30 P.M. All were hatched the following morning. Three of the young shed a very fine, thin layer of epidermis three days after hatching; the others moulted during the following twenty-four hours.

At the age of two days the young snakes were measured and weighed; the results follow:

<table>
<thead>
<tr>
<th>Total length</th>
<th>Tail length</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>190 mm.</td>
<td>29 mm.</td>
<td>6.0 gm.</td>
</tr>
<tr>
<td>197</td>
<td>31</td>
<td>6.6</td>
</tr>
<tr>
<td>183</td>
<td>27</td>
<td>5.0</td>
</tr>
<tr>
<td>202</td>
<td>30</td>
<td>6.6</td>
</tr>
<tr>
<td>203</td>
<td>32</td>
<td>6.0</td>
</tr>
<tr>
<td>168</td>
<td>29</td>
<td>4.6</td>
</tr>
<tr>
<td>192</td>
<td>34</td>
<td>5.9</td>
</tr>
<tr>
<td>200</td>
<td>34</td>
<td>6.4</td>
</tr>
</tbody>
</table>

U. M. M. Z. 66869, 66968 (8).

17. Coluber constrictor flaviventris (Say). Blue racer

The blue racer was a common snake in the higher areas near the lake. An extremely dark-colored specimen, more slate gray than bluish green, was discovered inside a rotten log near the lake on April 21, 1928. Others of normal coloration were collected on a hillside near Middle Creek the same day and two more were secured on September 23 of the same year. In 1929 several were taken during the month of April. Mr. Vernen Mann saw one of these kill and eat a copperhead (Agkistrodon mokasen Beauvois). According to his account of the incident, he came upon the two snakes just after the racer had made its capture and was chewing the head and neck of its victim, which was thrashing about in violent efforts to free itself. He observed the entire swallowing process, which lasted more than an hour. Mr. Mann also reported that a lizard (probably Eumeces fasciatus), on a rock about six feet from the snakes, was another interested witness and
Howard K. Gloyd
displayed great curiosity and animation, fleeing when a sudden movement of a snake occurred, but returning at once to its vantage point on the rock over the edge of which it peered intently as if fascinated by the spectacle. The blue racer was sent to me. Three days after its ophidian repast it was killed and the copperhead removed from its stomach. The anterior third of the latter was fairly well digested.

U. M. M. Z. 67055, 67053; H. K. G. 552, 1448, 1494, 1495, 1636, 1735.

18. *Elaphe laeta* (Baird and Girard). Rat snake

One small individual of this species was obtained. It was beneath a stone in open woods a short distance north of the sawmill, April 21, 1928.

H. K. G. 440.


Pilot blacksnakes were taken in the woods near the lake, on the hillsides above the sawmill and among rocks along Middle Creek. Nearly all were on higher ground, but one was beside a small rain pool with a *Natrix sipedon transversa* quite close to the lake. One was found in a cavity at the base of a large oak on the north shore of the lake (this tree is shown in Pl. XXXII, Fig. 2). Another was crossing the trail along this same hillside. It "froze" rigidly when we approached, with the curves of its body pressing closely into the irregularities of the ground. Collecting dates were May 15, 1926; March 24, 25, September 23, 1928; April 6, 1929.


20. *Pituophis sayi sayi* (Schlegel). Prairie bull snake

A bull snake was collected on May 1, 1928, at the edge of the prairie about two hundred yards northeast of the lake by Mr. Wilbur Doudna.

U. M. M. Z. 66950.

A small king snake of this form was taken from moist earth beneath a stone in open woods a half mile north of the sawmill, April 21, 1928. Another was found in a similar habitat on Middle Creek, April 6, 1929.

The color pattern of both these individuals is typical of the form *syspila* as defined by Blanchard (1921).

H. K. G. 430, 2354.

22. *Natrix grahamii* (Baird and Girard). Graham's water snake

This species is represented by but one small individual found on August 31, 1928, coiled in a slight depression in the top of a rotting log near the shore of the lake.

U. M. M. Z. 66989.

23. *Natrix rhombifera* (Hallowell). Diamond-backed water snake

Numerous individuals of this species were found in the open along the lake shore, in the marsh and swamp at night, and beneath logs, bark and débris in the vicinity of the lake. Collecting dates were March 24, 25, April 21, September 23, 1928; April 6, 1929.

U. M. M. Z. 67000, 67010; H. K. G. 1438, 1439.

24. *Natrix sipedon sipedon* (Linn.). Common water snake

This water snake was not often found in the vicinity of the lake and marsh. Two were secured on March 24, 1928, under a board at the edge of the lake. A third specimen was found on August 31 of the same year beneath a flat-bottomed boat drawn up on the lake shore.

Since in eastern Kansas this species seems to frequent running water rather than marshy habitats, it is probable that a more careful search along the streams of this vicinity would prove it to be fairly abundant.

U. M. M. Z. 67016 (2); H. K. G. 1079.
25. *Natrix sipedon transversa* (Hallowell). Blotched water snake

Our collections indicate that this was the most abundant water snake of the marsh and swamp habitats. It was encountered both along the lake shore and in the heart of the swamp. On the morning of March 24, 1928, after a cold night, several large specimens were coiled in the sun rather close together on a narrow strip of flat ground on the north side of the lake.

A female (U. M. M. Z. 66997) collected on August 31, 1928, gave birth to twenty-one young on September 14. The young were undergoing their first ecdysis at the age of three days.

Fusion of the lateral with the dorsal blotches in the neck region so as to form the complete cross-band pattern characteristic of the subspecies *sipedon* occurs in eleven individuals of this brood (U. M. M. Z. 66998). In the remaining ten the lateral blotches alternate with the dorsal ones anteriorly as far as the head, the typical pattern of the subspecies *transversa*.

U. M. M. Z. 66997, 66998 (21); H. K. G. 1242, 1335, 1447, 2109.

26. *Storeria dekayi* (Holbrook). De Kay’s snake

A snake of this species collected at night on March 15, 1927, was swimming in water twelve inches deep among the trees of the swamp. Another was found on April 21, 1928, beneath a log in woods about a mile north of the sawmill. Two were found among chips and dead leaves on September 23, 1928, and still another beneath a stone on April 6, 1929.

O. U. M. 874; U. M. M. Z. 66987 (2); H. K. G. 431, 1446.

27. *Storeria occipito-maculata* (Storer). Red-bellied snake

Only two red-bellied snakes were obtained; a small specimen among leaves on moist ground in heavily wooded region near the river, May 15, 1926, and an adult found on March 24, 1928, beneath a board in the vicinity of an old cabin on the north shore of the lake.

H. K. G. 423.

A single specimen was taken from beneath a stone in a shallow ravine of the pasture above the lake and swamp.
H. K. G. 1449.

29. *Thamnophis sauritus proximus* (Say). Western ribbon snake

The western form of the ribbon snake occurred along the lake shore and at the edge of the marsh. Three were taken near the lake, April 26, 1927; another in approximately the same locality, March 24, 1928; one beneath an old boat on the north shore of the lake, August 31, 1928; and two at the edge of the swamp at the west end of the lake, April 6, 1929.
A female, 625 mm. long, collected on August 31, 1928, contained six young which appeared to be almost ready for birth.

30. *Thamnophis sirtalis parietalis* (Say). Red-barred garter snake

The red-barred garter snake is represented by but two specimens. One was taken in open woods north of the sawmill, April 21, 1928, and the other found beneath a stone in a ravine of the pasture, April 6, 1929.
H. K. G. 432, 1437.

31. *Agkistrodon mokasen* Beauvois. Copperhead

Copperheads were fairly abundant in the rocky ledges on the east bank of the Marais des Cygnes River and on Middle Creek. Near the sawmill ten were found on April 21, 1928, at various intervals at depths of about twenty inches among loose rocks on a rather steep slope. The weather had been cool for the preceding two days and the snakes were quite sluggish. Mr. P. D. Evans and I secured seven, September 23, 1928, along the west bank of Middle Creek. Two were found beneath a stone, but the others occurred singly in crevices and on sunny ledges. In 1929 a male and a female were found, April 6, under a large stone southeast of the lake close to the Miami-Linn county line.
Mr. Vernen Mann had considerable success in collecting these snakes. In various rocky ledges southeast of the lake, both in Miami and Linn counties, he secured for me a total of over a hundred and twenty-five during the month of April, 1929. In the material which he collected the ratio of males to females was approximately two to one. Although unable to find copperheads during the summer months, he collected a few more in these same localities in September and October. A report of studies on the breeding habits of this species has been given elsewhere (Gloyd, 1932).

U. M. M. Z. 68427, 68428; H. K. G. a large series.

32. *Crotalus horridus* (Linn.). Timber rattlesnake

No rattlesnakes were collected by any of our parties although they formed one of the major objectives of our search. Through the kindness of Mr. Paul W. Keith we were able to obtain two specimens taken on Middle Creek, one on April 30 and one on June 11, 1928. Mr. Vernen Mann secured two a few miles north of La Cygne during late August, 1928, and the following year sent me twelve collected during April and nine secured in September and October, in rocky bluffs southeast of Pigeon Lake, the locality in which he found copperheads most numerous.

Mr. Alfred J. Black told us that frequently rattlesnakes wander up to his dooryard from Middle Creek, and that on one occasion he found two coiled upon his cellar door. Farmers near Fontana on the west side of the river asserted that during the summer rattlesnakes come across the river from the bluffs on the east bank into the low fields of the west side, and that they are often seen swimming the river in the fall as they return, presumably to crevices in the rocks for winter.


33. *Chelydra serpentina* (Linn.). Snapping turtle

One snapping turtle was collected in the shallow water of the east end of the lake, April 6, 1929, but the specimen is not now available.
PLATE XXXII

Fig. 1. A relatively open area in Pigeon Lake swamp. Water from a few inches to two feet deep. Habitat of *Rana pipiens* and *Hyla versicolor versicolor*. Photographed April 22, 1922

Fig. 2. Low bluff on north shore of Pigeon Lake. Loose rocks, decaying leaves and bark. Habitat of *Eumeces fasciatus*, *Eumeces anthracinus*, *Leiopisma laterale*, *Coluber constrictor flaviventris*, *Elaphe obsoleta obsoleta* and numerous other species. Photographed April 22, 1928
PLATE XXXI

Fig. 1. Outer edge of marsh, southeast edge of Pigeon Lake; deeper water. Habitat of *Rana catesbeiana*. Photographed April 22, 1928

Fig. 2. Marsh at southeast edge of Pigeon Lake. Habitat of *Hyla crucifer, Pseudacris triseriata* and *Bufo americanus*. Photographed April 22, 1928
Fig. 1. Pigeon Lake from the northeast; swamp woods on opposite shore. Photographed April 22, 1928

Fig. 2. Pigeon Lake from the north, showing marsh and wooded swamp of opposite shore. Photographed April 22, 1928
34. *Terrapene carolina triunguis* (Agassiz). Three-toed box turtle

A single individual of this form was found partially concealed under the edge of a stone in the pasture, April 6, 1929. This and two of the following species were sent to a correspondent.

35. *Terrapene ornata* (Agassiz). Western box turtle

Several specimens were secured in the pasture north of the lake. One was collected on August 31, 1928, two on September 22, 1929, and a fourth was found on April 7, 1929.

H. K. G. 1571.

36. *Chrysemys marginata bellii* (Gray). Bell’s painted turtle

Two painted turtles of this subspecies collected in the swamp on May 15, 1926, were sent to Mr. Percy Viosca, Jr., of the Louisiana State Museum.

37. *Pseudemys elegans* (Wied). Red-eared turtle

One was obtained by the use of a large seine in the lake, March 25, 1928, and two others were collected with hand nets at the edge of the water, September 23, 1928.

H. K. G. 1258.

**University of Michigan**

**LITERATURE CITED**


