The Turtles and Batrachians of the Lake Maxinkuckee Region.[1]

Barton Warren Evermann and Howard Walton Clark.

While engaged on a physical and biological survey of Lake Maxinkuckee, Indiana, in 1899 to 1913, under the auspices of the United States Bureau of Fisheries, the present writers paid some attention to the herpetology of the region. Although this work was rather incidental to the main purpose of the survey, it very soon became evident that most, if not all of the species of reptiles and batrachians of that region bear a very close and important relation to the fish-fauna of the lake. We therefore collected specimens of the various species observed and recorded our observations on the occurrence, abundance, distribution and habits of each. Our notes on the snakes have already been published in these proceedings.[2]

In the present paper we include the turtles, frogs, toads and salamanders.

The Turtles.

Nine species of turtles are known from Lake Maxinkuckee and vicinity, a number probably greater than has been recorded from any other locality in the State. Five of the 9 species are abundant, while each of the remaining 4 is rare.

The turtles constitute an interesting and important branch of the local fauna. Several of the species are so abundant and easily observed as to attract the attention even of people who are little interested in nature. The great numbers that may be seen on any bright or quiet summer day, basking on timbers or boards in shallow water, or on sandy reaches of shore, can not fail of observation even by the least observing.

The turtles are also among the most useful animals of the lake. All the species are scavengers and do much to keep the lake free of dead fishes and other animals which at times are so numerous that they would prove a menace to the comfort, if not to the health, of the people about the lake, were it not for aid rendered by the turtles in removing them. Several of the species are valuable as food for man, and considerable numbers are utilized at the lake for that purpose.

All these turtles are entirely harmless except, possibly, the snapping turtle. We know of no harm that any of them does. They should all be protected.

---

[1]Published by permission of Hon. Hugh M. Smith, U. S. Commissioner of Fish and Fisheries.

[2]Proceedings of the Indiana Academy of Science for 1914, pp. 337-348.

1. *Platypeltis spinifer* (Le Sueur.)

Soft-Shelled Turtle.

Compared with the other turtles of the lake, the Soft-shell has a rather northern distribution. It ranges from Canada southward to Kentucky and westward to Minnesota. It is very abundant in the upper Mississippi and its tributaries, great numbers being frequently seen on or about the sandbars which furnish them basking and nesting places. It is rather a river than a pond turtle, and rarely or never ventures into small isolated ponds.

At Lake Maxinkuckee it is very abundant, much more so than would appear to the casual observer, as it is one of the shyest and most wary of turtles, quickly taking alarm and disappearing whenever it is approached. It is found everywhere in the lake. Its pointed, shapely head is often seen sticking up above the surface even over the deeper waters of the lake. Examples of all sizes have been taken from almost every part of the lake shore. It seems to be more common in the region of Norris Inlet, probably because that is the most sequestered part of the lake, where it is less likely to be disturbed than elsewhere.

The Soft-shelled Turtle is the last turtle to make its appearance in the spring, and the first to disappear in the fall. Very small ones, benumbed or dead, may often be seen along shore late in the autumn and early in the spring before the older ones appear. These have probably been unable to take care of themselves. Very small ones have been found in the spring as early as March 18, but no large ones were seen until April 29, and then they were very scarce. It is not until May or June that they appear in abundance. None has been seen in the winter, and it was a problem where they spend that part of the year, until in the autumn of 1906 (Sept. 6) an example 5 inches long was found buried up to the eyes in mud at the edge of Lost Lake. It is probable that all of them bury themselves in the mud in the bottom of the lake. As none was seen moving under the ice, it is thought that they spend the winter in a quiescent state. The last one seen swimming about was noted in Lost Lake, Sept. 7, 1906.

This turtle is fond of basking during the hotter portions of the year. At this lake it generally prefers sandy or grassy bits of shore and is not often seen on stakes or boards. One of its favorite haunts was the sandy stretch of shore near Farrar's. They also basked in numbers at the edges of small pools in the Inlet marsh. Before the shore was cleared off, they used to bask in great numbers along the south shore of Outlet Bay. On June 11 many of these, with other species, were seen basking at this place and when a rush was made at them from a boat they scattered in every direction, many of them hiding under a large dense floating mass of algæ which was along the shore at that place. The Soft-shells that took refuge under the algæ thrust up their heads now and then to see what was going on. Several were caught. Even when stationary they are hard to catch and hold by hand; the tail is

too short and slippery to hold, and it is necessary to grasp them by the sides, but this permits them to claw one's hand severely. They are very pugnacious, and though the gape is not sufficiently large to allow them to get a very deep hold, even a small example is able to give a very severe pinch.

In some places this species basks not only on the sandy shore, but also on any log, board or other object upon which they can crawl. In Wild Cat Creek, just below the bridge near Stonebraker's mill, east of Burlington, Carroll Co., Indiana, hundreds have been seen on the large boulders with which the bed of the creek was strewn. There they would remain for hours basking in the sunshine, sliding quietly into the water if a passer-by came too near, but soon returning to bask again until evening or until again disturbed.

At Maxinkuckee they begin laying about the middle of June and continue until perhaps near the end of July. A large female killed June 14 contained 33 eggs of various sizes, but none fully developed; another killed on the same date contained several eggs in the large distended oviduct, but none was ready for laying. Still another examined June 17 had eggs ready to deposit. The next day a nest with about 30 eggs in it was found near the ice-houses. On June 25 one was seen digging a hole in the sandy shore at the southwest side of the lake and the next day another was seen doing the same thing. Each of 2 examples caught June 27 contained mature eggs. On July 16, 1899, 2 eggs were found on the bottom in 2 feet of water. On July 18, 1900, at the south end of the lake just east of Murray's, two large Soft-shells were seen hurrying into the water from the sand ridge pushed up by the ice. Upon examination several nests were found. The sand showed evidence of recent disturbance, and there was no difficulty in finding where the eggs were buried. There were probably 10 or 12 nests in a distance of a few yards along the ridge, though we did not dig into all of them. Some fresh holes into which we dug contained nothing; possibly the turtles had been trying different places and found some unsuitable. Each hole was usually at the edge of an abrupt ascent and was 2 to 4 inches in diameter at the mouth and generally sloped back somewhat. In one or two cases the eggs were uncovered but more often there was some sand over them. The eggs were generally at a depth of 4 to 10 inches and placed either on the bottom or on the sides of the hole which usually widened out somewhat toward the bottom. Five nests examined contained 4, 25, 3, 3 and 1 egg, respectively. The 25 eggs in the second nest evidently belonged to 2 different sets. In the bottom were 10 eggs that looked old. The yolk in each had settled into the lower half, giving it a pink tinge, while the upper half was opaque white. Above these, and partially separated from them by sand, were 15 other eggs that were uniform pink throughout and had evidently been deposited later. In and about this and other nests were a good many broken eggs, evidently destroyed by some animal, perhaps by the turtles themselves. The 3 eggs in the third nest were fresh, but those in the fourth and fifth were old and stale. Thirteen of these eggs and 2 others found elsewhere were taken to

the station and placed in sand-boxes exposed to the sun, but none of them hatched. The eggs were quite uniform in size, most of them measuring 1.3 x 1 inch.

On July 21, a large female was caught on her nest by the side of the railroad north of the ice-houses. Nineteen eggs were found in the nest, and 2 fully developed eggs were taken from the oviduct. These 21 eggs represented 2 different sizes, those taken from the turtle and a portion of the others measuring 15-16 x 15-16 inch, the others 1 1-16 x 1 1-16 inches and all were decidedly more nearly spherical than any of those obtained July 18.

The female Soft-shell Turtle caught July 21 weighed just 7 pounds and gave the following measurements:

Length of carapace, 13 inches.
Width of carapace, 10.5 inches.
Length of head and neck, 9 inches.
Length of fore leg and foot, 4.5 inches.
Length of hind leg and foot, 5.5 inches.
Length of tail, 3.5 inches.

Another example measured 11.75 inches long and weighed 5.5 pounds; another 11 inches, 4 pounds; another female measured, length of carapace 12.5 inches; width 11 inches; and still another was 12.5 by 10.25 inches.

The eggs of the Soft-shell probably hatch in the autumn, and there is probably some range in the time of their hatching just as there is in the time of laying. The period of incubation doubtless varies somewhat with the season, whether such as to warm up the soil considerably or not, and also a good deal with the nature of the soil in which the eggs are laid, a warm, sandy soil hatching them out sooner than a colder soil. In the late autumn of 1906, on November 16, a nest of eggs was found in the black mucky soil near the south shore of Outlet Bay, which contained well-formed young Soft-shells, the color-markings (spots on back) being distinct. The egg-yolk was not yet absorbed, but occupied one-half the shell while the turtle occupied the other. It seems probable that the turtles would not have left the nest that year, but would have wintered there. It is possible that this was a belated nest.

As an article of food the Soft-shelled Turtle is the most highly esteemed of any of the species found in Indiana, the soup made from it being delicious. Not many of the cottagers at the lake, however, seem to have acquired a taste for this or any species of turtle, and they are not much sought after.

This turtle is the species most often caught in traps, on set-lines and by anglers. On August 8, several were caught in water 14 feet deep east of Long Point, on a hook baited with grasshoppers. On June 27, six were caught on set-lines baited with meat, 2 others were obtained the same way August 1, and one on August 17. Set-lines placed in Lost Lake were always quite sure to take several any time from June to September. In 1906, a citizen of Culver who set out turtle traps caught numbers of these.

This species probably devours dead fish or other animals found in the water. Its principal diet, however, as evidenced by a number of stomachs examined, appears to consist of crawfishes.

This turtle has few enemies and would be able to escape almost anything that attempted to capture it. A good many young appear to perish during their first winter. The stomachs of some examples studied were infested by a few parasitic round worms, but we have no evidence that these cause much injury. Unlike the scute-bearing turtles, this species is never covered with algæ or other organisms, although one example was found in 1906 which had the plastron covered with a growth of *Opercularia*.

This turtle may be readily distinguished from all other turtles of the lake by the flat body, covered with a smooth leathery skin flexible at the margins. Color, olive-green, with dark spots; head and neck olive-green with light and dark stripes; legs and feet mottled with dark. The male has the tubercles on the front of the carapace smaller than in the female, the body longer, and the tail extending considerably beyond the carapace.

2. *Chelydra serpentina* (Linnæus).

Snapping Turtle.

The Snapping Turtle is of very wide distribution, its habitat extending from Nova Scotia to the equator and west to the Rocky Mountains. It is doubtless found in every stream and pond in Indiana.

At Lake Maxinkuckee it is quite common, but not nearly so abundant as the Map, Painted, Musk or Soft-shelled turtles. Although they may be seen almost anywhere in the lake, they do not often occur in the deeper, clear portions; they prefer shallow water with soft muddy bottom, especially water that is well warmed up by the sun. They are more common, therefore, in Lost Lake than in Lake Maxinkuckee, and in the latter body of water prefer shallow bays with marshy shores, such as the region about Norris Inlet and Outlet Bay. They are fond of streams and occur in numbers in Norris Inlet, also in Aubeenaubee Creek, Culver Inlet and the Outlet. In the Norris Inlet region, Outlet Bay, or Lost Lake, they can frequently be caught on set-lines or in turtle-nets baited with meat. They are not often seen basking about the shores, but usually spend their time floating or swimming with only the head projecting above the surface of the water. Numerous examples of various sizes were captured in many places about the lake. They were captured in various ways, some in hauls of the seine, some on set-lines, and many by hand. A few were seen that had been taken in traps.

The Snapping Turtle, Snapper, Mossback, or Mud Turtle, as it is variously called, is most frequent in and about muddy ponds, streams or bogs. It may often be seen long distances from water, however, when it is traveling from one pond to another, or in search of a suitable place for depositing its eggs.

It walks along with a slow, awkward, halting gait, often stopping, holding its head well up as if listening or looking about. When traveling about on the land, a great amount of mud may sometimes be seen on the back. The back or carapace is always rough and more or less covered with mud, and there is often a heavy growth of filamentous algæ on the back, the algae being generally some species of *Microspora*.

The Snapper is a vicious brute. When attacked it neither retreats nor withdraws into its shell as most species do, but shows fight at once, snapping viciously at any object held near it. It will even leap forward toward its tormentor. When its jaws have once closed on the enemy it holds on with dog-like persistence. Dr. Hay mentions a curious belief with which the writers have been familiar since boyhood days, viz.—that a Snapper when a hold has once been secured will not let go until it thunders. Another version of this superstition with which we are also familiar is that the turtle will hold on until the sun goes down. They may frequently be carried around for sometime by the stick which they have seized.

These turtles are carnivorous and very voracious. Their food consists of frogs, fishes, crawfishes, young waterbirds, and such other small animals as they can capture. Several stomachs examined at the lake all contained opercula and fragments of *Vivipara contectoides*, indicating that this mollusk is the principal food of this species of turtle at the lake during certain parts of the year. That they sometimes capture young ducks and goslings, catching them by the feet and pulling them under the water, seems well authenticated.

They evidently bury themselves in mud in swamps, frequently some distance from the lake, and hibernate in winter. A single, rather large individual was seen under the ice (Lost Lake, December 18, 1900.) It was close up against the ice, which was chopped away, and the turtle, which was apparently too benumbed to pay any attention to what was going on, was taken out. It was kept alive over night in a coop and the temperature, which was somewhat higher than freezing (35°) kept the turtle in such a benumbed condition that it could hardly move by morning.

These turtles began coming out of the mud about the middle of March, the first one having been seen March 19. From then they came out one by one, and from that time on they continued to be seen on land until through the nesting season. In the fall they were to be seen about the lake as late as the end of September. It is possible that the young turtles spend their first winter in the water or near it; they are usually seen about the water's edge and in pools early in the spring. On April 3, one about the size of a dollar was caught in a pool east of the railroad. The first winter appears to be a critical period in their lives; quite a number of small ones were found dead at the water's edge in early spring, between April 3 and April 26.

They begin laying about the middle of June. Several were seen on or about nests between June 14 and 20. The nests consist simply of holes made

in the sand, usually not very far from water. One of the favorite nesting places was the railroad embankment between the lakes. The eggs are quite spherical in shape and about an inch in diameter. The shell is calcareous, and, although not brittle, somewhat less flexible than in other species. The number may vary from 20 to 60, and they hatch in August or September. According to Agassiz, the young will snap before they have left the shell. We have never seen one so small that it would not snap viciously.

This turtle is often used for soup, though only the younger examples are suitable for that purpose. The older individuals have a strong disagreeable odor, and the flesh is tough. According to Dr. Hay, Storer wrote that in Massachusetts many persons saved the oil of this turtle and used it for healing bruises and sprains. "As a therapeutical agent it is worthy to stand alongside of goose, rattlesnake and skunk oil."

This turtle reaches a large size. Examples weighing 40 pounds each have been reported, although one of 12 or 16 pounds is generally regarded as a large Snapper.

The measurements of 3 of the larger examples taken at Maxinkuckee are given in the following table:

	1	2	3
Length of carapace, (inches)	13.25	11	7
Width of carapace	14.25	10	6.25
Length of Plastron	9 12	8 5	5.25
Width of Plastron	5		3 06
Length of head and neck	11		
Length of hind leg and foot	9 5		
Length of fore leg and foot	9		
Length of tail	12		
Weight	16 lbs.	13 lbs.	10 lbs.

The Snapper has very few enemies. Very young examples may occasionally fall a prey to voracious fishes, but the larger examples are exempt from the attacks of anything except leeches, which are usually present in small numbers. A Snapper kept in captivity in a live box in the lake was badly infested with them. During its confinement in the box it became much emaciated, and the algae on its back grew to extraordinary thickness and length. An immense bunch of leeches had collected in the hollow between the neck and front legs and would probably soon have caused the death of the turtle.

Shell high in front, low behind, the body heaviest forward; head and neck very large, jaws strongly hooked and very powerful; tail long, strong, and with a crest of horny, compressed tubercles; plastron small, cross-shaped, with 9 plates besides the very narrow bridge; claws 5-4, strong, the web small; color, dusky brown, head with dark spots. Size large.

3. *Kinosternon odoratum* (Latreille).

Musk Turtle.

The Musk Turtle, also called the Stink-pot, ranges from the eastern United States westward to northern Illinois. It is abundant in most parts of its habitat, particularly in the small lakes in the upper Mississippi Valley. At Lake Maxinkuckee it is one of the most abundant species, it being exceeded in numbers only by the Map, and possibly, by the Painted, Turtle. On account of its not having the basking habit well developed it is, however, far less conspicuous than either of those species.

The Musk Turtles seem to spend most of their time walking about on the bottom of the lake, and are particularly fond of muddy places, the Outlet region, Green's marsh, Lost Lake and the Inlet, being their favorite haunts. They are also found up Aubeenaubee Creek, a region well suited to them. This turtle is not built well for swimming, as it is quite deep in proportion to its diameters. There is, however, an immense amount of individual variation in this respect. It is a strictly aquatic species, and comes out on dry land, or even in the marshes, quite infrequently. It is not so much in evidence early in the spring as the Map and Painted turtles, and is rarely seen basking. The great majority of the numerous examples we have seen were observed in shallow water in such places as Outlet Bay, either walking slowly about on the bottom or partially concealed in the Chara; very rarely have they been observed swimming freely.

We have observed them during every month in the year except January and February. Our earliest record is March 18 (1901), when one was obtained near the railroad and another was seen on the bottom in Culver Inlet. From that date onward they could be seen any day when the water was smooth and the conditions favorable for observation. Even after the lake freezes over they may be seen. Our latest record is for December 31 (1904), when one was observed through the ice in Outlet Bay. It is, therefore, active practically throughout the year. On December 20, 5 were found alive in a mink burrow.

Although this species does not usually bask, it does so occasionally. Among a hundred turtles seen basking, probably there would be one or two Musk Turtles. They are quite disposed, however, to rest quietly in the water with the head just above the surface.

In disposition, this is the most vicious of any of our species except the Soft-shell and the Snapper. It is very sly and apt to take hold of one's finger when least expected. It holds on tenaciously and would be capable of inflicting a painful wound were its size not so diminutive.

As to food, one was seen June 6, 1901, in company with a Painted Turtle, swimming along behind a dead floating fish, and nibbling bites out of it. Also, in the late autumn (Oct. 30, 1904) one was seen nibbling at the body of a grass pike 13 inches long that lay on the bottom at the head of the Outlet. This turtle or others stayed near the fish several days, but did not seem to

make much progress in disposing of it, perhaps because the cold season was coming on, when they probably eat little or nothing. On September 2, 3 or 4 were seen feeding on fresh cow dung in the edge of Lost Lake. Professor Newman says they often contain *Viripara contectoides.*

We have not been able to determine definitely the breeding season of this species. Among many examples collected November 1 (1904), several pairs were copulating. On September 13 (1906), a pair were observed copulating, the female lying prone, as if dead. September 20 (1907), a female found crushed in the road contained eggs quite well developed. One was dissected November 27 (1904), which contained eggs the size of marbles. October 4, very small ones were abundant in shallow water near shore, some of them showing the placental attachment. These had probably hatched but recently. Early in June, a good many may be seen walking about on the land, and we supposed they were hunting nesting sites. Some very small ones were caught May 6 and 7, 1901, so they probably either hatch quite late in the year, or grow very slowly. This evidence is so conflicting as to render any positive statements regarding the breeding season hazardous.

The enemies of the Musk Turtle do not appear to be many. On December 20 (1904), one was found at the Inlet turned upon its back and the soft parts almost wholly gone—probably devoured by a muskrat, the tracks of which were in evidence. Another was found November 27, partly devoured. Apparently the muskrat occasionally catches one of these turtles or finds it torpid during the winter season and feeds on it. At any rate, we found them now and then (though not so frequently as we do the Painted Turtle) lying on the ice, usually belly up with the flesh chewed out from the sides. The muskrats were not actually caught doing the work, but as it took us some time to catch them actually catching mussels and cleaning out their shells, and as, on several occasions, muskrat tracks, and no other were seen coming to the turtles, we are convinced we would have caught them at it if our observations could have been longer continued. Probably the muskrats pick up the turtles and lay them aside much as they do shells they are unable to open, and after the turtles are frozen, devour them.

These turtles are often infested by leeches which doubtless cause annoyance, at least.

Like the Snapper, the Musk Turtle is frequently covered with algæ on the back, the algæ often being quite long and thick. The proportion of turtles covered with algæ varies with the season and conditions; in early summer, before the scutes were shed, all or nearly all the turtles would probably be covered; with the shedding of the epidermal scutes the turtle comes forth clean of algæ, and bright in color.

During the late summer and early autumn of 1906, many small Musk Turtles were seen surrounded by a white halo which was conspicuous at a distance, very much resembling the general appearance of Saprolegnia on fishes. It was found upon examination that the white growth consisted of a

dense growth of a stalked branched protozoan, *Opercularia*. Later it was found that larger Musk Turtles harbored considerable masses of the protozoan on the plastron, this being frequently entirely covered, so that the turtles were practically botanical gardens above and zoological gardens below. Neither the alga nor the protozoan appears to do the turtles any injury. The algæ above may assist the turtle in concealment; the protozoan below is self-supporting, feeding on minute organisms. The turtles in the muddy waters of Lost Lake are much more heavily overgrown than those of the clearer waters of Lake Maxinkuckee.

The Musk Turtle is a harmless creature and certainly does some good as a scavenger. It should, therefore, be protected.

So far as we are informed, it is never utilized as food by man; its small size and disagreeable odor preclude such a possibility. It is the smallest species in the lake. In the following table are given the weights and measurements of examples of the species, the first 51 of which were caught by us in the Outlet Bay, November 1, 1904, by means of a small dipnet, and afterward sent to the American Museum of Natural History.

No.	Weight in Ounces.	Carapace		Plastron.		Date.
		Length in inches.	Width in inches.	Length in inches.	Width in inches.	
1	4.75	4.375	3.625	2.375	1.25	Nov. 1, 1904
2	7.25	4.75	4.50	3.00	1.50	
3	3.50	3.875	3.75	2.375	1.25	
4	5.50	4.625	4.00	2.50	1.375	
5	3.50	4.00	3.625	2.25	1.25	
6	5.00	4.375	4.00	2.625	1.375	
7	5.75	5.00	4.00	2.94	1.50	
8	7.00	4.75	3 375	2.875	1.625	
9	7.00	4.75	4.25	2.875	1.50	
10	7.75	5.375	4.625	3.00	1.50	
11	4.25	4.25	3.75	2.25	1.19	
12	7.00	5.00	4.50	3.00	1.50	
13	4.50	4.312	3.625	2.625	1.44	
14	6.00	4.75	3.875	2.625	1.44	
15	7.00	4.75	4.50	3.25	1.625	
16	5.50	4.625	4.00	2.69	1.44	
17	6.00	4.56	4.25	2.625	1.375	
18	5.50	4.25	4.00	2.69	1.375	
19	4.50	4.25	3.625	2.50	1.312	
20	7.00	4.56	4.375	3.125	1.375	
21	3.75	4.00	3.00	2.375	1.125	
22	7.00	4.50	4.625	3.25	1.75	
23	8.00	5.00	4.563	2.875	1.563	
24	4.50	4.06	3.802	2.25	1.125	
25	3.75	3.802	3.375	2.50	1.375	
26	2.75	3.6875	3.25	2.125	0.94	

No.	Weight in Ounces.	Carapace		Plastron.		Date.
		Length in inches.	Width in inches.	Length in inches.	Width in inches.	
27	7 00	4 802	4.50	3.312	1.75	
28	3.25	3 75	3.312	2.312	1.00	
29	4 00	4 00	3 063	2 625	1.375	
30	3 00	3 75	3 25	2.25	1.312	
31	3.00	3 625	3.44	2 063	1.25	
32	5 00	4 625	3 94	2.625	1 50	
33	6 00	4 563	4.25	2 75	1.375	
34	5 75	4.50	4.063	2.802	1.375	
35	7 00	4 802	4 44	2 802	1 50	
36	5 75	4 69	4 25	2.563	1.312	
37	6 00	4 875	4 25	2.802	1 50	
38	2 75	3 75	3 312	2.19	1 063	
39	5 00	4 563	3 802	2.625	1 625	
40	5 75	4 625	4 125	2 75	1 50	
41	3.25	4.375	4 125	2.875	1 625	
42	6.50	4 875	4 312	2 75	1 50	
43	6.50	1 75	4 25	2 625	1 563	
44	6.00	4 75	4 50	2 50	1 375	
45	4 25	4 125	3 75	2 50	1 375	
46	3 75	4.063	3.563	2.50	1 125	
47	4 25	1 25	3.802	2.50	1 44	
48	3 25	3 875	3 50	2.25	1 187	
49	2.00	3.25	3 00	1 75	1	
50	3 00	3 50	3.25	2 187	1 187	
51	4.00	3 94	3 687	2.50	1 44	
52	3 75	3.312	2 50	2.50	1.687	April 29, 1901
53	6 375	1 25	2.75	3.375	1 875	
54	5 00	3 687	2.563	2 94	1 687	
55	7.25	5 00	4 75	3.00	1 375	Oct. 21, 1907
56	6.00	4 625	4.25	2.563	1 44	
57	6 50	4.25	4 50	2.94	1.50	
58	3 25	3.75	3 50	2.25	1 187	
59	7.00	5 125	4 44	2 75	1 625	
60	6 25	4 563	4 375	2 875	1 50	
61	4 25	4 187	3 625	2 375	1.312	
62	2 25	3 625	3 44	2.19	1.19	
63	4 00	3 94	3 75	2.375	1.25	
64	6 25	4 625	1 125	2.875	1.50	
65	4 25	4 125	3.75	2.375	1 25	
66	2 75	3 75	3.25	2.19	1 063	
67	3 75	3 94	3 625	2 44	1.25	
68	4 50	4 00	3.25	2 375	1.312	
69	5 25	4.44	4 00	2 615	1 312	
70	3.25	3.625	3 41	2 19	1 19	
71	3 00	3 625	3 375	2 25	1.125	
72	7 00	4 94	4 25	3 00	1.563	
73	4.50	3 94	3.44	2 14	1.25	
74	4.75	4 375	4.063	2.625	1.44	
75	7.00	4.875	4.50	2 875	1.50	

No.	Weight in Ounces.	Carapace		Plastron		Date.
		Length in inches.	Width in inches.	Length in inches.	Width in inches.	
76	4.50	4.063	3.625	2.50	1.25	
77	5.25	4.19	4.00	2.875	1.312	
78	7.00	4.75	4.44	2.625	1.375	
79	5.75	4.125	3.19	2.50	1.44	
80	5.75	4.75	4.125	2.563	1.44	
81	2.25	3.19	3.00	1.94	1.00	
82	4.25	4.125	3.19	2.375	1.19	
83	3.00	3.625	3.375	2.25	1.125	
84	3.00	3.50	3.25	2.25	1.125	
85	7.25	5.25	4.312	2.94	1.625	
86	4.00	4.00	3.625	2.25	1.19	
87	6.00	4.50	4.25	2.69	1.375	
88	6.25	4.75	4.25	2.75	1.563	
89	6.00	4.75	4.25	2.75	1.375	
90	4.25	4.00	3.625	2.50	1.25	
91	3.25	3.50	3.25	2.125	1.125	
92	6.00	4.69	4.312	2.625	1.375	
93	6.75	5.063	4.312	3.00	1.563	
94	3.00	3.563	3.375	2.25	1.125	
95	5.75	4.50	4.00	2.802	1.312	
96	3.00	3.625	3.25	2.25	1.125	
97	4.25	4.44	3.875	2.625	1.50	
98	4.75	4.25	4.19	2.50	1.375	
99	3.00	3.625	3.25	2.125	1.125	
100	4.50	4.19	3.75	2.625	1.312	
101	5.00	4.375	3.94	2.50	1.25	
102	4.50	4.375	3.875	2.44	1.375	
103	3.75	3.94	3.50	2.375	1.25	
104	7.00	4.75	4.69	2.875	1.50	
105	6.00	4.50	4.25	2.75	1.625	
106	7.50	5.25	4.50	2.875	1.50	Oct. 22, 1907
107	5.25	4.125	4.00	2.75	1.375	
108	6.50	4.94	4.125	2.802	1.50	
109	6.25	4.563	4.25	3.063	1.563	
110	4.00	4.125	3.94	2.50	1.312	
111	2.50	3.563	3.19	2.125	1.063	
112	6.25	4.875	4.69	2.69	1.375	
113	5.25	4.375	4.125	2.802	1.312	
114	4.50	4.25	3.94	2.75	1.25	
115	4.50	4.25	3.94	2.50	1.375	
116	6.25	4.75	4.125	2.755	1.50	
117	6.25	4.75	4.375	2.875	1.44	
118	5.25	4.312	4.505	2.69	1.50	
119	3.75	4.063	3.625	2.44	1.312	
120	5.50	4.625	4.125	2.625	1.375	
121	7.00	5.00	4.625	2.94	1.563	
122	2.75	3.563	3.312	2.19	1.125	

No.	Weight in Ounces.	Carapace		Plastron		Date
		Length in inches.	Width in inches.	Length in inches.	Width in inches.	
123	4.25	4.375	3.802	2.50	1.375	
124	2.25	3.25	3.063	1.875	0.94	
125	4.50	4.063	3.875	2.312	1.25	
126	2.75	3.312	3.25	2.19	1.063	
127	3 75	4.063	3.75	2.50	1.19	
128	6.25	4.802	4.25	2.69	1.50	
129	5.00	4.50	4 125	2.69	1.44	
130	6.25	4.69	4.312	2.94	1.44	
131	3.50	3.94	3.69	2.375	1.312	
132	3.25	3.875	3.375	2.44	1.19	
133	3.50	3 75	3.563	2.25	1.19	
134	8.50	5.125	5.00	3.00	1.625	
135	4.25	4 312	3.875	2.563	1.375	
136	3.25	3 875	3.25	2.312	1.25	
137	5 75	4 563	4 125	2.94	1.563	
138	2.75	3.75	3.312	2.25	1.19	
139	5.25	4 563	4 125	2 563	1 375	
140	5.25	4 44	4.00	2.625	1.44	
141	4 00	4.063	3 75	2.625	1.25	
142	4 00	4.25	4 00	2.50	1.312	
143	3.50	3 75	3 625	2.125	1.19	
144	5 25	4 69	4 312	2.69	1.375	
145	3 25	3 69	3 625	2.25	1.19	
146	6.50	4 802	4 .625	2.802	1.50	
147	3.50	4 00	3.44	2.375	1.19	
148	4.75	4.125	4 00	2.50	1.312	
149	4.00	4 00	3.94	2.50	1.312	
150	5 25	4 44	4.25	2.75	1.50	
151	3 00	3 75	3.50	2.375	1.25	
152	6.25	4 94	4.625	2.75	1.41	
153	4 00	4 063	3 802	2.375	1.312	
154	2.50	3.625	3 25	2.25	1.125	
155	2.75	3.563	3.19	2.19	1.125	
156	2.00	3 19	3.125	1 94	1.00	
157	3.25	3 802	3.563	2.375	1.125	Oct. 21, 1907
158	3.50	3 94	3 563	2.44	1.375	
159	4 75	4 312	4 063	2.50	1.50	
160	3 00	3 802	3 375	2 25	1.375	
161	5.00	4 312	4.063	2.625	1.44	
162	3.50	3 875	3.375	2 312	1.125	
163	2.75	3 75	3 25	2.25	1.19	
164	3.25	3 802	3.563	2.25	1 19	
165	3.50	3.563	3.375	2.19	1.125	
166	3.75	4 00	3..563	2.25	1.19	
167	1.75	3 063	2 875	1 94	0.875	
168	0.50	2 19	2.25	1.25	0 69	
169	0.50	1 94	2.063	1.19	0.563	
170	0.50	1.94	2.00	1.063	0.625	
171	0 25	1.44	1.50	0.802	0.50	
Average	4.66	4.50	3.78	2.51	1.32	

The Musk Turtle may be known from the following description:

Carapace rather long and narrow, the outline rising gradually from the front to a point beyond the center, then abruptly descending, the bulk of the body, therefore, thrown backwards; margin of carapace turning downward and inward rather than outward; shell dusky, clouded, sometimes spotted; neck with 2 yellow stripes, one from above the eye, the other from below it; head very large, with strong jaws; carapace with traces of a keel. Length 6 inches or less.

4. *Graptemys geographicus* (Le Sueur).

Map Turtle.

The Map Turtle is found from the Mississippi Valley eastward to New York, but is more common in the western part of its range. It is common everywhere in the lakes and larger streams of Indiana.

At Lake Maxinkuckee it is by far the most abundant turtle and is found in all parts of the lake; the heads may often be seen sticking up above the surface even in the deeper portions of the lake. Like most of the other turtles of the lake, however, they prefer shallow bays. Examples have been taken almost everywhere about the shores of the lake. It occurs in both lakes, in the lagoons between them, in the Inlet and Outlet, and perhaps also in the smaller streams about the lake. It does not travel far from shore, and is not found in the pools and woodland ponds of the region.

The Map Turtle makes its appearance swimming at the surface or basking, early in the spring; the first seen in 1901 was on April 27, and they were seen in gradually increasing numbers from that time on. They are very abundant from May on to August or September. They are essentially aquatic in their habits and are never seen away from the water except when laying their eggs. Though most numerous near the shore and in protected bays, they may often be seen far from shore out in the lake, slowly swimming about or quietly resting at the surface. When approached, they sink silently beneath the surface, swim slowly a short distance, again come up and rest with head above the water as before. In our seining operations about the lake small Map Turtles were taken at nearly every haul. They were particularly abundant in the patches of Scirpus and on sandy bottom covered with a growth of Chara. They were less common among the Potamogetons, Myriophyllum and Ceratophyllum. A few can usually be seen on any log, board or other floating object of sufficient size and stability, but they most delight in low, sandy, somewhat grassy beaches. A favorite basking place of this kind is on the south side of Outlet Bay near the wagon bridge. Here a score or more could often be see. They would crawl out upon the shore about 8 or 9 o'clock in the morning, or earlier if the day were bright and warm, and there they would remain for many hours. They usually rest quietly basking in the sun, occasionally moving about a little. From the amount of

time they spend basking during the day, it is supposed that they feed principally at night.

The basking ground along the south shore of Outlet Bay was so much used that the grass and weeds were much worn off by the turtles, and a great many shed scutes were to be found there. A dense growth of algæ occurred near shore in which the turtles would hide when frightened. On April 23, a Map Turtle of medium size was seen basking, sitting crosswise on the back of a somewhat larger Painted Turtle.

The time of mating was not positively observed. On October 4, and later in the fall, they appeared frequently in pairs walking about on the bottom of the lake, or a small one following a large one about. On April 27, small ones were also noted following large ones about as if about to mate. As a pair of Musk Turtles were observed actually mating in the autumn, it is probable that the other turtles, including this species, occasionally do so at that time. They begin laying their eggs at least as early as June 12. They do not go far from the water, but dig their nests in the sandy shores or banks near the lake. They even sometimes attempt to make nests in rather stiff clay, or in rather hard ground. On June 18 one was seen in the road back of the Miller cottage, digging a hole for a nest. The hind feet were used in digging. On June 23 one was seen on her nest between the ties of the railroad south of the ice-houses. After the turtle had left, the place was examined and 11 eggs were found. Occasionally an egg may be dropped in the water or on the shore where there is no nest. The eggs are elliptical-cylindrical, about 1½ x 7-8 inch, the shell being quite soft and flexible.

This turtle continues basking later in the fall than any other species. On November 2 and 3 quite a number were seen on the stones along the east side of the lake, and one was seen basking as late as November 22. Late in autumn when the air gets chilly these turtles, when basking on stones or boards, assume a peculiar position. The legs instead of being drawn up toward the body, are stretched out straight and stiff and the turtle on being approached tumbles rather than scrambles into the water. The cold of autumn benumbs them quite considerably. On November 30, while walking along the south shore of the lake, several turtles of this species were observed to leave shore and take to the water. They attempted to dive, but were unable to do so; they plunged their heads below the surface, tilting up the posterior part of the body, and finally succeeded in getting all under water except the hind legs, which, projecting above the surface, fanned the air frantically and in the most ludicrous fashion. Seven of these turtles were caught; four of them were quite large. They were placed in an open-bottomed live-box near the station where it was thought they would bury themselves in the soft sand for the winter. All, however, were soon frozen.

In the autumn these turtles, along with the Painted, show a tendency to migrate from the larger lake into Lost Lake. They usually go down the Outlet, but in the autumn of 1906 a dam was built across the Outlet at the

railroad bridge, and the turtles were seen in considerable numbers climbing over the dam or making the journey over the road by land.

The Map Turtle does not hibernate, but many, if not all of them, keep walking about on the bottom of the lake, where they can be seen through the ice whenever it is clear.

Throughout the winter of 1900-1901, they could be seen any day when the ice was not covered with snow. In the early winter of that year these turtles appeared to congregate in considerable numbers in the northwest corner of Lost Lake, in shallow water near shore. On Dec. 15, 25 were counted in this place, and only one or two were seen elsewhere. Later on in the season they were found in various other places; a good many were found in the bottom of Outlet Bay. On Christmas day, 1900, in walking out 149 steps from Chadwick's pier, 69 Map Turtles and one Musk Turtle were counted. They were also found in some numbers in the Norris Inlet region. These turtles keep moving about more or less all winter, although they are not nearly so active, as in the summer; and they probably eat little or nothing. They do not appear to swim any or leave the bottom. They do not appear to take fright easily and would probably be unable to make good time in attempting to escape even if they tried; one can walk above them and study their actions in detail through the clear ice. While walking about the motion of the limbs is quite jerky and irregular. Where they walked over soft bare muddy bottom the tracks left by them could be plainly seen—two parallel rows of dots, the distance between the rows indicating the size of the turtle; by following these, the animal could frequently be tracked down.

The Map Turtle is unable to withstand a freezing temperature, at least in air. During the winter several were caught where the ice men had taken out ice, and were set out on the ice. They began to stiffen almost immediately, and froze solid in a very short time. They were very gradually thawed out by being placed in cold water, but did not revive.

The Map Turtle is probably a scavenger and does much to rid the lake of dead animal matter. It also feeds largely on the smaller mollusks, particularly *Viripara contectoides*. It is never used for food— perhaps on account of its small size as compared with the two species here used for food—the Snapper and Soft-shell. So far as our observations go it has no enemies except, possibly, leeches.

The Map Turtles reach only a moderate size. The largest examples seen by us weighed 4 to 4½ pounds.

The following table gives weights and measurements of 19 individuals examined:

MEASUREMENTS OF MAP TURTLES.

No.	Weight	Carapace.				Plastron.	
		Length (Straight)	Length (Curve)	Width (Straight)	Width (Curve)	Length	Width
1	4 lbs.	10.25	10.75	7.50	9.75	9.12	5.00
2	4.25	10.75	11.00	7.50	9.00	9.25	5.00
3	4.	10.40	10.60	7.12	9.33	9.00	4.88
4	3	8.75	9.20	6.37	8.37	8.00	4.50
5	2 oz.	4.20	4.27	3.25	3.80	3.63	2.00
6	2 oz.	4.07	2.25	3.20	3.88	3.50	1.88
7	6.14 oz.	4.75	.....	3.63	.....	3.88	2.88
8	4.23 oz.	3.94	.....	1.13	.....	3.43	2.43
9	3.32 oz.	3.63	.....	2.94	.....	3.13	2.31
10	2.65 oz.	3.43	.....	2.81	.....	2.43	2.13
11	2.43 oz.	3.25	.....	3.06	.....	3.00	2.25
12	0.85 oz.	2.19	.....	2.00	.....	1.94	1.43
13	0 81 oz.	2 13	.....	1.94	.....	1.81	1.38
14	2 lbs.	8.00	.....	.....	.....	.....	.....
15	3 oz.	3.38	.....	2.87	.....	2.87	1.63
16	2.5 oz.	3.43	.....	2.75	.....	3.00	1.56
17	3.5 oz.	3.81	.....	2.87	.....	3 25	1.67
18	3.25 oz.	3 67	.....	2.75	.....	3.13	1.50
19	.....	2.13	.....	1.87	.....	1.87	1.37
1	.75 oz.	2.125	.....	2.25	.....	1.682	.93
2	.75 oz.	2 125	.....	2.25	.....	1.682	.93
3	1 50 oz.	3.	.....	2.93	.....	2.434	1.31
4	4.50 oz.	4 434	.....	3 868	.....	3 50	1.744
5	6. oz.	4 744	.....	4.434	.....	3.93	2.

The Map Turtle is usually free from growths of algæ or other organisms. The young differ from the older in being decidedly more strongly keeled, the portions of the carapace each side of the keel being rather straight, so that the shell of the young turtle looks somewhat like a roof. The young are covered with delicate reticulations which give pleasing color patterns, but which disappear more or less completely in the adult. This is one of the most inoffensive of the turtles and can hardly be induced to bite.

Carapace ovate, broadest behind, the margins flaring outward, highest near the middle and not strongly convex; carapace strongly notched behind and usually decidedly keeled. Color, dark olive brown, with greenish and yellowish streaks and reticulations, especially distinct on neck, legs and edge of carapace; plastron yellowish.

5. *Pseudemys elegans* (Wied).

Elegant Turtle.

This is the rarest as well as the most beautiful turtle occurring about lake Maxinkuckee. Its habitat extends from the Carolinas to Mexico and in the Mississippi Valley northward to Indiana and northwestward to the Yellowstone. It was described originally from specimens taken near New Harmony, Indiana. According to Dr. Hay it has been found at Mt. Carmel, Ill., and in the Tippecanoe at Winamac. At the latter place Dr. Hay obtained a specimen about July 1, 1892. There seem to be no other Indiana records until now.

During our several seasons at Lake Maxinkuckee we obtained but one specimen of this turtle. This was secured by Mr. Clark, June 13, 1901, at the south end of the lake near the small spring, where, about 200 feet from shore, the water was about three feet deep and the bottom covered with Chara. The specimen was a very fine one. The length was about 6 inches. We saw the shell of a second example in a shop in Culver. It had been caught in a trap in Lost Lake, and the carapace was 9.5 inches long and 7 inches across.

We know but little of the habits of this fine turtle. It is probably entirely aquatic.

It may be known from the following description:

Shell broad and depressed; carapace serrated behind, a slight emargination in each scute and deeper ones between them.

Color of carapace, olive; with lines and spots of yellow and black; the lines running mostly lengthwise on the vertebral scutes, and transversely on the costals; a yellow band of varying width down the middle of each costal scute, parallel with other lines and bands of black and yellow, some narrow, some wide: on the upper and lower surfaces of the marginal scutes are spots consisting of concentric circles of yellow and black, between them a yellow band crossing each marginal; plastron yellow, with a black blotch on each scute, these often ocellated with yellow; spots on bridge usually confluent; head with numerous narrow stripes of greenish or yellow; a broad stripe from under eye extending backward on neck, being met at angle of mouth by a stripe from middle of lower jaw; another stripe, often blood red, from posterior corner of eye running back on neck; legs and tail striped with yellow.

Length 10 inches or less.

6. *Chrysemys marginata* Agassiz.

Western Painted Turtle.

The Western Painted Turtle is found from central New York westward through the Great Lakes and the Mississippi Valley and southward to the Gulf. It is generally common and is abundant throughout Indiana. It is

found in practically every stream, pond and lake in the state. While it is not rare in running streams, it is in the small lakes and ponds that it most delights to dwell. Choice situations are small muddy ponds in which are many old logs or chunks on which they may bask.

Next to the Map Turtle, this is the most abundant species in Lake Maxinkuckee; and, excepting the Spotted Turtle and the Elegant Turtle, it is the most beautiful.

In the spring they are first noticed about the middle of March in the small pools along the railroad between Green's flat and the Outlet. Here they become very abundant in April, sitting on logs, chunks, or other objects, sunning themselves. They do not appear in numbers in the lake proper until later. By the first of June they can be found anywhere in shallow water about the lake.

During the summer and until December they may be seen basking in the sun. Wherever a log, post, board or other object affords support above the water there they will sit quietly all day long, sliding off into the water only when disturbed. A favorite place was on the boards and timbers in the lake off the ice-houses. From July to October, hundreds could be seen at this place. The earliest and latest dates upon which we saw this species basking were March 17 and December 3. They were observed moving about under the ice as late as December 16.

Near the end of Long Point on the north side was a portion of an old pier which had drifted ashore and grounded in shallow water. This was a favorite basking place for turtles throughout the summer and fall, and 40 to 50 could be seen there any time. When disturbed they would scurry into the water where they could be seen scattered about near the pier, their heads sticking out of the water, ready to crawl out again when the cause of their alarm has disappeared. The majority were Painted Turtles, though there were usually among them several Maps and a few Soft-shells, an occasional Musk Turtle, and now and then a Snapper.

On July 25, 1899, 280 Painted Turtles were caught at one haul with a 35-foot seine off the Assembly Grounds.

This turtle is a shallow water species and is not often observed out in the lake at any great distance from the shore; in which respect it differs markedly from the Map Turtle, the Soft-shell and the Snapper. We have no record of any Painted Turtle having been seen in the lake more than a few rods from shore.

On the other hand, it is seen oftener than any other species on dry land about the lake.

Early in June, they begin wandering about, apparently hunting for suitable nesting places. They probably wander farther from the lake than any other species (excepting the Snapper), and may be seen in the fields, pastures, along the railroad, and in the open woods. They lay their eggs about the middle of June in shallow holes which they dig in the sand with their hind

feet. The eggs appear to hatch out late in the fall. On September 28 a nest of 10 young, each about an inch long was dug up in a potato field on Long Point. Favorite nesting sites are the sandy slopes of the railroad grade and the Assembly grounds, the field south of Green's flat, and the north shore of Long Point. Soon after hatching the young seek the nearest water, crawl into the mud, and remain until spring.

In the fall they seem restless and wander about a great deal. They are often seen crossing the railroad between the main lake and Lost Lake. The number killed by passing trains is astonishingly great. It is probably within safe limits to say that not fewer than a hundred are killed at Maxinkuckee every year by passing trains. Many are also killed by wagons on the public highway.

Along with the painted turtles killed in these ways there are killed a good many map turtles and a few each of the snappers and musk turtles, as well as a great many frogs, toads and snakes.

The Painted Turtle muds up and hibernates during the winter. We never observed many under the ice. Early in the fall those about Outlet Bay and along the west side of the Lake tend to migrate to Lost Lake, or more definitely to Green's flat and the shallow ponds along the railroad below the Outlet.

Here they "mud up" for a brief period. The first warm days of March call them forth, however, and they may again be seen on the logs and chunks basking in the sun.

The food of this turtle consists chiefly of small mollusks, crustaceans, insect larvæ, and dead fish. On June 6 a Painted Turtle and a Stink-pot were observed both feeding on a floating dead fish, and at other times we have seen the former species feeding upon dead fish. In every case the turtles began eating at the caudal end of the fish.

We have no evidence that this species ever catches live fish. The stomach of one examined October 8 contained a quantity of Spirogyra. Others examined contained Spirogyra and quantities of another alga, Lingbya; another contained some Naias. This turtle is therefore largely a vegetable feeder. It is probably chiefly a scavenger and in this capacity serves a useful purpose in freeing the lake beaches of dead fishes, waterdogs, and the like, which wash up on the shore in considerable numbers.

This turtle is not often used as food, although there is no reason why it should not be so utilized. It has no disagreeable odor and the flesh is doubtless tender, palatable and nutritious.

The enemies of the Painted Turtle are not many. Among animals, doubtless the worst is the muskrat. On December 18 a large example of this turtle was found at Norris Inlet, turned on its back and partly devoured. Muskrat tracks were the only ones about, and it is evident that that animal had been feeding on it. It is this turtle more than any other that is found, back up, on tussocks in the winter along the Inlet and Outlet, and with the body more or less gnawed away, probably the work of muskrats.

On another occasion (November 19) we found a small live Painted Turtle lying up side down on a log. It may have been left there by a muskrat or a raccoon.

Leeches are often found on this turtle and doubtless cause it considerable annoyance. All the turtles of the lake, but this one especially, usually harbor the flat leech (*Clespine*) in considerable numbers. These are usually found on the bare skin along the sides and in the axils of the arms, at which time they are probably sucking blood. The leeches are also frequently found on the shell of the turtle, either on the carapace or plastron, but when in this situation, it is doubtful if they are obtaining any food. Winter seems to be the period of greatest mortality with them; in spring, one occasionally finds them lying about dead in such places as they make their winter quarters, such as pools in Green's flat. Mention has already been made of the great number that are destroyed by being run over by trains on the railroad and by wagons on the public highway. Many are destroyed and many more intolerably annoyed by thoughtless men and boys who shoot them or stone them whenever they see them basking near shore.

The Painted Turtle is easily distinguished from all other species of this region by its shiny black, blue-black or brownish-black color, and bright red on the neck. It may be described as follows:

Shell broad and depressed, broadest behind the middle; shell flaring posteriorly, its surface very smooth, no trace of keel even in the young.

Color of carapace, dark green or greenish-black, the hinder border of the costal and vertebral scutes narrowly bordered with black, the anterior border with slightly wider bright red lines lying immediately against the black margin; the red or yellow lines not joining to form straight lines across the back; a very narrow red line along middle of back; upper surfaces of marginal plates with many crescent-shaped bright red marks; lower surfaces of the marginals black, with large splotches of blood-red and bright yellow; plastron bright yellow or brownish-red, with a large dusky blotch on central portion; soft skin of head, legs and tail dark olive, with red stripes; two large waxy yellow spots on back of head, nearly as large as eye, these prolonged backward as 2 narrow pale yellow stripes; another short yellow stripe from upper corner of eye and another from lower side of eye back on neck; two red stripes on front of each fore leg, and similar ones on posterior surfaces of thighs; besides these, numerous small red spots all over soft parts. Sometimes, in the brownish-black individuals, the sutures of the back are red. The red markings fade to yellow in alcohol.

The claws of some of the painted turtles caught early in the spring of 1901 (April 4) just after they came out of winter quarters, seemed to be remarkably long and sharp. Four examples were caught, and the length of the middle claw of the front feet was taken. The claw of the first was ¼ inch long, that of the second ½ inch long, that of the third ½ inch, and that of the fourth ⅜ inch. The turtles were only of moderate size, the carapace being about 4½ to 5 inches long.

The Painted Turtle varies somewhat in color, the ground-color in most of the examples being a brownish-black. In some cases there is a considerable mixture of green in the ground-color, giving the whole shell a somewhat livelier hue. In some examples seen the lines between the scutes of the carapace were red, and there were other markings of red on the back—sometimes a red dorsal median line and a small red spot in the middle of each of some of the scutes. These color-markings were observable at some distance while the turtles were in the water and made the turtles possessing them objects of peculiar beauty. As the epidermal scutes of these turtles grow old they occasionally become covered with various growths. An alga which appears to belong to the genus *Microspora* grows on the dorsal scutes, and, less frequently a branched stalked protozoan, *Opercularia*, grows on the ventral scutes. Sometime during the year, usually in the late summer, the turtles shed these epidermal scutes, and can frequently be seen with some clean new scutes and old overgrown ones. At the end of the shedding period they come forth bright and new, their colors apparently much clearer. In the autumn of 1906 one of these turtles was caught with the alga on it in fruit, the base of the alga being green, while the fruiting tips had a reddish cast.

There is considerable variation in the epidermal scutes of this turtle, one frequently being added irregularly. An example caught in 1906 had 2 additional triangular scutes, symmetrically placed at the anterior corners of the anterior dorsal scute. In some cases the anterior marginal scute, and those on each side of it are ornamented with peculiar serrations.

Excepting the musk and spotted turtles this is the smallest species found in this region. Its maximum length is bout 6 inches and the maximum weight three-quarters of a pound. The following table gives the weights and measurements of a number examined.

MEASUREMENTS OF PAINTED TURTLES.

No.	Weight.	Carapace.		Plastron.	
		Length in inches.	Width in inches.	Length in inches.	Width in inches.
1	.....	4.87	3.5	4.37	3 0
2	.....	4.37	3.13	4.00	2 5
3	.....	4.25	3.13	3.87	2.5
4	.....	4.5	3.25	4.00	2.5
5	6.75 oz.	4.67	3.25	4.19	2.13
6	12.00 oz.	5.37	2.93	4.87	3 31
7	12.81 oz.	5.63	3.87	5.13	3.25
8	2.65 oz.	3.13	2.57	2.79	2.06
9	6.25 oz.	4.87	3.87	4 00	2.00
10	11.00 oz.	.....	.....	.....	.....
11	10.75 oz.	5.94	5.19	4.87	2.37
	Average.....	4.76	3.47	4.21	2.56

Several young seen May 22 were each about the size of a silver quarter.

7. *Clemmys guttatus* (Schneider).

Speckled Turtle.

The Speckled Tortoise is found from New England to North Carolina and west to Indiana. In this state it has been found only in the northern part. It has been recorded only from Kendallville, Rochester, English Lake and Lake Maxinkuckee. It is not a very common turtle at Lake Maxinkuckee. Two specimens were obtained at the lake in May, 1891, by members of the Indiana Academy of Science.

The first example seen by us was got at the south end of the lake October 1, 1900. It was next seen April 1, 1901, when 2 were found on a tussock in Green's flat. The following is the record of all the remaining individuals seen by us: April 3, 1901, one found dead on Green's flat and another found dead in the elevator pond; April 4, 4 caught and several other seen basking in Green's flat; April 9, several seen in a ditch in Green's flat and one in a tamarack swamp west of lake; April 15, one caught in Green's flat; April 24, several s en in Hauk's marsh chasing each other in a lively manner. They were evidently mating; 3 pairs and one odd one were caught; April 25, caught one male in Green's flat; April 26, several seen in Green's flat; April 30, one seen in Green's flat; May 14, one found dead on the west edge of Long Point; May 22, several seen in a ditch near the tamarack swamp, 4 of which were collected.

The only one see in the fall was found in Hauk's marsh September 3, 1906. One was obtained in a ditch near Fort Wayne, September 28.

This interesting and beautiful little turtle is by preference an inhabitant of the small ponds, marshes and open ditches, and is less aquatic than any of the preceding species. We never saw it in Lake Maxinkuckee proper. The one found at the south end of the lake was south of the Farrar cottage at a small pond. As may be seen from the above, its favorite haunts are Green's flat, Hauk's marsh and the vicinity of the tamarack swamp. None was seen on the east side of the lake, but careful search in April and May would doubtless reveal its presence along Aubeenaubee Creek and Norris Inlet, and possibly at Culver Inlet. Late in May, when the ponds have become pretty dry, these turtles disappeared.

They began mating about the middle of April. Several were seen paired April 19 to 24. When mating, they are more active than we have observed any other species to be. The males chase the females rapidly and persistently until the female is captured. The male would immediately climb upon the female's back. Several pairs that were placed in a tub were continually assuming this position, although actual copulation was not observed.

We have never found the eggs of this species and know very little about its nesting season or habits. Its eggs are said to be only 3 or 4 in number, about 1.25 by .75 inch in size, and to be laid in June.

This turtle is apparently silent, as we have never heard any note which we could positively associate with it.

A good many dead ones are found in the spring; the winter is probably a critical period with them.

These turtles are entirely harmless and should be protected. Their food consists chiefly of crawfish, tadpoles, angleworms, and other weak animals found about the water and in the marshes.

The Speckled Turtle may be readily distinguished from all others by the following description:

Shell moderately to strongly depressed, oval, widest behind, no trace of keel in adult and scarcely evident in the young; nuchal scutes very narrow; plastron large, the hinder lobe about three-fourths width of carapace, with a shallow notch in posterior border; anterior lobe truncated, not movable on a transverse hinge; plastron of male concave; snout not at all projecting; upper jaw notched, the edge nearly straight; legs and feet covered with scales, those on front limbs large and overlapping; feet not large, claws rather short, the web not extensive; tail long, that of the male bringing the vent beyond the carapace.

General color of carapace black, patches of reddish brown showing through the darker; on each scute from one to 12 round bright orange spots, each larger than the pupil; plastron red, orange and black, the black predominating, the orange usually occupying the center and the margin; head black above, with orange dots, usually a large orange spot just above the ear; neck black, with more or less red; shoulders with much red or orange; upper surface of limbs black, with yellow and red, lower surfaces red and orange; tail black, red at base. Length of carapace 4 to 5 inches. Weights and measurements of 14 examples are given in the following table.

No.	Weight.	Carapace.		Plastron.		Sex.
		Length in inches.	Width in inches.	Length in inches.	Width in inches.	
1	3.87 oz.	3.56	2 69	3 00	1.87	
2	4.13 oz.	3.50	2.13	3.19	1.94	
3	3.87 oz.	3.75	2.50	3.00	1.75	
4	4.13 oz.	3.81	2 69	3.13	1.94	
5	3.75 oz.	3.50	2 69	2.94	1 87	
6	4.50 oz.	3 56	2.75	3.25	1.94	
7	3.50 oz.	3.44	2.56	3.00	1.81	
8	4.37 oz.	3.63	2.75	3.37	1 94	
9	.....	4.00	3.00	3.50	2 63	male
10	.....	3.75	2.87	3.25	2.50	male
11	.....	4.00	3.00	3.63	2.50	female
12	.....	3.87	2.87	3.25	2.37	
13	4.30 oz.	3.63	2.75	3.31	2.25	
14*	3.39 oz.	3.56	2.68	3.00	2.19	male
	Average...	3.68	2.71	3 2	2 1	

*In the last specimen the carapace had strong concentric striæ and the plastron parallel radiating striæ. The tail was much larger than in the next preceding specimen.

8. *Emys blandingii* (Holbrook).

BLANDING'S TORTOISE.

This species occurs from New England westward to Illinois. It is found in southern Canada, but is not known from the southern states.

It is nowhere abundant; indeed, in most parts of its range it must be regarded as a rare species. In Indiana it is known only from the lakes in the northern part of the state. It has been recorded from Lagrange and Steuben Counties (Levette), Lake Maxinkuckee (Hay), Rochester (Gould) and English Lake. Only one specimen has previously been recorded from Lake Maxinkuckee; this was obtained by Dr. O. P. Hay in May, 1891.

It is apparently as common about lake Maxinkuckee as anywhere in the state. Our notes record no fewer than 11 examples as having been collected or observed by us in the neighborhood. The definite dates are as follows:

March 29, 1901, one caught on west side of lake near the small pond at the elevator; April 4, one was taken in Green's flat; April 9, one taken in a ditch east of tamarack swamp; May 17, one caught climbing the bank in front of Assembly grounds, and another near same place next day; May 20, a large one found in Hauk's marsh; May 22, two taken near tamarack swamp; July 29, 1905, a large one caught in a kettle hole swamp in Walley's woods; September 11, one seen in a ditch between Arlington and Delong; September 14, a large example in Hauk's marsh; November 4, several large examples, some about 9 or 10 inches long, found dead on Yellow River west of Knox. They had been killed by pearl hunters.

Those taken May 17 and 18 were walking about on dry land as if hunting for a nesting site. We have never seen this species in the lake; it is, rather, an inhabitant of small shallow ponds, marshes and muddy ditches.

Very little was learned regarding the habits of this turtle. As only one of our specimens was found in the water, all the others being out on the land, it appears that it is somewhat less aquatic that the Speckled Turtle. On May 17 and 18 those observed walking about on the land had apparently come up out of the lake. They acted as if hunting nesting sites, though we found none.

The species is described as follows:

Shell elongate oval, widest just behind the middle, without keel; carapace not serrated behind; plastron large, entirely closing the shell; head long and wide; limbs and feet scaly; tail scaly, that of male about one-fifth length of shell, that of female shorter. Color dark green to black, each scute with several round, triangular or oblong spots of yellow or orange, the marginal ones largest, all sometimes wanting; plastron yellow, with the outer posterior portion with a brown blotch which sometimes covers the whole scute; head and neck above and along sides dusky, with numerous yellow dots; chin, throat and under side of neck yellow; legs yellow, with brown mottlings; tail striped longitudinally with yellow and brown. Length 9 inches or less.

Dr. Hay states that the young of this species can be distinguished by the absence of yellow or orange spots on the shell, in marked contrast with the young of the speckled turtle on which the spots appear even before the young are hatched.

9. *Terrapene carolina* (Linnæus).

Box Turtle.

The Box Turtle is found from New England to Texas and westward to Iowa and Kansas. Although occurring throughout Indiana, it is rare about Lake Maxinkuckee. The only record given by Dr. Hay for northern Indiana is Marshall County. During our observations there we saw only three specimens, as follows:

April 13, 1901, a dead shell found near a small pond back of the Farrar cottage at the south end of the lake.

May 22, 1901, one caught in a ditch near the tamarack swamp west of the lake.

July 10, 1902, one found in Walley's woods near the railroad south of the lake.

We have heard of perhaps half a dozen others taken or seen within a few miles of the lake.

The second and third examples listed above give the following measurements:

No.	Carapace.		Plastron.		Circumference.
	Length.	Width.	Length	Width.	
2	5 inches	3.87	4.75	3.	.....
3	6.75	7.25	5.5	3.5	15.5

This species is entirely terrestial in its habits and is the only strictly land tortoise found in the vicinity of Lake Maxinkuckee. It is never seen in the water and only rarely in or about marshy situations. It most delights in dry, sandy, open woodlands where there is some underbrush and where the ground has a thick covering of dry, decaying leaves. Favorite places are old overgrown fence-rows along the borders of woodland, in blackberry and raspberry patches and in beech and oak forests where there are old decaying logs and chunks.

The Box Turtle is a silent, solitary, and solemn creature; one rarely sees more than one at a time. During the mating season, however, two are sometimes found together. Very rarely is one seen moving about, and a person is not apt to find any of these turtles unless he direct his observations to the

ground. And when one is found it will be seen resting perfectly still, with its head projecting from the shell and staring at you stupidly. When you pick it up it will draw in its head and feet and close its shell tightly. Occasionally it will make a slight hissing noise, the only noise we have ever heard it make. It is a wholly harmless, inoffensive creature. It is easily domesticated and, as a garden pet, possesses many interesting and attractive characteristics, albeit not very exciting.

Their mating season in this region is in late April and May, and the eggs are laid in shallow burrows in sandy soil. We know nothing about the number of eggs laid nor the period of incubation.

The food of this species consists chiefly of grubs, angleworms and succulent plants and fruits. When kept as pets they will eat cabbage, lettuce, musk melon, tomatoes, mushrooms, angleworms and meat. They soon learn to take food from one's hand.

Shell broadly oval, sometimes four-fifths as broad as long, high, very convex, and extremely solid; plastron large, tightly closing the opening of the carapace, consisting of 2 lobes movable on each other and the carapace, the bridge entirely obliterated; plastron rounded in front and behind; head of moderate size, the snout not projecting; upper jaw with the cutting edge drawn down in front into a hooked beak, the hook not notched, the alveolar surface narrow; lower jaw turned upward at the tip; legs and feet scaly; claws stout, the web between the toes narrow; tail short.

Color of carapace yellow, brown and black, sometimes the darker color predominating, sometimes the yellow; ground color usually brown or reddish brown, the yellow appearing as spots of various shapes, often radiating from the point of growth of the scute; the ground color may appear to be yellow relieved with black spots; plastron variously ornamented with black and yellow. Young with a single yellow spot on each scute of the carapace. Length of carapace, 4 to 6 inches in full grown examples.

THE BATRACHIANS.

Eighteen species of batrachians are now known from the vicinity of Lake Maxinkuckee. These include one water-dog, seven salamanders, one toad, two tree-toads, and seven frogs.

All of these are of some importance in their relations to the life of the lake, and several of them, such as the water-dog and the various species of frogs, of every considerable importance. Of all the animals inhabiting the lake, perhaps the worst enemy of the fishes is the water-dog. And of the vertebrate animals about the lake, exclusive of the fishes themselves, frogs doubtless enter most largely into the menu of the large-mouth black bass. All of the species are more or less aquatic, all being found in or about the water.

1. *Necturus maculosus* Rafinesque.

WATERDOG.

The Waterdog or Mudpuppy is one of the most common, and certainly the most interesting, of the several species of batrachians occurring in or about Lake Maxinkuckee.

It is strictly aquatic in its habits and is found only in the water. It is found in both Lake Maxinkuckee and in Lost Lake and apparently approximately abundant in each. That it was seen more frequently in the former is probably due to the fact that our observations were more often directed to that lake.

While pretty generally distributed throughout the lake, it is naturally most often met with in relatively shallow water near shore. It appears to prefer those locations where the bottom is of muck, marl or other soft material covered with a growth of short Chara. In such situations it makes considerable burrows in the bed of the lake or sometimes merely under the Chara or other covering. Here it rests when not moving about in search of food or for other reasons. The burrow usually has two openings, a few inches apart, one evidently for entrance the other for exit; and the animal, when in the burrow, is often seen with its head projecting from one of the openings as if watching for small fishes or other food that may approach. Thrusting an oar or pole into the burrow would frequently reveal the presence of the animal. They seem to occupy these burrows singly, as in no instance were two individuals found in the same hole. Whether they are more prone to remain in their burrows during the day-time or night our observations did not clearly disclose. Certain evidences, however, which will be presented later in this account, indicate that this curious batrachian is largely noctural in habit, and the burrows, if they could be examined with equal facility at night, would probably be found more frequently empty.

While nearly all examples seen in the lake were in water one to ten feet deep, they doubtless on occasion go out to greater depths, evidenced by the frequency with which they are taken on hooks of set-lines placed at a depth of 10 to 35 feet. They are doubtless most abundant in water less than 15 feet deep, but extend out to more than twice that depth in some numbers. It is probable that their bathymetric distribution is practically coincident with that of the plant covering of the lake bottom.

That the species is largely nocturnal is indicated by a number of habits which were observed. Frequently individuals were seen or were caught with seines at night when they had come near shore in shallow water evidently for the purpose of feeding on the small fishes which also come into shallow water at night to feed. Although large schools of the same species of fishes were often seen in the same places in the day time waterdogs were rarely noted and then usually in the winter and the under ice. Set-lines were much

more apt to have waterdogs on the hooks when examined in the morning than when inspected in the evening.

That the species is, however, not wholly nocturnal is shown by the fact that individuals are often seen in day-time moving about on the bottom, especially in winter under the ice, and the further fact that they are sometimes taken in the day-time by anglers or on set-lines.

They also appear to be active throughout the year; there is no evidence that they hibernate. We have observed them moving about and have caught them at all seasons, practically in every month in the year.

Actually, we saw them most frequently in winter, probably not because they were more abundant then or moving about more constantly, but because they were less active in their movements and therefore more easily observed; and especially because the presence of a sufficiently strong sheet of transparent ice on the lake gives an ideal condition for observation and study of the lake bed even in considerable depths.

As already stated, the waterdogs make shallow burrows in the soft bottom or under the Chara mat, in which they make their homes. They are also found under water-logged chunks or boards where they may be sometimes seen with their heads slightly exposed. Then again they may be observed now and then among the roots of the pond-lilies or the denser patches of Potamogeton, Myriophyllum and similar aquatics.

In late autumn and early winter, when the water has cooled and the straw-colored minnows, grayback minnows and skipjacks crowd to the shore, waterdogs may be sometimes seen coming in among them, evidently for the purpose of preying upon the fishes. Later, during the winter, on bright sunny days, these animals were frequently seen in some numbers crowded close to shore and lying motionless under the clear ice. Several were caught by cutting holes through the ice above them. Occasionally one would take alarm while the ice was being chopped away, and swim off, rather slowly at first and then quite rapidly, with lateral flexions of the tail. Though not so rapid in their movements in winter as in summer, they can swim quite swiftly when occasion arises. When not frightened, if moving at all, they walk along the bottom with great deliberation, moving their heads from side to side as if smelling their way along. In walking, diagonal limbs are moved in unison, that is, the right front with the left hind leg and the other two the same way, with a good deal of circular or rotary motion at the hips and shoulders like one turning a crank. When one is caught in the hand or when a feint is made to take hold of one, it will make quick, vicious snaps at the hand. The jaws are strong enough to make the bite painful. This quick snappy motion offers a suggestion as to the manner in which the animal catches fishes.

The Waterdog seems to feed chiefly on small fishes and crawfishes. The stomachs of several examined December 10, 1900, and later the same winter, were literally packed with fishes. At various times in December one or more

were seen among schools of skipjacks near shore, apparently feeding on them. Examples examined December 18 contained, in one instance, two small fishes each about 3 inches long, another the bones of the hind legs of a frog, and still another a fish hook baited with a piece of liver, evidently from some fisherman's line. Of several stomachs examined December 28, some were filled with full grown skipjacks, while others contained several small fishes each. Four examined February 27 contained several minnows evidently taken from fishermen's hooks. On March 2, several others examined contained a number of bait minnows and one a large crawfish. Three examined March 8 contained 6 shiners, 3 crawfish, 2 Asellis, 2 leeches, and several long flat worms; and a fourth contained 3 crawfish and 3 snails (probably *Physa*). One examined March 18 contained one small minnow and a large worm. The stomachs of 4 examined April 27 were all empty, as was another (a male) inspected May 9. On November 16, 1904, one was found with stomach empty and another with one long red leech. One examined January 1, 1905, contained 2 straw-colored minnows, 3 crawfish, 2 large insect larvæ, and one large brown flat leech.

The species of fishes which we have found in the waterdog stomachs are the skipjack (*Labidesthes sicculus*), the straw-colored minnow (*Notropis blennius*), the grayback (*Fundulus diaphanus*), and 2 or 3 species of bait minnows not indigenous to the lake and evidently stolen from fishermen's hooks. One fisherman reported that he had seen a waterdog trying to catch a sunfish, but we were not able to verify this observation. We have frequently observed these animals in shallow water near shore among schools of the small fishes named above and evidently intent on preying upon them; never, however, did we see one capture a fish. As already stated, they were most disposed to feed near shore at night during the summer; but in winter when ice covered the lake they seemed habitually to come into shallow water under the ice in the day-time, particularly on bright sunny days. Sometimes they seem to congregate in considerable numbers under the ice. In the winter of 1899-1900 some boys found several bunched under the ice in a little cove of Lost Lake just north of the Bardsley cottage, and succeeded in killing 15 by hitting with a stout club on the ice above them.

Crawfish also form an important and considerable element in the menu of the waterdog, while the smaller, softer-shelled mollusks, insect and other larvæ and perhaps other small aquatic animals, are utilized to some extent.

According to Mr. J. J. Stranahan, for many years Superintendent of the Fish Cultural Station at Put-in Bay, the waterdog is very destructive to the eggs of the whitefish. He states that in January, 1897, many of these animals were pumped up with the water supply of the Put-in Bay station and that the stomachs of a considerable number of them contained whitefish and cisco eggs, the contents of one stomach consisting of 288 whitefish eggs and 4 cisco eggs. From June to August, 1894, while Dr. H. F. Moore, of the Bureau of Fisheries, was engaged on investigations in Lake Erie he examined

the stomach contents of a number of waterdogs at Sandusky and elsewhere and found fish-eggs present in many cases.

While writing this account (August, 1907), a specimen of waterdog was received by the Bureau from a lake near Irwin, Colorado. Its stomach contained 6 or 8 examples of *Gammarus* (a small crustacean) and several small bits of rotten wood, the latter taken incidentally along with other food.

Garman* states that the waterdog subsists on crustaceans, insects and mollusks.

It is undoubtedly a bottom feeder, and its habit of walking or crawling about over the bottom makes the finding of fish-nests and the destruction of the eggs a particularly easy matter. The evidence, therefore, would seem to be conclusive that the waterdog is wholly carnivorous in its habits; that its food consists chiefly of small fish, and in season, of fish eggs, along with a smaller proportion of crustaceans, mollusks, insect larvæ, etc.

Waterdogs may be caught quite readily in any season on hooks baited with minnows, crawfish, liver, bits of meat, or almost any animal matter. Set-lines placed by us for experimental purposes at various depths and places in the lake usually yielded at least one waterdog every time examined. When the hooks were set at a greater depth than 35 or 40 feet, however, they rarely caught any. On hooks set in Lost Lake for catfish and dogfish, waterdogs were often taken.

Anglers often catch them while still-fishing in the spring, summer and fall, but it is during ice-fishing in the winter that they are most troublesome and most frequently taken. All fishing through the ice is necessarily still fishing and the fishermen are much annoyed by the waterdogs stealing the bait from their hooks as well as being caught thereon. Their abundance in the vicinity of ice-fishing is doubtless increased to some extent by the practice of the fishermen of throwing dead minnows from their minnow buckets through the ice holes into the lake. While this attracts predaceous fish it serves also to attract the troublesome *Necturus*.

Although the waterdog is entirely harmless, fishermen scarcely without exception firmly believe it to be poisonous and are in mortal fear of its bite. So strong is this fear that when a fisherman finds a waterdog on his hook he never tries to dislodge the hook while the animal is alive but either cuts the line and lets it escape or mashes its head and then removes it from the hook with many misgivings as to whether it is safe to remove even a *dead* waterdog from the hook.

When caught on the hook this animal squirms and thrashes about a good deal at first but soon becomes quiet and remains so until lifted out of the water when it again becomes very active, its squirming contortions, slimy touch and repulsive appearance all contributing to the fisherman's dread.

The breeding habits of the waterdog have not been fully studied by us,

*A synopsis of the Reptiles and Amphibians of Illinois. Bull. 111, State Lab. Nat. Hist., Vol. III, Art. XIII, p. 383, 1891.

though a number of interesting observations were made. Several nests were found and the eggs and young seen at different times. The breeding season is in the spring. A nest was found June 12, 1901. It was under a submerged board in shallow water at Long Point. The eggs which were not numerous, were about the size and color of yellow peas, and each was fastened to the board above by a small gelatinous cord. One of the parents remained near the nest apparently watching it. The eggs, however, disappeared one by one, probably taken by crawfishes. Apparently none of these eggs remained to hatch and we were unable to determine the period of incubation.

In our observations of these animals we were struck by the frequency with which they were found dead in pairs. There seems to be a brief period of unusual mortality among them early in the spring when considerable numbers may be found dead along the shore; a phenomenon analgous to that observed in the bluegill. During the summer and fall occasionally dead individuals are found. We are unable to say what significance, if any, lies in the observation that these animals are often found dead in pairs; it is probably a mere coincidence. The condition of the examples found dead was such as to make it difficult if not impossible to determine the sex and the cause of their dying; nor could their stomach contents be satisfactorily examined.

The food value of the waterdog has never been fully tested. Some years ago some experiments were made at Put-in Bay by Mr. J. J. Stranahan which indicated that this batrachian might, through proper treatment, be made a very palatible and nutritious article of food. Its repulsive appearance, however, will to some extent militate against any extensive or general use of the animal for this purpose.

Summing up, then, the waterdog does not appear to have any thing to commend it or in favor of its preservation; it seems to serve no useful purpose except that it is an interesting member of the local fauna.

It is an animal feeder and is destructive to several species of fishes, in that it preys not only on the adults but upon their eggs as well.

Following are dates on which waterdogs were observed at the lake: April 6 and 7, 1885, the senior author was at Lake Maxinkuckee, and saw a large number of dead waterdogs frozen in ice in what is now known as Green's marsh south of Outlet Bay. There was more water in that place then than we have ever observed there since. The waterdogs had apparently come out into the marsh and, the temperature suddenly dropping, were caught in the freezing ice; or possibly they had died from another cause and their bodies had been carried by the current on to the marsh.

In October, 1898, Mr. Chadwick reported them as abundant and stated that they are often caught while fishing through the ice in winter; also that they are often seen in shallow water on muck bottom in winter.

In 1899, one seen September 10.

In 1900, one found under a board in shallow water on Long Point August 8; one found dead near Maxinkuckee pier August 11; one seen dead floating

near Long Point August 15; one got in Culver Inlet August 21; one found dead near shore near Arlington Hotel August 22, and another at Outlet August 31; one seined in Lost Lake September 1; one very large example found dead in lake near Lakeview Hotel September 29; two found dead in Culver Bay October 11; two dead on south shore November 9; and two more November 17, also two on east side November 22; a small one dead in a pool near Farrar's December 3; one got with rake and another seen at Long Point among a school of skipjacks December 10; one seen near shore on Long Point among skipjacks and another seen through the ice farther out, December 12; December 28 many of various sizes observed under the ice, crawled up as near shore as possible. In 1901, one killed and several others seen January 7; several seen under ice, January 9; several seen near shore January 10; one seen in its burrow in front of station January 16, 18 and 19; a dead one seen January 19; one seen under the ice swimming straight for shore and later three others seen January 21; one caught by a fisherman January 23; one speared February 7; 4 caught February 27; 6 caught on hooks of set-line March 2 and about six others seen while looking down a hole in the ice where a fisherman was bobbing; a dead one found March 7, and 3 others March 8; one caught on a hook March 10; two found dead March 13, evidently killed by fishermen; a large one under a board lying on lake bottom and another caught March 18; one seen in Outlet, apparently going down toward Lost Lake March 20; one found dead April 1; a great may seen in Outlet Bay April 27; 4 seen April 27 and 5 dead at mouth of Aubeenaubee Creek, April 30; one seen under stones in Outlet April 29; a fisherman got two on a hook May 1; a dead one seen in Outlet May 4; one caught on outline May 7 and one May 9, the latter a male; three dead ones seen in Outlet May 13; five dead found along shore in various places May 20; also on May 23 and 31; a nest found June 1; several dead on shore June 4; one caught on hook from Chadwick pier June 20.

In 1904, one found near shore, and a small one under a board, November 16; one seen on bottom in about 4 feet of water off Long Point, December 15; one seen under ice near Inlet December 21; two seen near shore in south part of lake December 27.

On November 2, 1904, one caught under an old board in Outlet Bay, contained only a small bit of weed. One was caught on same date in a minnow trap which it had doubtless entered for the purpose of feeding on the minnows confined therein. One caught at Chadwick's pier November 6 contained 2 crawfish. Another taken at same place contained one crawfish and 2 Physa shells. Another taken under a board south of Green's pier November 12 had the remains of one minnow. One examined 3 days later was entirely empty. In 1905, one examined June 1 contained 2 straw-colored minnows, 3 crawfish, 2 insect larvæ and one flat leech.

Two examined January 7 contained several small fishes each, and four dissected February 27 contained several small minnows evidently taken

from fishermen's hooks. On March 2 several examined contained a number of bait minnows and one large crawfish. At various times in December one or more were seen among schools of skipjacks near shore on which they were feeding. Three examined March 8 contained 6 shiners, 3 crawfish, 2 *Aselli*, 2 leeches and several flat worms. Another had 3 crawfishes and 3 snails probably *Physa*.

In 1905, a large example caught from under ice at Long Point, January 1; one seen under ice near shore January 3.

In studying the feeding habits and food of the waterdog many stomachs were examined. Several dissected December 10, 1900, were literally packed with fishes. Two other were seen on the same day among a large school of skipjacks on which they were evidently feeding. Three were examined December 18; one contained two small fishes each about 3 inches long, another the bones of the hind legs of a frog, while the third contained a fish hook baited with a piece of liver, evidently from some fisherman's line. One examined December 20 contained 2 straw-colored minnows, 2 and 3 inches long respectively. Seven waterdogs were caught and their stomachs examined December 28. The data obtained are given in the following tabulated statement:

FOOD OF WATERDOGS.

No.	Length in inches.	Sex.	Stomach Contents.
1	12	F.?	5 skipjacks packed tight.
2	12½	F.	7 large skipjacks, 1 small skipjack partly digested, 2 bluegills, 1 and 2 inches long respectively, one small fish not identifiable, one worm and a small quantity of vegetation. The waterdog's eggs were large.
3	9½	M.	2 dragonfly larvæ, 4 other small larvæ, one fish much digested.
4	9½	M.?	1 large skipjack, one small bluegill, one crustacean and 2 larvæ.
5	10	F.?	Homogenious muddy mixture, some bits of plants, remains of 3 fishes, and 2 dragonfly larvæ.
6	6½	F.?	3 small fishes (probably bluegills), 2 other fishes much digested, one isopod, and 2 larvæ.
7	7½	F.	6 small flat fine-scaled fishes, probably bluegills.

2. *Ambystoma punctatum* (Linnæus).

SPOTTED SALAMANDER.

The Spotted Salamander has a rather wide range, extending from Nova Scotia to Nebraska and southward. It is not very common about Lake

Maxinkuckee, probably the soil is too sandy. One specimen was obtained at Culver in 1906, and one captured under a chunk in Farrar's woods on October 5, 1907. This one had a row of yellow spots along the middle of the back.

In spite of its rather handsome coloration, the Spotted Salamander, with its blunt, stubby head and slimy body, is a rather unattractive creature. They spend the day hiding under logs, chunks or stones, in moist cool ground. They probably seek their prey at night. Although generally viewed with distrust, they are perfectly harmless, and probably do good by devouring noxious insects.

Costal grooves 10 or 11, usually 11; sole with one indistinct tubercle, or none; black above with a series of round yellow spots on each side of the back; body broad, depressed and swollen; skin punctuate with small pores from which exudes a milky fluid; 2 or 3 clusters of enlarged pores on head; a strong dorsal groove; tail 2⅓ in length; length 6 inches.

3. *Ambystoma tigrinum* (Green).

TIGER SALAMANDER.

The Tiger Salamander does not appear to be common in this region. Our collections contain only two specimens, one obtained in 1906, and one in Farrar's woods, October 5, 1907.

4. *Ambystoma jeffersonianum* (Green).

COMMON SALAMANDER.

The Common Salamander is frequent from Virginia to Indiana and northward. At Lake Maxinkuckee it does not appear to be common, only five examples having been taken. These were obtained under logs in damp ground on the east side of the lake in the autumn of 1906 (August 3 and October 14); all had small pale blue spots along the lower portion of the sides.

In some parts of the country, one of the first signs of spring soon after the ice has disappeared and the water is still frigid, and before the frogs have yet begun to sing, is the sight of a number of these creatures in the bottom of shallow pools, too stiff almost to move, preparing to lay their eggs. The eggs are small shot-like black objects, surrounded by a thick sphere of clear jelly, a number cohering to form an irregular mass. As the water warms up, the embryos develop rapidly, first lengthening somewhat, then bending to a comma-like form, and finally the little fish-like larva, with gill-tufts on each side of the neck, wiggles through the jelly. On April 23, 1901, some larval salamanders were found swimming in Farrar's pond, which may have belonged to this species. The creatures develop rapidly into the mature form and leave the pool; in a few weeks none can be found there. The mature form spends its days under chunks and logs in moist places, and probably spends its nights in search of prey.

This species can be distinguished by its 12 costal grooves, single indistinct tubercle on the sole of the foot, and the color which is usually black or blackish, with pale bluish spots on the body.

5. *Hemidactylum scutatum* (Schlegel).

This curious little salamander appears to be quite rare. Our collections contain but 4 specimens. These were obtained October 7, 1906, under logs in a dry woodland near the tamarack swamp west of the lake. The young 44 mm. long has the tail compressed laterally as if to fit it for aquatic life; the larger examples have the tail more nearly cylindrical.

This species is brown in color, the snout yellowish, whitish below and with small inky spots.

6. *Plethodon erythronotus* (Green).

Red-Backed Salamander.

The Red-Backed Salamander is common throughout the eastern part of the United States. It is not often seen, however, except by those who especially search for it. This graceful, slender salamander does not appear to be particularly rare about the lake, although it is not often seen. October 7, 1906, 4 were obtained a few miles west of the lake. On October 16, 1906, while turning over logs in Farrar's pond, 11 examples were obtained in a short while. On October 15, 1907, a search was made in Farrar's pond again for them, but none was found. It was much wetter this year than the previous year, and it was thought that the wetness of the pond may have driven them out. On looking under chunks on higher ground bordering the pond, about dozen were secured in a little while. Some were still quite small; a few had a well-marked broad red stripe down the back, but in most this was wanting.

Little is known by us of the habits of this salamander. It is said to be nocturnal in habit, and to lay its eggs beneath logs and moist leaves, instead of in the water. The eggs are laid in the latter part of April.

"Costal grooves 16 to 18; palatine teeth not extending outward beyond inner nares; plumbeous above, often with a broad brownish red dorsal band; belly marbled; body very slender; tail cylindric; inner toes rudimentary; length 3½ inches."

7. *Spelerpes bislineatus** (Green).

Apparently rare. Our notes make mention of this species but there are no specimens in the collection.

*As originally spelled by Green.

8. *Diemyctylus viridescens* (Rafinesque).

NEWT.

The Newt is found throughout the eastern part of the United States and is particularly abundant in the north and northeastern part of its range. At Lake Maxinkuckee only one example was captured; this was obtained in Farrar's pond, June 11, 1901, while collecting crawfishes. In addition to the example captured another very small one was seen in the swamp adjoining the lake below Farrar's, but it quickly hid among leaves in the bottom.

This graceful and bright-colored little batrachian is probably common in the region of the lake in woodland ponds. It is so elusive, however, that it is difficult to capture. It is a graceful, rapid swimmer, quickly dodging under leaves when pursued.

This salamander lays its eggs, round, clear objects, among the leaves in the bottom of brooks and ponds. They can frequently be found in late spring by lifting up the leaves, the minute yellow larvæ wriggling inside the clear envelop.

Above olive green or reddish of varying shades; lemon yellow below; each side usually with a row of several rather large scarlet spots, each surrounded by a black ring; back with a pale streak; belly with small black dots; head with 3 longitudinal grooves; three large pores behind eye. Length 3.5 inches.

9. *Bufo americanus* Le Conte.

COMMON TOAD.

The toad, familiar everywhere over the eastern United States, is not particularly common about the lake during summer and autumn. One occasionally sees them hopping about in the grass or along the road, usually one at a time. In the breeding season, however, they congregate in large numbers in pools and along the lake shore. Only a few examples were taken but they could be captured almost anywhere about the lake.

The last seen in 1900 was on October 6, at which time they were observed working their way backward into the ground, as if to hibernate. From March 31 to April 11, it was noticed that chickens were scratching them out of their winter-quarters and eating them. They came out of winter-quarters about April 23, when they repaired to the water at once and began singing. By April 27 they were in full chorus in a pool by the railroad, and were busy mating and spawning. The height of the mating season extended from about the last of April until well into May, although they continue mating until the 4th of July and perhaps even later. They have been heard singing as late as August 26.

A great number were observed mating in Culver Inlet, April 30. The males cling very tightly to the females; some captured and kept all afternoon in a botany can filled with plants did not relax their hold. The singing toads are

usually unmated males. They sit at the water's edge and call with a tremulous, hardly musical, note, beginning with explosive emphasis and dying down at the end, the loose skin under the throat being blown up into a hemispherical bubble while they call. A good many dead toads were found in the pool at the same time, indicating that the mating season is one of especial mortality among them. The female toads were noted spawning while clasped by the male. The eggs are laid in gelatinous strings, 2 strings laid at a time, each string of clear jelly, about 3-16 inch in diameter and containing 2 rows of eggs, black objects about the size of pinheads with a whitish point on each. While carried in a closed vessel the toads uttered a low purring humming noise, quite pleasing to the ear. Two were kept in a bucket over night and a number of eggs were found there in the morning.

The toads of this region represent 2 distinct color phases, one type being more or less slaty blue and the other brick red. This difference in color is not usually noted when one sees single toads hopping about, but where numbers are congregated during the breeding season the contrast is quite noticeable. It appears to have nothing to do with age or sex, and toads of different colors are often found mating together.

The toads spawn in the lake as well as in the shallow pools. The eggs soon hatch into small black tadpoles which, in warm water, rapidly develop into minute toads, which can be seen hopping along shore. Young toads were seen hopping about on July 27; they are almost black, much darker than their parents. After mating and spawning, the toads scatter again, and in the autumn one comes across them of various sizes, the variation in size being probably the result of the long breeding season.

The toad is a decidedly beneficial creature, as it captures great numbers of insects. They frequently fall a prey to snakes, and these, with the exception of thoughtless boys, appear to be their only enemy.

In addition to its mating song the toad appears to have a song it sings on land, a low, pleasing, tremulous strain.

The singing is often prolonged late into the summer, and "its music in retired ponds and swamps, as darkness creeps over the face of nature, is both weird and somnific."

10. *Acris gryllus* (Le Conte).

Cricket Frog.

The Cricket Frog is common in swamps throughout the eastern United States. It is common along the shore of Lake Maxinkuckee, but more particularly abundant along such parts of the lake edge as are low and swampy. It is abundant along the shores of the various inlets of the lake, and quite common about the Outlet and the shores of Lost Lake. Numerous examples were taken representing all parts of the shore, and the various inlets of the lake.

Although the cricket frogs are related to the tree-frogs, they never stray far from the water's edge, but remain along the shore ready to jump into the water at the slightest alarm. They are very alert and strong jumpers; and are therefore difficult to catch. When they jump into the water they do not dive to the bottom, as many of the water frogs do, but swim back to shore. They are very variable in appearance; some have a bright green y-shaped mark, but in others this is brown or obscure. The cricket frogs come out of their winter-quarters and remain out until late in the fall; they have been seen on shore as early as March 7 and as late as November 30.

Although the Cricket Frog comes out early in the spring, it does not begin to sing until the water is well warmed up, which is some time after the Pickering Frog and the Swamp Tree Frog have begun their singing. They began singing as early as April 28 and continued until as late as August 5. After a short season of rest they sing again more or less in late autumn. One was heard singing September 12, and they were heard singing again October 22.

During the height of the singing season the rattle of these frogs is almost continuous, and at times nearly deafening. The note resembles the rattling of pebbles. Toward the end of the singing season, the music was rather peculiar. After an interval of silence, one would start the song, then all the others would being spasmodically and sing awhile. During the summer it is easy to start one of these frogs singing by concealing one's self and striking two pebbles together, thus imitating the note of the frog. The first one seen singing was started this way. It had been difficult actually to see any of these frogs singing as they usually became silent when approached. By the means described above, one that was in sight was started, and the whole process observed. They sit fully out of the water, hidden in grass or rushes, inflate a large bubble under the chin, and work their flanks considerably while rattling.

In raking out leaves and water weeds near shore in the late autumn these frogs are frequently brought out torpid and stiff. In such places they doubtless spend the winter.

On December 3, several dead Cricket Frogs were found in a cut-off east of Farrar's and several were found hiding and in a semi-torpid condition under leaves at the water's edge.

The Cricket Frog probably subsists on insects, especially the small midges so abundant at the water's edge. They are sometimes used for bait.

The following brief description will assist in identifying the species:

Toes broadly webbed, tipped with small disks; tympanum indistinct; hind legs very long; brownish above; middle of back and head bright green or reddish brown; a dark triangle between the eyes; sides with three oblique blotches; a white line from eye to arm. Length 1½ inches.

11. *Chorophilus feriarum* (Baird).

Swamp Tree-frog.

The Swamp Tree-frog is common throughout all parts of the eastern United States where there are ponds, swamps or creeks. Its presence is usually made known by sound rather than by sight, as the frog, though quite noisy, is both shy and inconspicuous and easily overlooked.

At Lake Maxinkuckee this frog is probably common, scattered about in the marshy regions surrounding the lake. It is not often see, however, and only a few examples were secured. One was obtained on Aubeenaubee Creek July 8, 1899, three about the shore of Lake Maxinkuckee July 28, 1900; one in Norris Inlet August 8, 1900, and one in Farrar's pond at the edge of the lake below Farrar's October 8, 1907.

A few days after the first high-pitched "peep peep" of Pickering's Tree-frog has sounded from the marshes, the announcement of the arrival of spring, the Swamp Tree-frog begins its chorus, and although it is not the first frog to be heard, it is its chorus coming from the woodland ponds and from the creeks and marshes, that announces to the world in general that "the frost is out of the ground." These frogs all seem to wake up at about the same time, so that the very first song is a pretty full chorus. They begin singing first in the pools and ponds surrounding the lake, and only later stray down to the lake shore. In 1901 they were first heard about March 23; at the beginning of their song season they sang only during the warmer parts of bright days. Intermixed with the chorus came at intervals the high piping of *H. pickeringii*.

From March 23 to about the middle of April they sang chiefly during the warmer part of the day, the chill of the night quickly silencing them. About April 24 till May 9, they sang chiefly during the evenings and mornings; later on they sang in diminishing numbers and chiefly on moist muggy nights. They were heard singing as late as June 22. The song is a rattle with a rising inflection at the end, or like the scraping of a coarse-toothed comb.

It was quite difficult at first to catch this frog in the act of singing, as they become immediately silent on one's near approach. On April 5 some were seen singing near Hauk's pond. The frogs stuck their heads above the water, expanded the skin under their throat until it looked like a large yellow bubble; this vibrated somewhat, but did not collapse while the frogs were singing. All the frog out of the water was pretty well hidden behind the bubble, so that the animal itself easily escaped detection. Later on they were occasionally seen singing in a row at the edge of the pools. A pair were seen mating April 9 over by Hauk's pond. In a pond where many were heard singing a number of small bunches of eggs were found which probably belonged to this species. They were placed in an artificial pool and kept under observation but did not hatch.

The small tadpoles soon develop, and about June, minute frogs of this species can be seen hopping about, leaving the water.

The Swamp Tree-frog has a second season of song in autumn. This is usually sung by individuals rather than in chorus, and the singers are frequently found some distance from the water, anywhere in damp situations. They are quite frequently heard in low copses or in cornfields on damp days in autumn, and one was known to have its abode in a damp cellar a good distance from any pond. One example found in autumn in a cornfield was quite plump, and was found to be full of well developed eggs. As these frogs are dormant during the winter, it is probable that the ova reach their full development in autumn, and that the brooding instinct developed by this time is held in abeyance until spring, when the frog wakes and recommences the song begun the autumn before.

During the autumn of 1900, this frog was heard singing at the edge of the lake from October 28 to November 20.

These frogs can usually be seen better during the autumn than any other time. They are then to be found on the ground in damp situations and are somewhat sluggish and inactive. They are quite handsome and elegant in appearance.

These little frogs often fall a prey to the large-mouth black bass and pickerel and are sometimes used for bait by anglers.

Fingers and toes ending in small disks; fingers not webbed, toes scarcely so. Tympanum distinct. Bluish ash, a dark dorsal stripe from snout backward, bifurcating above middle of body; a stripe on each side of this and one on side of head and body, the latter pale-edged below. Length 1 inch.

12. *Hyla versicolor* Le Conte.

Common Tree-Toad.

The Tree-toad is generally common throughout the United States east of Kansas. At Lake Maxinkuckee it is frequently heard in the evenings or in damp weather preceding a rain. Very few examples were seen, however, and it does not appear to be abundant. One was taken August 6; on September 13 one was found on the rushes near Lakeview Hotel. It was dark blue-green in color, simulating the rushes on which it was found. Three examples were obtained near the lake July 8. The first one heard in 1901 was on April 29 and the species continued trilling through the summer. In 1906, 2 examples were seen, both of the usual gray color it assumes when resting on bark.

One of the favorite haunts of the Tree-toad in spring is in clumps of low willows growing in wet situations. Here they nestle in a crotch and trill almost continuously. Even when they can be heard everywhere they are difficult to find, as the sound is hard to follow, and they become silent at one's near approach. Their resemblance in color to the object upon which they rest protects them, and by the time one gets close enough to distinguish them clearly they give a prodigious leap to safety, the bright colors of their under parts showing like a streak of yellow through the air.

Green, gray or brown with irregular dark blotches, below yellow, behind white, tympanum 2-3 diameter of eye; fingers 1-3 webbed; skin with small warts; length 2 inches.

13. *Hyla pickeringii* Storer.

Pickering's Tree-toad.

Although its range extends over all the eastern United States, there are comparatively few people who know Pickering's Tree-toad at sight. Its presence is manifest to the ear rather than to the eye. At Lake Maxinkuckee, it is seldom seen, only two examples having been obtained by us. These were captured in Aubeenaubee Creek, September 3. It appears, however, not to be uncommon. Its shrill peep is the first sound to waken the marshes in spring. It begins singing a few days before *Chorophilus*, and after that species has begun, the high-pitched "peep, peep" of the little *Hyla* can be heard above the rattling chorus of the Swamp Tree-toad. Pickering's Tree-toad does not sing in concert, but different individuals appear to pipe to each other. It sings about the edges of flat shallow marshes, such as those by the Inlet, and by the tamarack swamps. It continued to sing from early April until about May 9.

In autumn a sound much resembling the springtime note is frequently heard from forest trees or low shrubs on damp days. All attempts to find the author of the note were unavailing, but it is supposed that it is made by this toad. It is one of the characteristic sounds of autumn.

The following description will assist in recognizing the Pickering Tree-toad: Yellowish or fawn-color, with dusky rhomboidal spots and lines, the latter usually arranged in the form of an oblique cross; head with lines; limbs barred; tympanum very obscure; length one inch.

14. *Rana pipiens* Shreber.

Leopard Frog.

The Leopard Frog is the most widely distributed of the frogs found about the lake, its range extending over North America westward to the Sierra Nevada and southward into Mexico.

At Lake Maxinkuckee it is to be found almost anywhere along the shore and in low grassy meadows and in the shallow ponds of the region. Examples were taken in Lost Lake, in Culver Inlet, in various places about Lake Maxinkuckee, in the shallow pond by Hauk's marsh, and in the woods northeast of the lake.

The Leopard Frog is the least aquatic of the frogs. It does not spend much of its time in the water, but prefers to dwell in meadows and moist grassy places, and can even be found in quite dry situations; for this reason it is often called the Meadow Frog or Grass Frog. After the tadpoles have trans-

formed they quit the water and scatter everywhere through pastures and meadows, in this respect rather resembling toads than frogs. One of their favorite haunts in late summer is some meadow, where they sit at the edge of a burrow snapping up insects that come along, and quietly backing into the hole at the approach of danger. One such, that had become too plump with food to squeeze into the burrow, was caught and kept a captive. When undisturbed, it frequently uttered low tremulous notes, quite pleasing to the ear. Another favorite habitat is the prairie-like flats at the edge of ponds. It is only occasionally that they are found at the water's edge, ready to jump in at the sign of danger.

There are occasions, however, when this frog seeks the water. They retire to the bottom of ponds or to the edge of the lake to hibernate, and frequently on lifting a stick or board from the bottom near shore late in autumn, one or more of these frogs can be found under it, straight and stiff, unable to move. In the spring a good many are often found dead under the ice of the thawing ponds, and it appears that the wintering-over process results in considerable mortality among them.

Early in the spring as soon as the ice has left, they begin to be commonly seen about. One of the earliest records is March 18. As soon as the sun has slightly warmed up the pools in the neighborhood of the lake they appear in numbers. A dismal croaking can be heard in marshy places, but no singer can be seen, and although all heads in sight seem to go down under water, the croaking continues. For a long time this croaking was a mystery, and was attributed to some other creature, but on a trip along a ditch west of the lake in the spring (April 9), two of these frogs were observed engaged in a lively tussle, like a boxing match. They then sank to the bottom of the ditch and began croaking. Conspicuous gular pouches projected from each side of the head, giving it a lance-like appearance, much more like that of a serpent than a frog. As the frogs croaked, the pouches worked in and out like parts of a bellows. Although the frogs were entirely under water no bubbles were seen.

In the spring when these frogs first come out of winter quarters, they are semi-torpid and easily captured, but with the advent of warm weather they become active and are difficult to capture without a landing net.

In some places these frogs are esteemed as an article of diet. In Chicago they are hunted almost to extermination. The frog hunters go with sacks to the ponds where they breed and catch them in great numbers. When placed in the sack they croak constantly, the sound being much like that which they make during the mating season. The saddles are seen in great numbers on the fish markets where they retail at 15 cents per dozen.

The Leopard Frog mates and spawns throughout April and probably into the month of May. One of the favorite spawning places was a shallow temporary pool near Hauk's marsh. Here on April 8, (1901) a great many were seen mating. The male which appears to be usually the smaller, clasps

the female closely around the waist and simply hangs on and squeezes. He probably assists by this pressure in forcing out the spawn which he is at hand to fertilize. The eggs on being extruded rapidly absorb water in the gelatinous envelop and swell up to irregular masses as large as or larger than the parent frog. The eggs, which are black and resemble small shot, rapidly hatch out into rather dark tadpoles which are not so black nor so small as those of the toad. The tadpoles leave the water in the early summer of the same year, and can be seen about the beginning of July, crawling up into the grass, the shrivelled tail in some cases still persisting.

The Leopard Frog has quite a number of enemies. In the water they are eagerly seized by fish, and are frequently used for bait. The larva of the water beetle, *Dystichus*, attacks the tadpoles and devours them. Snakes catch a good many. At the edge of Bass Lake (August 14, 1906) a pitiful crying, much like that made by a young chicken when caught, was heard in the grass, and it was found that a garter snake had one of these frogs halfway into its mouth, while the frog was vainly trying to escape.

The Leopard Frog is an entirely harmless creature, and is of great service in helping keep down hordes of insects.

This frog can be easily distinguished from any other of the frogs about the lake except the Pickerel Frog, which it resembles considerably, but from which it can be told by the absence of yellow on the under part of the hind legs, the absence of any marked color, the blotches being rather rounded than square, and black in color instead of dark brown. The following description will assist in identifying it:

Brownish or green, with irregular black blotches edged with whitish, these mostly in two irregular rows on back, usually 2 spots between eyes; legs barred above, belly pale, glandular folds large; head rather elongate, length 2.75 inches.

There are two distinct shades of ground color among these frogs; some are rather dark brown, while others are bright green.

15. *Rana palustris* Le Conte.

Pickerel Frog.

The Pickerel or Swamp Frog has a rather narrow distribution compared with its near relative, the Leopard Frog, it being confined to the eastern part of the United States. It is not common about Lake Maxinkuckee; only 15 examples were collected. These were found in various situations, 4 of them being obtained at Lost Lake, one by Farrar's, 3 or 4 in Lake Maxinkuckee and 4 or 5 in Aubeenaubee Creek. One was found along the railroad between the lakes. Dr. Hay, in his report on the reptiles and batrachians of Indiana, reports 2 specimens in the State Normal School collection from Lake Maxinkuckee.

Very little was learned about its habits. It probably has nearly the same

habits as the Leopard Frog. Its rank odor probably protects it from some enemies that prey on the Leopard Frog, and would prevent it being used for food, even if it were common enough to be caught for that purpose.

During the spring of 1901, a woodsman living near the lake gave information that he often heard proceeding from the forest ponds a tremendous quacking like that of many ducks. A visit was made to ponds east of the lake with the result that the same sound was heard, but the perpetrators of the noise were too shy to allow themselves to be seen. It was thought that the noise was made by the Pickerel Frog, which may sing under the water like the Leopard Frog, and thus escape detection.

The Pickerel Frog may usually be readily distinguished from the Leopard Frog which it much resembles, by the decidedly yellowish cast of the under part of the hind legs, and by its strong minky order.

The following brief description may assist further in its identification.

Light brown, with 2 rows of large oblong square blotches of dark brown on back, one or two on sides; a brown spot above eye; a dark line from nostril to eye; upper jaw white, spotted with black; head short; obtuse; toes well webbed; glandular folds low.

16. *Rana sylvatica* Le Conte.

Wood Frog.

The Wood Frog is somewhat common in damp woods through the eastern part of the United States. At Lake Maxinkuckee it is not particularly common, only about 20 examples having been seen. Of these, 4 were taken on the shore of Lost Lake, and 3 on the shore of Lake Maxinkuckee, the others were obtained in the various inlets of the lake, a few in Culver Inlet, a few in Norris Inlet, but the greater number in or along Aubeenaubee Creek.

The earliest date on which it was seen was May 24, the latest August 23. In general it prefers the neighborhood of creeks in low damp woods, and in such situations, it is the most common frog in some parts of the State. It is too small to be used for food.

This frog, with its slender, elegant form and rich coppery color, is one of the most handsome of our frogs.

Side of head with a dark brown band, wider behind, from snout to shoulder, bordered below by a yellowish white line; usually a black spot at base of arm. General color pale reddish brown; arms and legs barred above, head small, pointed; femur and tibia about equal, the latter considerably more than half body; a rounded outer metatarsal tubercle present. Length about 2 inches. This species can be easily distinguished from any other about the lake; farther north it has a relative much resembling it.

17. *Rana clamitans* Latreille.

Green Frog.

The Green Frog is well known throughout the eastern part of the United States. At Lake Maxinkuckee it is common. Examples are occasionally seen along the lake shore. It is much more common, however, about springs, pools and creeks. Of about 25 examples obtained 4 were caught at the edge of Lost Lake, 5 in Aubeenaubee Creek, 3 in Norris Inlet and 4 in Lake Maxinkuckee.

This frog is more aquatic than the Leopard, Marsh or Wood Frog, and does not often stray far from water. Its favorite haunt is the edge of some creek, spring or pool, where it plunges with a surprised chung, at the first alarm. It makes straight for the bottom and usually a bit of stirred up mud shows where it has landed; or, where leaves are present in the bottom it works its way under these. It can remain under water some little time without discomfort. As its tadpole does not develop during the first year, this frog does not spawn in shallow pools, but usually chooses some place where the water is permanent. The tadpoles—rather large grayish creatures—can be found in muddy pools and creeks.

The Green Frog makes its appearance early in the spring and can be seen until late in the autumn. A few dead ones were seen during the winter and early spring, the first live one was seen April 15, and they were noted as late as October 9. Many tadpoles were seen in Hauk's Marsh which seems to be one of their favorite breeding places. The call of the Green Frog is a repeated "thrum, thrum, thrum," usually heard late in the evening or at night. They began thrumming about May 5, and continued until as late as August 26.

The Green Frog is excellent as an article of food and grows larger than the Leopard Frog. It is occasionally seen on the markets, not so frequently, however, as the Leopard Frog, because it is much more difficult to capture. In the autumn of 1906 large numbers of these frogs were seen to jump into pools in Overmeyer's and Culver's woods, but though these pools were thoroughly dredged with a dip-net none of the frogs came to bag. This frog exhibits a marked variation in the color of the underside, some of them being plain white, others a rich yellow color; this difference seems to be merely an individual variation. They also vary greatly in the size of the tympanum. It is sometimes very difficult to distinguish this species from the young of the Bullfrog, as they greatly resemble each other in general appearance. The Green Frog has the glandular folds on the back more or less distinct and the web of the foot not reaching the tip of the fourth toe, and can be always distinguished by these characteristics. The following brief description gives the details more fully.

Green or brownish, brighter in front; generally with irregular small black spots; arms and legs blotched, yellowish or white below; tympanum large;

glandular folds large; toes well webbed; first finger not extending beyond second; tibia and femur equal 1½ body. Length 3 inches.

18. *Rana catesbiana* Shaw.

Bullfrog.

The Bullfrog was formerly rather common in sluggish streams and ponds throughout the United States east of Kansas. At Lake Maxinkuckee it is said to have been formerly abundant, but it has been hunted until it is now rare. The method of hunting them was by means of a bicycle lamp at night which so blinded them that they could easily be picked up.

This is the rarest frog about the lake, only 6 examples having been seen, and of these only one captured. This one was obtained near the Fish Commission station while seining for minnows at night. A lantern was in use which probably blinded the frog. A large one was seen November 20 down by Norris Inlet, at the edge of the water. It was somewhat torpid, but managed to escape. On January 7, 1901, one of the ice-fishers saw a large Bullfrog on the bottom in several feet of water off the Gravel Pit. He cut a hole in the ice, let down a hook and pulled out the frog. It was too torpid to move. One was obtained April 15, 1901 (No. 35445, U. S. Nat. Mus.). On May 1, a large one was seen in the pond back of the Winfield cottage, and on September 30, 1907, one was seen basking on the shore of the Outlet about 2 miles below Lost Lake.

The deep, sonorous, bull-like bellow of this frog can be heard about some portion of the lake shore throughout the summer. They usually are heard over toward the southeast shore of Lost Lake where the miry shore and fringe of rushes give them good protection. During the summer of 1906, one kept bawling almost every day from the neighborhood of the icehouses. They keep up their bawling from May 1 to as late as August 26.

Like the Green Frog, the Bullfrog rarely strays far from the water, but stays by the shore, ready to jump in at the slightest alarm. There are few animals hunted more persistently than these. They are captured by several methods—by shooting, by use of acetyline light and by the use of red flannel on fish-hooks at which they readily jump, so that in spite of the almost inaccessible bits of shore they frequent, they are unable to hold their own.

The Bullfrog is said to be very voracious, and is reported to capture and swallow young ducklings. On account of its rarity at the lake, little was learned of its habits.

The Bullfrog can usually be identified by its size and voice. The following short description will assist in identifying specimens.

Greenish, of varying shades, with small faint dark spots above; head usually bright pale green; legs blotched; tympanum large; toes broadly webbed; femur equal to tibia, not half body. Length 5 to 8 inches.