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THE ECOLOGY OF THE SKOKIE MARSH AREA, WITH SPECIAL REFERENCE TO THE MOLLUSCA.

BY

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of Sciences

ERRATA AND ADDENDA.

Page 58, line 7, for *ovalis* read *ovata*.

Page 85, line 8, for *longicaudus* read *longicauda*, and just above *Phacus pleuronectes* read the following paragraph:—

Phacus longicauda var. *torta*, n. var.—This variety, for which I propose the name *torta* because of the twisted body, is figured by Stein ('78, Taf. 20, Fig. 3). It occurred sparingly in midsummer from July to September, rarely in October, in 1896 and 1897.

Page 91, line 18, after *T. caudata* Ehrb. read *T. lagenella* Stein.

Pages 153, line 3 from bottom, 168, line 16, and 178, line 14, for '*98* read '*98a*.

Pages 156, line 11, 159, line 16, and 161, line 5 from bottom, for '*93* read '*98a*.

Pages 175, line 5, 186, line 3, and 208, line 17, for *Bimærium* read *Dimærium*.

Page 288, line, 3 for *Lampsilus* read *Lampsilis*.

Page 292, line 13, for *gracilis* read *gracile*.

Page 471, line 3 under heading beetles, for *pennsylvanicus* read *pennsylvanica*

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ARTICLE IV.—*The Ecology of the Skokie Marsh Area, with Special Reference to the Mollusca.* BY FRANK COLLINS BAKER.

INTRODUCTION.

The present paper is an attempt to place on record a minute study of a small area with special reference to its molluscan inhabitants. It is believed that this is one of the first attempts to apply the ecological method, so notably used by the botanists (Cowles, 1901; Jennings, 1909, etc.), to the study of the Mollusca, although Adams (1906) and Ruthven (1904) have included this class of animals in their report of the Ecological Survey of Michigan, and Pilsbry (1905), Elrod (1901–03) and Adams (1900) have made valuable contributions to molluscan ecology. Attempts to study the mollusks of a restricted region from an ecological standpoint are, however, rare, the writer having been unable to find any papers in which these animals were studied purely from this standpoint.

It was thought that an exhaustive study of the habitat relations of all the mollusks of a given area might throw some light on their specific distinctions (especially those of the fresh-water pulmonates), and the studies herein detailed seem to warrant the belief that some good results along this line have been accomplished. These are referred to under the head of taxonomy (page 489).

METHOD OF STUDY.

The area in question was visited once or twice a week from May 18 to September 5, 1908; some additional work was also done in 1909. Many of the stations were visited several times, and nearly all were examined twice or more. Specimens were collected from the edges of the pools and ponds as well as from the deeper parts. In the woods almost every old log and piece of rotting wood was examined, and in the dry ponds the ground was dug up in many places in search of any burrowing mollusk. All material has been carefully preserved with exact data, and now forms a part of the ecological collection of the Chicago Academy of Sciences.

It has been thought of value in this connection to list all those species of animals which have been found directly associated with the mollusks in their various habitats. Thus, if a beetle was found under bark with a mollusk it was secured and listed with the molluscan species found at this station. So, also, the aquatic insects were listed in connection with the aquatic mollusks.

As an ecological survey is not complete without a knowledge of the plant societies, the more characteristic plants have been listed in connection with the various habitats. This list does not pretend to completeness, its purpose being to indicate those species of plants most intimately associated with the molluscan habitats.

At the time the survey was made, a collection of the nesting birds of the Skokie region was secured for the museum of the Academy, and it has been thought of value to include a few notes on these.

ACKNOWLEDGMENTS.

My thanks are due to the following persons who have greatly aided in the work of the survey:

To Dr. H. C. Cowles, University of Chicago, and Miss Carrie A. Reynolds, Lake View High School, for identifying the majority of the plants; to Mr. V. E. Shelford, University of Chicago, Mr. Chas. A. Hart, of the State Laboratory of Natural History, and Mr. J. J. Davis, Assistant to the State Entomologist, for assistance in working up the insects; to Mr. A. E. Ortmann, of the Carnegie Museum, Pittsburg, for the identification of the crawfishes; and to Mr. Frank M. Woodruff and Mr. Edward R. Ford for assistance in the determination of the birds as well as for many notes and suggestions on the same.

The photographs of habitats have been made by Mr. F. M. Woodruff, of the Chicago Academy of Sciences, and the author. On each photograph the name of the photographer appears in parenthesis.

Economic Considerations.

An area such as is herein described has a distinctly economic value, affording, as it does, both concealment and food for vertebrate life. The birds find excellent protection for their young in the thick vegetation, and abundant food is provided in the numerous ponds, streams and woodlands. The habitats are especially

favorable for a large variety of avian life. The thrushes, catbirds and thrashers find nesting sites in the large number of thorn-bushes (*Cratægus*); the woodpeckers and bluebirds, in holes in the rotting trees; the rails, bitterns and marsh wrens find protection among the cattails; and the crows and hawks find nesting locations high up in the tall trees. Many low bushes harbor the nests of the summer yellowbird, the goldfinch and the indigo bird. In fact the environments obtainable here are suitable for a large majority of the nesting birds of northern Illinois.

Food is everywhere abundant. The ponds and streams as well as the woods and fields teem with invertebrate life (mollusks, insects, crustaceans), thus affording endless supplies for the sustenance of nestlings. The preponderance of insect-eating birds in this region should be gratifying to the farmers, as during the spring these birds destroy vast numbers of injurious insects—a fact which is, unfortunately, not fully appreciated by the agriculturists. The hawks and owls are also very beneficial in destroying injurious rodents. In this connection the humble snake must not be overlooked, for it is equally valuable for this purpose. A number of birds were observed to feed on crawfish and also to feed their young on this crustacean. The stomachs of the young of the green heron and American bittern contained crawfish of large size, as did also the stomachs of the parent birds. The great blue heron, green heron, American bittern, and a single specimen of the fish-hawk were observed fishing in the East Branch of the Chicago River, evidently for crawfish, which are very abundant in this stream. Stomach pellets from the screech-owl were also observed to contain the remains of crawfish.

It would seem eminently desirable that in a farming district, tracts of land similar to those recorded below should be preserved, that the birds may be allowed to nest unmolested; and the agriculturist should be impressed with the value of these animals as destroyers of noxious insects, especially during the nesting season.

General Topography.

If a map of the Chicago area as it appeared during Pleistocene time be examined, the following features will be noted in the northern part of the region, in the vicinity of Glencoe.

Explanation of Fig. 1.

A. Map of area surveyed—from Glencoe west to Shermerville, a distance, east and west, of three miles. The width of the map (north and south) represents one mile.

1–36. Stations studied.

37. Chicago, Milwaukee and St. Paul Railroad passing through Shermerville.

38. Chicago and Northwestern Railroad cut-off.

39. Chicago and Northwestern Railroad passing through Glencoe.

40. Chicago and Milwaukee Electric Railroad.

 Large trees and virgin forest.

 Shrubs and small trees.

 Swamp.

 Houses.

 Roads.

 Small ponds and pools.

Unmarked spaces indicate open fields.

This map is based on the Highwood topographic sheet of the United States Geological Survey.

B. Profile section from Glencoe to Shermerville (the vertical scale is much exaggerated, in comparison with the longitudinal scale). 630, 670, etc., altitudes above sea-level.

1. East Arm of Skokie Bay.

2. West Arm of Skokie Bay.

3. Small bay west of Skokie Bay.

A. Skokie Marsh.

B. Intermediate Ridge.

C. East Branch of the Chicago River.

D. Glenwood Beach Ridge.

E. North Branch of the Chicago River.


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FIGURE 1.

A rather large bay, called Skokie Bay, extended northward for a considerable distance. It is this ancient Skokie Bay which, when the ice-sheet had retreated to such an extent that Lake Chicago (now Lake Michigan) no longer discharged its waters by way of the Desplaines-Illinois rivers, became partly drained and now forms the region familiarly known as the Skokie Marsh. A second bay lay to the west of Skokie Bay. A glance at the cross-section on the map (Fig. 1) will show the relation of Skokie Bay to this small bay, the Glenwood ridge separating the two. It seems evident, that at a stage later than the time at which the Glenwood ridge was formed, there must have been a period when Skokie Bay was itself divided into two arms. This condition is very plainly marked in the topography of the country, the ridge between the east and west shores of Skokie Bay being one of the conspicuous features of the landscape, especially at its highest point, overlooking the East Branch of the Chicago River. This ridge attains an elevation of twenty feet above the surface of the stream. The height of the Glenwood ridge in this area is 670 feet, or twenty feet above the ridge previously mentioned. The cross-section shows the relation of these three elevations. The view of the Skokie Marsh from the top of the highest ridge at the western edge of the town of Glencoe, is really quite picturesque, and on a bright, cool morning in early spring is sure to leave a lasting and pleasing impression.

The recession of the water of Skokie Bay has left some peculiar topographic features: the bed of the bay proper (see map and section) is now the Skokie Marsh; the surface of the ridge, which divided Skokie Bay into two arms and which was probably a long sand spit, contains a large number of pools of various sizes, which are more or less dry in the summer and fall; this area is rather sparsely wooded; the smaller arm of Skokie Bay is now occupied by the East Branch of the North Branch of the Chicago River; the small bay to the west of Skokie Bay is now occupied by the North Branch of the Chicago River, while the ridge between these two streams, which is believed to be equivalent to the Glenwood beach, is heavily wooded, with but few of the small pools so characteristic of the lower ridge to the east.

The area surveyed, which is three miles long and one mile wide, is thus seen to comprise five rather distinct areas, which may be designated as A, B, C, D and E.

A. Skokie Marsh.

(Plate VI.)

A strip of low, marshy land, about one mile in width, through which a small stream flows in the spring and early summer. In late summer and fall this stream is reduced to a series of pools separated by dry land. The marsh, which is covered with water from a few inches to several feet in depth in spring, becomes dried out in the fall and the ground becomes hard and sun-cracked. The marshy area is open, for the most part, and is covered with a thick growth of cattails and other aquatic vegetation, while toward the margins a tall, thick growth of swamp grass (*Calamagrostis*) succeeds the reeds. The marsh is dotted here and there with many small "islands" composed of several species of marsh-loving trees (see Fig. 1). These "islands" are surrounded by a dense growth of cattails, which attain a height of over ten feet and are very difficult to penetrate. The Glencoe road crosses the marsh, and on either side a rather deep ditch has been made, which is filled with aquatic plants. In two places these ditches form a large, deep, circular basin, connecting the ditches and spanned by a low bridge. The stream also widens as it flows under the Glencoe road bridge, forming a wide, deep pool. In the fall these ditches become more or less dry, and the basins are reduced to small pools.

B. Intermediate Ridge or Sand Spit.

A triangular piece of territory about a mile wide, lying west of the Skokie Marsh. The ground is from ten to twenty feet above the surface of the stream and is well wooded for the most part. The slope on the eastern face of this ridge is very gradual, but on the west it is quite abrupt, forming a rather steep terrace bordering the East Branch of the Chicago River. Scattered throughout this area are numerous depressions of various sizes, from a few feet to two hundred feet or more in diameter. These are of varying depth, from a few inches to several feet. In the spring they are filled with water and support a varied fauna and flora, but in the summer they dry up wholly or partially. These may be termed summer-dry ponds or pools—a name which seems more comprehensive than the word swale, which is used in the eastern states. About a dozen

such ponds were examined in this area and careful notes were made of their biotic contents.

This triangular area divides naturally into three subordinate areas: one beside the road running at right angles with the Glencoe road and between this and the Northwestern Railroad cut-off; one west of the railroad; and one bordering the East Branch of the Chicago River and separated from the second area by a field about three hundred feet in width. The first area is a few feet above the Skokie Marsh stream, the second is on rising ground, and the third is on an elevation twenty feet above the river. A large part of the southern portion of this area is cleared for grazing purposes.

C. The East Branch of the Chicago River.

(Plates XVII.,2, and XVIII.,1.)

This stream is quite wide in the spring, and is from one to six or more feet in depth. It occupies a little valley with a rather broad flood-plain flanked on either side by abrupt ridges about ten feet high, forming, in this part of the area, distinct terraces. The river meanders considerably and also varies in width and depth. The latter is shown plainly in the late summer, when the river is reduced to a succession of small, muddy pools, varying from a few inches to three or four feet in depth (Plate XVIII., 1). The river may be properly termed an intermittent stream.

The flood-plain varies in width from a few feet to two or three hundred feet. It is covered with swamp grass, interspersed with reeds in the lower places. Trees have invaded this area, and such species as the swamp white oak and maple are abundant on the broader portions, in some places forming large groves, or thick tangles—as where the button-bush borders the river near the southern end of the area in question. In several places the river spreads over the entire flood-plain, forming a characteristic bog. In most places, however, the river occupies little territory outside of its bed, except in times of very high water.

D. Glenwood Beach Ridge.

(Plate XXII.)

This area lies west of the East Branch of the Chicago River, between this branch and the North Branch. The beach reaches

an elevation of 670 feet, or forty feet above the river, and twenty feet higher than the ridge on the east side of the East Branch. This region is rather heavily timbered, the trees being large and the ground being covered with an accumulation of debris, showing that the area has not been disturbed by man. About a third of a mile west of the East Branch a large ridge is encountered which is very abrupt, rising suddenly from a level plain and gradually sloping toward the south until it reaches the level of the surrounding area. This was probably a sand spit extending into Skokie Bay. Small ponds, like those found in the area east of the East Branch, are generally absent, although there are several ponds and semi-marshy spots at the foot of the sand spit mentioned above. Several small streams drain into the East Branch during the spring, but aside from these, this area is quite free from summer-dry ponds, owing, probably, to its greater elevation and the absence of large depressions in which water might gather.

To the south, this territory is cleared for pasture and farm land, and the same may be said of the areas bordering the Shermerville road, which cuts through this portion of the region. Bordering the river to the north, the ground is lower and forms a wet, marshy area in spring. This is especially true of those portions of the territory to the north of the Glencoe road.

E. The North Branch of the Chicago River.

(Plate XVIII., 2.)

This stream, which is not of an intermittent character as is the East Branch, is from twenty to thirty feet in width and is quite deep. It flows through a low area, the banks also being low, just a foot or so above the stream, and the territory on either side is swampy and reed-grown. East of the St. Paul railroad bridge, the river forms an extensive arm at the foot of the railroad embankment, which is marshy and supports a fauna different from that of the river proper. The river flows through the village of Shermerville and is becoming contaminated with sewage, like the larger stream at the southward. This area was found to be very poor biologically.

Seasonal Comparisons.

The area herein discussed is typical of many in the middle west, especially in those states bordering the southern part of Lake Michigan. It is typical also of those areas in which the volume of water fluctuates through the seasons of the year as well as in the same season in different years. In spring, there is an abundance of water in all the streams and ponds, and every depression in the woods (as shown in Plate XVI.) is filled with water and supports some kind of animal life. Spring conditions are shown in plates XVII., XVI.,2, XX., XXIII., and XVIII.,2. In the fall the water evaporates, either entirely or to such an extent as to leave only small pools here and there. This condition is shown in plates XVII.,1, XVIII.,1, and XXIV.,1, which should be compared with the photographs of the same habitats in spring.

The difference in one year as compared with another may be seen by comparing plates XVII.,1, and XXIV.,1, which were taken September 5, 1908, with plates XVI. and XXIII., of the same habitats, taken September 10, 1909. It will be recalled that the year 1908 was much drier than 1909, this difference in precipitation causing a marked effect on the summer-dry ponds of this area. The year 1909 has, therefore, been much the more favorable year for invertebrate life in these ponds and streams, owing to the less rigorous conditions of the environment. The effect has also been notably different on the vegetation, which was much more luxuriant in the fall of 1909 than at the same period in 1908.

The five areas just described break up into a number of more or less distinct stations, the biota of which differ more or less. These stations will next be taken up in detail. Their positions may be ascertained by consulting the map.

A. SKOKIE MARSH. (Stations I and II.)

Station I.

(Plate VI.)

Skokie stream and tributary ditches. This stream was once a tributary of the East Branch, but it now ceases to exist at a point southwest of Glencoe. It is an intermittent stream, in the spring

being about five feet in width and from knee to waist deep. In certain spots, as at the bridge over which the Glencoe road passes, it widens to form a pool twenty feet in diameter and from six to eight feet in depth. The ditches are about five feet wide and two or three feet deep. In two places (1*) the ditches form wide pools ten or fifteen feet in diameter and six to ten feet in depth.

The characteristic plant life is as follows:

Chara sp. In the deep pool.
Polygonum muhlenbergii. In the ditches in a few inches of water.
Sagittaria latifolia. In shallow water.
Iris versicolor. In shallow water.
Sparganium eurycarpum. In shallow water.
Typha latifolia. On edge of pool.
Salix longifolia. A heavy clump bordering the deep pool, north of the Glencoe road.

The animal life observed was as follows.

MOLLUSKS (FLUVIATILE SPECIES).

Musculium partumeium.
Physa gyrina.
Planorbis trivolvis.
Segmentina armigera.
Lymnæa reflexa.

INSECTS.

Limnotrechus marginatus.	Water-strider.
Corixa interrupta.	Water-boatman.
Notonecta undulata.	Back-swimmer.
Hydroporus undulatus.	Diving beetle.
Dytiscus larva.	Larva of diving beetle.
Culex sp.	Mosquito.
Libellula basalis.	Dragonfly (adult).
Anax junius.	Dragonfly (nymph).
Zaitha fluminea.	Water-bug.

LOWER VERTEBRATES.

Ameiurus melas.	Black Bullhead.
Esox lucius.	Pickerel.
Rana pipiens.	Leopard-frog.
Natrix grahami.	Water-snake.

STATION II.

(Plates VII. and VIII.)

The open marsh. It is about a mile in width. In the spring the whole surface is covered with water which is from a few inches to

several feet in depth. In the late summer and fall this area is either entirely dry or with only a few shallow pools distributed over the surface. Scattered over the marsh are numerous forest islands from fifteen or twenty feet to over two hundred feet in diameter. Some of these are irregularly round in outline; the largest ones, however, are of an oblong shape.

There are three distinct plant societies in the marsh, which may be characterized as follows.

I. THE FOREST ISLANDS SOCIETY.

Populus tremuloides.	American Aspen.
Ribes floridum.	Wild Black Currant.
Salix longifolia.	River-bank Willow.

II. THE TYPHA LATIFOLIA SOCIETY.

Cattails surround the forest islands, often reaching a height of ten feet or more, presenting an almost impenetrable jungle. In several places small areas of cattail islands occur, and the ditches and streams are lined with *Typha.*

III. THE IRIS VERSICOLOR-CALAMAGROSTIS CANADENSIS SOCIETY.

The greater part of the swamp is covered with these two plants, interspersed here and there with clumps of *Sagittaria latifolia*, *Sparganium eurycarpum*, *Sium cicutæfolium* and *Eupatorium purpureum.*

The bluejoint grass (Pl. VIII., 2) reaches a height of eight feet or more, affording excellent concealment for the nests of marsh-inhabiting birds.

THE FAUNA OF THE MARSH.

INSECTS.

With the addition of a few small beetles in the fall, the insect fauna of the marsh is the same as that of the ditches and stream.

MOLLUSKS.

FLUVIATILE SPECIES.

Physa gyrina. Very abundant.
Lymnæa reflexa. Rare.

LAND SPECIES.

Succinea retusa. Very abundant.
Succinea avara. Less abundant.
Agriolimax campestris. Abundant.

No difference could be detected between the mollusk fauna of the marsh and that of the forest islands except in the distribution of *Agriolimax campestris*, which was found only about the trees of the islands.

BIRDS.

During the nesting season the following birds are more or less abundant:

Blue-winged Teal.	Nesting site not located.
American Bittern.	Nesting among cattails.
Least Bittern.	
Great Blue Heron.	Nesting site not located.
King Rail.	Nesting among cattails.
Virginia Rail.	Nesting among cattails.
Sora.	Nesting among cattails.
Florida Gallinule.	Nesting among cattails.
Marsh Hawk.	Nesting in marsh.
Kingbird.	Nesting on forest islands.
Traill's Flycatcher.	Nesting on forest islands.
Bobolink.	Nesting on border of marsh.
Dickcissel.	Nesting on border of marsh.
Red-winged Blackbird.	Nesting in marsh.
Swamp Sparrow.	Nesting on border of marsh.
Song Sparrow.	Nesting on border of marsh.
Grasshopper Sparrow.	Nesting on border of marsh.
Leconte's Sparrow.	Nesting on border of marsh.
Field Sparrow.	Nesting on border of marsh.
Savannah Sparrow.	Nesting on border of marsh.
Catbird.	Nesting on forest islands.
Short-billed Marsh Wren.	Nesting in marsh.
Long-billed Marsh Wren.	Nesting in marsh.

B. THE INTERMEDIATE RIDGE OR SAND SPIT.

(STATIONS III–XX.)

(Plate IX.)

A low, wet area, on the western edge of the Skokie Marsh. It is well wooded, many of the trees being of large size. A rather wide opening extends diagonally through this area, and is occupied by a summer-dry pond. In the spring the pond is from one to two feet

in depth and there are several small streams which flow through the wooded portion, in which there are also many small pools in depressions of greater or less size. These afford good habitats for a number of mollusks.

The flora of this region comprises a number of distinct plant societies which may be classed as follows.

(1). That of the central nucleus, the pond, which provides a habitat for

Typha latifolia.	Cattail.
Iris versicolor.	Large Blue Flag.
Asclepias incarnata.	Swamp Milkweed.

(2). That at the edge of the pond, which is marked by the presence of

Salix longifolia.	River-bank Willow.
Ulmus americana.	American Elm.
Quercus bicolor.	Swamp White Oak.

This plant society is closely encroaching upon the first society, and will ultimately exterminate it by invading the entire area.

(3). The large forest-trees form a distinct society which follows closely upon the society mentioned above. The trees are of large size, showing that the area has been untouched by man. The following species comprise the dominant types:

Ulmus americana.	American Elm.
Tilia americana.	Basswood.
Cratægus punctata.	Large-fruited Thorn.
Cratægus mollis.	Red-fruited Thorn.
Corylus americana.	Hazelnut.
Quercus bicolor.	Swamp White Oak.
Carya ovata.	Shellbark Hickory.

(4). The ground beneath the forest growth is carpeted with low-growing plants, among which the following species are conspicuous:

Arisæma dracontium.	Green Dragon.
Campanula americana.	Tall Bellflower.
Cicuta maculata.	Water Hemlock.
Osmorrhiza longistylis.	Smoother Sweet-Cicely.
Rudbeckia laciniata.	Green-headed Coneflower.

The entire area is an excellent example of plant succession.

The poison ivy or poison oak (*Rhus radicans*) grows luxuriantly on the western edge of this area.

Station III.

This includes the pond, and also the ditches within this region.

INSECT LIFE.

Limnotrechus marginatus.	Water-strider.
Corixa interrupta.	Water-boatman.
Notonecta undulata.	Back-swimmer.
Culex sp.	Mosquito.
Zaitha fluminea.	Water-bug.
Libellula basalis.	Dragonfly (adult).

MOLLUSKS.

FLUVIATILE SPECIES.

Musculium partumeium. Occasional.
Physa gyrina. Very abundant.
Segmentina armigera. Very abundant.
Planorbis trivolvis. Common.
Lymnæa reflexa. Common.

LAND SPECIES.

Succinea retusa. Common.
Succinea avara. Occasional.

Station IV.

A small stream which drains from ditch beside Glencoe road into the center pond. Also, hollows in the wooded area which are filled with water in the spring. In the fall, all of these habitats are dry, and the dead shells of mollusks may be found scattered over the surface or under dead leaves.

MOLLUSKS.

FLUVIATILE SPECIES.

Sphærium occidentale. Very abundant.
Aplexa hypnorum. Very abundant.
Physa gyrina. Occasional.
Segmentina armigera. Very abundant.
Planorbis parvus. Rare.
Lymnæa caperata. Occasional.
Lymnæa parva sterkii. Rare.

LAND SPECIES.

Succinea retusa. Common.
Succinea avara. Occasional.

Station V.

The wooded area. The ground beneath the trees is covered with leaves, dead twigs, old logs and other wood debris, which afford cover for the following species of land shells:

Succinea ovalis optima. Plentiful.
Succinea avara. Plentiful.
Zonitoides arboreus. Common.
Vitrea hammonis. Rare.
Polygyra fraterna. Very common.
Polygyra albolabris. Rare.
Polygyra thyroides. Very common.
Pyramidula alternata. Common.

The larger Polygyras appear to frequent the base of large trees, while the smaller species are common under the forest debris and leaves. *Succinea ovalis* is plentiful under old leaves. *Pyramidula alternata* and *Polygyra fraterna* prefer to hide under "started" bark on dead stumps and logs, in company with the large beetle *Osmoderma scabra.* Of twenty-one specimens of *Polygyra thyroides*, five individuals had a pronounced denticle on the parietal wall. The specimens of *Succinea ovalis optima* vary greatly in the height of the spire and in the width of the last whorl.

ANIMALS ASSOCIATED WITH THE MOLLUSCA.

INSECTS.

Osmoderma scabra.	Beetle; under bark.
Melanotus communis.	Beetle; under bark.

CRUSTACEA.

Cambarus blandingi acutus.	Crawfish.

LOWER VERTEBRATES.

Eutænia sirtalis.	Garter-snake.
Storeria occipitomaculata.	Storer's Snake.

BIRDS.

Red-headed Woodpecker.
Northern Flicker.
Chimney Swift.
Blue Jay.
Crow.

Cowbird. Young; in yellow warbler's nest
Song Sparrow.
Indigo Bunting; nesting.
Northern Yellow-throat.
Yellow Warbler; nesting.
Red-eyed Vireo.
Catbird; nesting.
Brown Thrasher; nesting.
Wood Thrush; nesting.
American Robin; nesting.

Station VI.

Clay hole about twenty feet in diameter in woods on west edge of Skokie Marsh, north of Glencoe road. The pool is almost circular in outline, but a ditch-like depression has been formed on the southwest edge, which extends irregularly for some forty or fifty feet. There is no vegetation in or about the pool. *Physa* inhabited the pool by thousands, all, however, being immature. During a visit in July they were observed to form a dark border about three inches in width entirely around the pool. In the ditch-like outlet fully adult Physas were found, as well as *Planorbis*.

Only two species were found, the *Physa* being by far the most abundant. These were

Physa gyrina,
Planorbis trivolvis.

During the summer and fall, the ditch-like outlet is dry. In the clay pit no Planorbes were found, and only immature *Physa*. In the ditch-like depression were the dead shells of *Planorbis* and of adult *Physa*. Old shells of the latter were marked with four well-defined varices, indicating rest periods.

Station VII.

(Plates X., XI. and XII.,1.)

A marshy pond about three hundred feet in greatest diameter, west of the Northwestern Railroad cut-off. The pond is roundly ovate in shape. In the spring the water is from one to three or four feet in depth, but in late summer and fall the pond is reduced to a number of isolated pools here and there and a small wet area in the center.

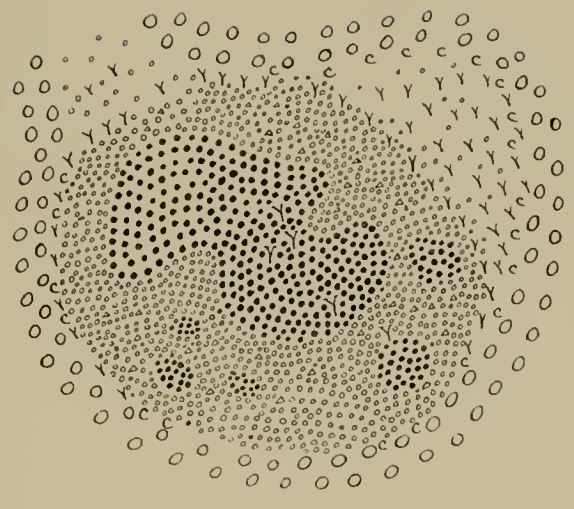

FIGURE 2.

Diagram showing relation of characteristic vegetation of Station VII. The zonal arrangement is notable.

- • Typha latifolia.
- o Iris versicolor.
- △ Sagittaria latifolia.
- Y Salix longifolia.
- C Cratægus, Pyrus and Viburnum.
- O Quercus, Carya, Ostrya and Populus, the oaks predominating.

The vegetation is divided into a central area and more or less distinct concentric zones of plant societies (Fig. 2), which may be described as follows.

(1). A nucleus of cattails, *Typha latifolia.*

(2). First zone, a wide expanse of reeds, *Iris versicolor*, interspersed with *Sagittaria latifolia* and *Sparganium eurycarpum.*

(3). Second zone, consisting of bush-like trees, as follows.

Cratægus punctata.	Large-fruited Thorn.
Cratægus tomentosa.	Pear Thorn.
Cratægus coccinea.	Scarlet Thorn.
Pyrus coronaria.	American Crab-apple.
Viburnum lentago.	Nanny-berry.
Salix longifolia.	River-bank Willow.

(4). Third zone, the forest proper, containing

Quercus macrocarpa.	Mossy-cup, or Bur Oak.
Populus tremuloides.	American Aspen.
Ostrya virginiana.	Hop Hornbeam or Ironwood.
Quercus bicolor.	Swamp White Oak.
Carya ovata.	Shellbark Hickory.

The western end of the pond is free from reeds, is very shallow, and supports the following marsh-loving plants:

Proserpinaca palustris.	Mermaid-weed.
Ranunculus multifidus.	Yellow Water-Crowfoot.
Sium cicutæfolium.	Hemlock Water-Parsnip.

Ranunculus multifidus covers the bottom of the pond everywhere, in the deeper as well as in the shallower portions.

The invertebrate life of this station is quite varied*. The following species were observed.

INSECTS.

Limnotrechus marginatus.	Water-strider.
Corixa interrupta.	Water-boatman.
Notonecta undulata.	Back-swimmer.
Zaitha fluminea.	Water-bug.†
Libellula basalis.	Dragonfly (adult).
Hydroporus undulatus.	Diving beetle.

CRUSTACEA.

Cambarus blandingi acutus.	Crawfish.

MOLLUSKS.

Molluscan life was quite abundant in the pond. *Lymnæa* was found plentifully on dead pieces of cattails and reeds, many having hibernated on the stems of the reeds, two to four inches above the water; other individuals were found in the water attached to the submerged base of the cattails. The Lymnæas were not found in open patches of water where no cattails grew. *Planorbis* occupied the same habitat as *Lymnæa*. *Physa* was rare in this area. *Succinea* was plentiful on the stems of cattails near the water. *Seg-*

*The vertebrate life of stations VII–XVII, is listed on page 468.

†This water-bug preys upon mollusks. Mr. B. F. Isely, of Tonkawa, Oklahoma, has observed it feeding upon *Physa* in an aquarium, large numbers of the snail being eaten.

mentina, as well as *Musculium*, was common in open spaces in the pond.

The following species were secured.

FLUVIATILE SPECIES.

Musculium partumeium. Common.
Physa gyrina. Common.
Segmentina armigera. Common.
Planorbis trivolvis. Common.
Lymnæa reflexa. Common.

LAND SPECIES.

Succinea retusa. Common.

Station VIII.

Woods surrounding Station VII. The ground is high and dry, the trees are rather far apart, producing an open woodland effect. The ground is covered with dead leaves, rotting logs and stumps, and the various debris found in such a habitat. The ground about the pond is quite high and the slope pondward is rather abrupt. *Polygyra albolabris* was found in fair numbers in holes in logs and stumps and under old logs; *Polygyra fraterna* was common under logs and "started" bark; the smaller land snails were plentifully distributed in old stumps and on chips and other small debris; while *Succinea ovalis* was common under dead leaves in small hollows. *Zonitoides* was plentiful under "started" bark.

The following species were secured.

LAND MOLLUSKS.

Polygyra albolabris. Occasional.
Polygyra fraterna. Common.
Pyramidula alternata. Rare.
Agriolimax campestris. Common.
Zonitoides arboreus. Common.
Succinea avara. Rare.
Succinea ovalis. Common.

INSECT LIFE.

Ceuthophilus sp.	Cricket; under log with land shells.
Pterostichus permundus.	Beetle; under log with land shells.

Station IX.

A small pool to the southeast of Station VII, and connected with that habitat by an area of low swampy ground, forming a depression in the high ground surrounding Station VII. Area about fifteen by twenty-five feet. The vegetation is the same as that of Station VII.

This station is carpeted with

Ranunculus multifidus.	Yellow Water-Crowfoot.
Proserpinaca palustris.	Mermaid-weed.

The following mollusks were observed, *Physa gyrina* being the predominating species.

FLUVIATILE SPECIES.

Sphærium occidentale. Rare.
Musculium partumeium. Common.
Physa gyrina. Abundant.
Planorbis trivolvis. Common.
Segmentina armigera. Common.
Lymnæa reflexa. Rare.

LAND SPECIES.

Succinea retusa. Common.
Agriolimax campestris. Common.

Lymnæa reflexa is a migrant from Station VII.

Station X.

A small pond about thirty feet in diameter, almost circular in outline, two hundred or more feet from the larger pond (Station VII), and connected with that station by a narrow stream of water. The pond hole is from six inches to two feet in depth, and the bottom is composed of soft, tenacious, clayey mud. In the spring the hole is filled with water, but during the summer and fall the water evaporates, leaving the mud in hard, irregular cakes, the cracks between being filled with vegetation. The mollusks find a retreat in these cracks, into which they crawl and æstivate. An epiphragm is formed, as in the helices, and many individuals are thus enabled to survive the dry summer, to be revived in the late fall when the rains begin, thus providing for the perpetuation of the species. *Physa gyrina* is the most abundant species in this station, the dead

shells being scattered over the mud and in the cracks in endless profusion. Only about three per cent. of the shells contained living animals.

The vegetation of this station is as follows.

On the Dry Bottom.

Ranunculus multifidus.	Yellow Water-Crowfoot.

About the Border.

Iris versicolor.	Large Blue Flag.
Cratægus punctata.	Large-fruited Thorn.
Tilia americana.	Basswood.
Ulmus americana.	American Elm.

Mollusks as listed below were obtained.

FLUVIATILE SPECIES.

Musculium partumeium. Common.
Physa gyrina. Very abundant.
Segmentina armigera. Rare.

LAND SPECIES.

Succinea retusa. Rare.

INSECTS.

Notonecta undulata.	Back-swimmer.
Corixa interrupta.	Water-boatman.
Zaitha fluminea.	Water-bug.

Station XI.

A small stream, dry in summer, extending from Station X, in a curved direction, to the railroad embankment. The bed of the stream is about a foot in width, but in the spring the water covers the area to a width of from two to five feet.

The following plants were noted in the immediate vicinity:

Onoclea sensibilis.	Sensitive Fern.
Ribes floridum.	Wild Black Currant.
Cratægus punctata.	Large-fruited Thorn.
Carya ovata.	Shellbark Hickory.
Sium cicutæfolium.	Hemlock Water-Parsnip.
Quercus bicolor.	Swamp White Oak.
Caltha palustris.	Marsh Marigold.
Anemone canadensis.	Canada Anemone.

Mollusks of the following species were secured, all fluviatile:

Sphærium occidentale. Rare.
Musculium partumeium. Common.
Segmentina armigera. Common.
Aplexa hypnorum. Very common.
Physa gyrina. Common.
Lymnæa caperata. Common.
Lymnæa reflexa. Rare.

Lymnæa reflexa is undoubtedly a migrant from Station VII, probably floated down during high water. But two specimens were found after a careful search.

Station XII.

Woods bordering Station XI. The ground is low and consequently wet in spring. *Succinea ovalis* was observed on leaves of various plants, four to five feet from the ground. It was also found under dead leaves. In summer this area is dry and the ground is quite hard.

The following land mollusks were secured:

Succinea avara. Rare.
Succinea retusa. Rare.
Succinea ovalis. Common.
Polygyra thyroides. Uncommon.
Polygyra fraterna. Common.

Station XIII.

Wet portions of woods connecting stations XII and XIV, evidently fed by overflow from Station XIV.

Vegetation the same as that of Station XI.

The following species of mollusks, all fluviatile, were secured. Of the first three species, the *Lymnæa* was the least abundant and the *Aplexa* the most abundant.

Sphærium occidentale. Common.
Aplexa hypnorum. Very common.
Lymnæa caperata. Uncommon.
Planorbis exacuous. Rare.

Station XIV.

(Plates XII.,2, and XIII.)

A small pond about thirty feet in diameter, rather pyriform in shape. The water is knee to waist deep in the spring, but in the

fall it is reduced to a small area in the center. The plant societies here form into zones, as in Station VII, though not with the same regularity (Fig. 3). There is a central portion (see Pl. XII.,2) which

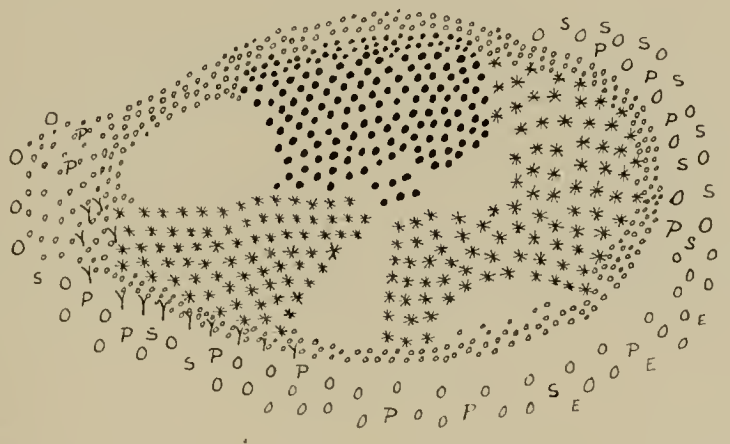

FIGURE 3.

Diagram showing relation of characteristic vegetation of Station XIV. The arrangement of Typha and Cephalanthus in distinct associations is noteworthy.

* Cephalanthus occidentalis.
• Typha latifolia.
o Iris versicolor.
O Quercus.
S Carya.
P Populus.
E Ulmus.

is open and free from vegetation. The north side and west end of the pond are occupied by button-bush. The edge is bordered by a zone of *Iris*. There is a zone of cattails (*Typha latifolia*) at the south side; the east end is shallow and is filled with swamp grass.

The following trees occupy the area surrounding the pond:

Quercus bicolor.	Swamp White Oak.
Cephalanthus occidentalis.	Button-bush.
Salix longifolia.	River-bank Willow.
Populus deltoides.	Cottonwood.
Populus tremuloides.	Trembling Aspen.
Ulmus americana.	American Elm.
Carya ovata.	Shellbark Hickory.

Animal life was fairly abundant, the invertebrates being as follows.

INSECTS.

Limnotrechus marginatus.	Water-strider.
Corixa interrupta.	Water-boatman.
Notonecta undulata.	Back-swimmer.
Zaitha fluminea.	Water-bug.
Tropisternus dorsalis.	Water-beetle.
Cybister sp.	Larva of water-beetle.
Sympetrum rubicundulum.	Dragonfly (nymph).
Libellula basalis.	Dragonfly (adult).
Anax junius.	Dragonfly (nymph).

MOLLUSKS.

FLUVIATILE SPECIES.

Physa gyrina. Abundant.
Segmentina armigera. Common.
Lymnæa reflexa. Rare.

LAND SPECIES.

Succinea retusa. Rare.

Station XV.

(Plate XIV.)

An open area about thirty-five feet in diameter in the midst of a rather thick growth of trees. The ground is covered with dead leaves, dead branches and other forest debris.

The forest surrounding the area includes the following species:

Quercus bicolor.	Swamp White Oak.
Carya ovata.	Shellbark Hickory.
Ulmus americana.	American Elm.

Under the leaves and in cracks in the dry earth the following mollusks were found.

FLUVIATILE SPECIES.

Sphærium occidentale. Common.
Physa gyrina. Very rare.
Aplexa hypnorum. Common.
Lymnæa caperata. Rare.

LAND SPECIES.

Succinea avara. Rare.

During the spring this area is very wet, forming a miniature pond, a few inches in depth, but in the summer and fall it is dry and sun-baked.

Station XVI.

(Plate XV.)

An oval depression on the highest portion of the intermediate ridge, about one hundred feet in longest diameter. The center of the pond is filled with cattails, about which is a zone of grass and aquatic plants. The pond is edged with bushes and bush-like trees, while the forest proper succeeds this formation. There are thus four different kinds of plant societies, or three zones surrounding a

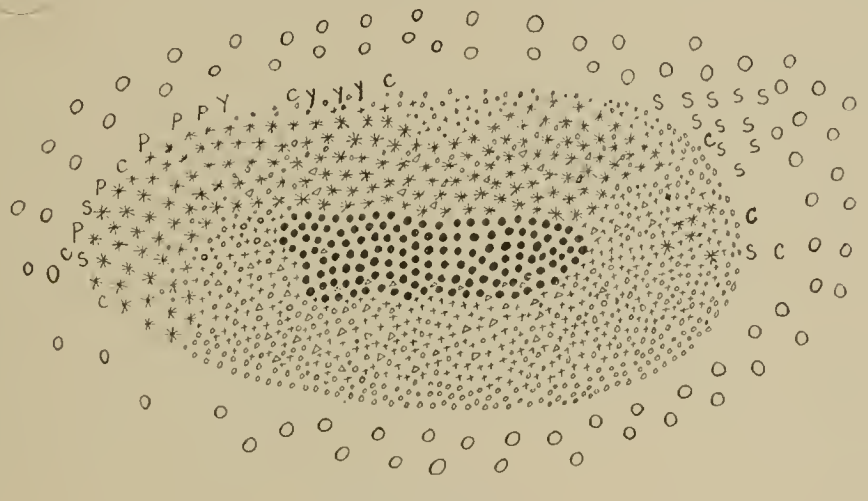

FIGURE 4.

Diagram showing relation of characteristic vegetation of Station XVI.

* Cephalanthus occidentalis.
● Typha latifolia.
o Iris versicolor.
+ Dulichium spathaceum.
△ Sagittaria latifolia.
O Quercus coccinea.
S Quercus bicolor.
Y Salix longifolia.
P Populus tremuloides, Corylus, Hamamelis, Viburnum, etc.

central nucleus. (Fig. 4.) The plant societies may be tabulated as follows.

CENTRAL AREA.

Typha latifolia.	Cattails.

FIRST ZONE.

Sparganium eurycarpum.	Broad-fruited Bur-Reed.
Sagittaria latifolia.	Broad-leaved Arrow-head.
Iris versicolor.	Large Blue Flag.
Dulichium arundinaceum.	Sedge.

SECOND ZONE.

This zone is confined to the east, west and north sides. On the north side the button-bush has filled the pond to the *Typha* society.

Populus tremuloides.	American Aspen.
Cephalanthus occidentalis.	Button-bush.
Corylus americana.	Hazelnut.
Hamamelis virginiana.	Witch Hazel.
Viburnum lentago.	Nanny-berry.
Salix longifolia.	River-bank Willow.

THIRD ZONE.

Quercus bicolor.	Swamp White Oak.
Quercus coccinea.	Scarlet Oak.
Carya ovata.	Shellbark Hickory.
Ulmus americana.	American Elm.
Ostrya virginiana.	Hop Hornbeam.

In the late summer, the first zone becomes covered with small plants, ferns, etc., among which the following species are notable:

Viola blanda.	Sweet White Violet.
Fragaria virginiana.	Scarlet Strawberry.
Ranunculus multifidus.	Yellow Water-Crowfoot.
Onoclea sensibilis.	Sensitive Fern.
Aspidium thelypteris.	Marsh Shield Fern.
Aspidium cristatum.	Crested Shield Fern.

Ranunculus multifidus is abundant over the entire ponded area, both under water and forming a carpet on the dry border.

Insect life is abundant in the spring, but is rare in the fall owing to the almost complete drying-up of the pond. The following species were noted.

INSECTS.

Corixa interrupta.	Water-boatman.
Notonecta undulata.	Back-swimmer.
Zaitha fluminea.	Water-bug.
Limnotrechus marginatus.	Water-strider.

Mollusks were very abundant in this pond, especially the larger species. Only a few individuals of two or three species (*Musculium*, *Physa*, *Lymnæa*) were found in the central cattail area, the majority being found about the edges of the pond near the button-bushes, where they had taken refuge beneath the wet leaves and grass when the water disappeared. Under decaying logs and about the roots of the shrubs were the best localities for the majority of the species. The Lymnæas were abundant under damp vegetation at the east end of the pond (July–August). In this wet situation the Lymnæas, as well as some Physas and a few Musculiums, are able to survive the long dry summer and are ready to revive when the fall rains begin.

The following species of mollusks were secured in this pond.

FLUVIATILE SPECIES.

Sphærium occidentale. Not common.
Musculium partumeium. Common.
Physa gyrina. Common.
Segmentina armigera. Common.
Planorbis exacuous. Common.
Lymnæa reflexa. Common.

LAND SPECIES.

Succinea avara. Rare.

Station XVII.

A small depression about 100 feet southwest of Station XVI, thirty feet or more in diameter. The arboreal vegetation in and about this spot is as follows.

Ostrya virginiana.	Hop Hornbeam.
Cephalanthus occidentalis.	Button-bush.
Quercus bicolor.	Swamp White Oak.
Carya ovata.	Shellbark Hickory.

In summer and autumn this locality is dry and becomes filled with dead leaves. Under these leaves the following bivalve mollusk may be found in large numbers:

Sphærium occidentale. Very common.

Vertebrate Life; Stations VII—XVII.

The area included in Stations VII to XVII abounds in avian life, both during migration and in the summer months, the locality affording excellent nesting sites for the birds, a majority of which nest in the vicinity.

Vertebrates were observed as follows.

LOWER VERTEBRATES.

The following species were found about the edges of the ponds and pools:

Rana pipiens.	Leopard-frog.
Amblystoma jeffersonianum.	Jefferson's Salamander.
Hemidactylium scutatum.	Scaly or Four-toed Salamander.

BIRDS.

American Bittern.	Nesting in reeds of Station VII.
Green Heron.	Nesting in oak tree on edge of Station VII. Young out of nest July 29.
Great Blue Heron.	
Sparrow Hawk.	
Red-shouldered Hawk.	
Red-tailed Hawk.	
Cooper's Hawk.	
Yellow-billed Cuckoo.	
Flicker.	
Red-headed Woodpecker.	
Downy Woodpecker.	
White-bellied Swallow.	
Whippoorwill.	
Nighthawk.	
Kingbird.	
Wood Pewee.	
Chickadee.	
Crow.	
Blue Jay.	

Red-winged Blackbird.	Nesting in Station VII.
Song Sparrow.	
Red-eyed Vireo.	
Warbling Vireo.	
American Redstart.	
Yellow Warbler.	
Ovenbird.	
Northern Yellow-throat.	
Catbird.	
Robin.	
Wood Thrush.	
Bluebird.	

Station XVIII.

(Plates XVI. and XVII.,1.)

An oval depression 80 by 125 feet in the edge of the woods east of the East Branch of the Chicago River, bordering an open field. In the spring this depression forms a large pond, two or more feet in depth, which supports a varied and abundant fauna. In the summer and fall the water evaporates, leaving an open space in the woods, with dry, mud-cracked surface which is covered with dead leaves. Aquatic vegetation (excepting algæ) is rare in this pond, only a few flags growing in a wet depression, subject to overflow from the larger body of water.

The characteristic vegetation is as follows.

In the Pond.

Algæ. Sp. undet.

Bordering the Pond.

Iris versicolor.	Large Blue Flag.
Cephalanthus occidentalis.	Button-bush.

In the Forest surrounding the Pond.

Quercus bicolor.	Swamp White Oak.
Quercus coccinea.	Scarlet Oak.
Ostrya virginiana.	Hop Hornbeam.

The insect and molluscan species thrive well among the thick clumps of algæ. The following species were secured.

MOLLUSKS.

FLUVIATILE SPECIES.

Physa gyrina. Very common.
Lymnæa reflexa. Rare.

LAND SPECIES.

Agriolimax campestris. Common.

The absence of *Sphæriidæ* is noteworthy.

INSECTS.

Hydroporus undulatus	Diving Beetle.
Dytiscus sp.	Larva of water-beetle.
Notonecta undulata.	Back-swimmer.
Corixa interrupta.	Water-boatman.
Limnotrechus marginatus.	Water-strider.
Leucorhinia sp.	Dragonfly (nymph).
Libellula basalis.	Dragonfly (adult).
Epiæschna heros.	Dragonfly (nymph).

CRUSTACEA.

Cambarus blandingi acutus.	Crawfish.

Station XIX.

An irregular depression, two hundred or more feet west of Station XVII, lying in a northeast by southwest direction. This area is about one hundred feet long by forty feet wide, and is well stocked with plant life, among which the following species are conspicuous:

Iris versicolor.	Large Blue Flag.
Sparganium eurycarpum.	Broad-fruited Bur-Reed.

The following species of trees surround the area:

Ostrya virginiana.	Hop Hornbeam.
Cratægus punctata.	Large-fruited Thorn.
Carya ovata.	Shellbark Hickory.
Quercus bicolor.	Swamp White Oak.
Cephalanthus occidentalis.	Button-bush.

During the spring this depression is filled with water to the depth of about eighteen inches. In the summer the water evaporates and the ground becomes hard and sun-baked. The mollusks

bury themselves in the mud-cracks, and hide under leaves and in crawfish chimneys. The old stumps in and about this area afford shelter for several species of land mollusks.

The following species of Mollusca were secured.

FLUVIATILE SPECIES.

Sphærium occidentale. Common.
Physa gyrina. Rare.
Lymnæa caperata. Rare.

LAND SPECIES.

Agriolimax campestris. Common.
Zonitoides arboreus. Common.
Strobilops virgo. Rare.

The following were associated with the land mollusks.

BEETLES.

Penthe obliquata; adult.
Meracantha contracta; adult.
Alobates pennsylvanicus; adult.
Anisodactylus baltimorensis; adult.
Scotobates calcaratus; adult.
Patrobus longicornis; adult.
Pterostichus scrutator; adult.
Alaus oculatus; larva.

ORTHOPTERA.

Ischnoptera sp. Cockroach (nymph).

CRUSTACEA.

Cambarus blandingi acutus. Crawfish.

Station XX.

A small pool east of Station XVIII, extending from the edge of the woods into the open field. The pool is shallow, irregular in shape and bordered by a few scattering trees from Station XVIII, among which the button-bush (*Cephalanthus occidentalis*) is conspicuous. It is dry in the summer and fall. *Physa gyrina* was the only animal observed, and this was very abundant.

Vertebrates in the Vicinity of Stations XVII–XX.

In the triangular piece of woodland, between the river and the open field, including within its borders Stations XVIII to XX, a number of vertebrate animals were observed.

REPTILIA.

A large garter-snake (*Eutænia sirtalis*) was observed nicely tucked away between a large piece of "started" bark and the stump of an old tree. It was discovered while pulling the bark away in a search for mollusks.

AVES.

Birds were very plentiful in this area, and were as noted below:

American Bittern.
Great Blue Heron.
Green Heron.
Cuckoo; nesting.
Flicker; nesting.
Crow; nesting.
Bronzed Grackle.
Red-winged Blackbird.
Blue Jay.
Cowbird.
Swamp Sparrow.
White-throated Sparrow.
Bobolink; nesting.
Chewink.
Catbird; nesting.
Wood Thrush.
Brown Thrasher; nesting.
Robin.
Bluebird.

C. EAST BRANCH OF THE CHICAGO RIVER.

(Stations XXI–XXIX.)

Station XXI.

(Plates XVII.,2, and XVIII.,1.)

As previously intimated, in the spring the river is quite wide and contains an abundance of water (Plate XVII.,2), but in the fall (Plate XVIII.,1) is reduced to a succession of elongated pools into

which the aquatic life crowds at this season of the year. The bottom of the river is composed of sticky blue clay. The whole area is much trodden by the feet of cattle.

The principal plant life of the river is as follows:

Polygonum pennsylvanicum	Pennsylvania Persicaria.
Polygonum hydropiperoides.	Mild Water-Pepper.
Iris versicolor.	Large Blue Flag.

The *Polygonum* forms large masses in the shallower portions of the river.

MOLLUSKS.

The molluscan fauna of the stream is quite varied, the mollusks being able to adapt themselves to the rigorous summer conditions, at which time they retreat to the small pools which are left in the deeper parts of the stream.

The appended list of species is large, considering the character of the habitat.

Lampsilis parva. Common.
Anodonta grandis. Common.
Anodontoides ferussacianus. Occasional.
Sphærium stamineum. Abundant.
Musculium transversum. Abundant.
Physa gyrina. Abundant.
Ancylus rivularis. Common.
Planorbis trivolvis. Abundant.
Planorbis parvus. Common.

The pelecypods thrive in the soft blue clay, the unionids in the deeper parts, the sphæriids along the shore in shallow water. *Ancylus rivularis* and *Planorbis parvus* live on the stems of rushes.

INSECTS.

The insect life of the river is apparently the same as that in the larger ponds and pools of the intermediate ridge. The following were observed:

Limnotrechus marginatus.	Water-strider.
Corixa interrupta.	Water-boatman.
Zaitha fluminea.	Water-bug.
Dineutes assimilis.	Water-beetle.
Notonecta undulata.	Back-swimmer.

VERTEBRATES.

The river vertebrates observed were as follows:

Rana pipiens.	Leopard-frog.
Chrysemys marginata.	Western Painted Tortoise.
Ameiurus melas.	Black Bullhead.

Station XXII.

In many places the river forms bayous of considerable depth, which are largely filled with *Iris versicolor*. This area, as well as certain portions of the flood-plain adjacent to the river, is subject to overflow. *Physa* and *Planorbis* are abundant in this habitat, and *Lymnæa parva sterkii* is common on the margin on leaves and sticks, or on the bare surface of the mud. It is seldom found in the water.

MOLLUSKS.

Physa gyrina.
Planorbis trivolvis.
Lymnæa parva sterkii.

Station XXIII.

Small streams running into river, on west bank. These streams start from springs in the higher ground and gradually enlarge until, in several cases, a stream has been formed two or three feet in width. That there is frequently a large volume of water is shown by the depth to which the stream has cut, forming a miniature valley, and cutting away a large portion of the surrounding area. In the summer and fall these streams completely dry up. The banks on the west side of the river are more heavily wooded, thereby holding the water and storing it up in springs.

Physa gyrina was the only mollusk found in these streams.

Station XXIV.

(Plate XIX.)

The flood-plain between the river and the terrace-like banks. The ground is low and level, and subject more or less to overflow from the river during high water. The vegetation is made up of two main plant societies—(1) the trees which have descended from the terraced banks and (2) the more natural semiaquatic vegetation. The notable species of each group are as follows.

Vegetation characteristic of wet and swampy localities:

Cephalanthus occidentalis.	Button-bush.
Iris versicolor.	Large Blue Flag.
Verbena hastata.	Blue Vervain.
Lobelia cardinalis.	Cardinal Flower.
Penthorum sedoides.	Ditch Stonecrop.

Trees encroaching from higher ground:

Carya ovata.	Hazelnut.
Populus tremuloides.	American Aspen.
Ulmus americana.	American Elm.
Quercus bicolor.	Swamp White Oak.
Cratægus punctata.	Large-fruited Thorn.
Acer saccharum.	Sugar or Rock Maple.

Beneath decaying logs and under "started" bark, in depressions in the bark, in rotting stumps and in crevices, the smaller land mollusks, as well as insects, are more or less abundant.

MOLLUSKS.

Agriolimax campestris.	Common.
Zonitoides arboreus.	Common.
Vitrea indentata.	Rare.

INSECTS.

BEETLES.

Ceruchus piceus.	Adult.
Alaus oculatus.	Larva.

ORTHOPTERA.

Ischnoptera intricata.	Adult.

LOWER VERTEBRATES.

Amblystoma jeffersonianum.	Jefferson's Salamander.
Rana pipiens.	Leopard-frog.

BIRDS.

The avian life was abundant, the following species being noted:

American Bittern.
Great Blue Heron.
Green Heron; nesting.
American Osprey.

Belted Kingfisher.
Yellow-billed Cuckoo.
Hairy Woodpecker; nesting.
Northern Flicker.
Nighthawk.
Long-billed Marsh Wren.
Blue Jay.
American Crow; nesting.
Red-winged Blackbird.
Swamp Sparrow.
Phœbe.
Song Sparrow.
Yellow Warbler.
Northern Yellow-throat.
Catbird.

Station XXV.

A small depression about eight feet in diameter, a few feet fron the river, north of the Glencoe road. In the spring this spot i filled with water which overflows into the river, but in the summe and fall it becomes perfectly dry. It is bordered on the one side near the road, by a number of *Cratægus* bushes (*C. punctata*), an on the other side by an open field.

It is noteworthy that the mollusks are the same as those in th smaller summer-dry ponds mentioned previously. The *Lymnæa* i not found in the river. The *Lymnæa* is the most abundant, th *Physa* being represented by only a few individuals.

Physa gyrina.
Lymnæa caperata.

Station XXVI.

(Plate XX.)

A rather large area (several acres) of virgin forest, situate north of the Glencoe road and west of the middle branch of th river. The vegetation consists of the following trees, which are o large size:

Quercus bicolor.	Swamp White Oak.
Ulmus americana.	American Elm.
Carya ovata.	Shellbark Hickory.
Corylus americana.	Hazelnut.
Tilia americana.	Basswood.
Cratægus punctata.	Large-fruited Thorn.

Beneath the trees the vegetation consists of bushes and ground plants, among which the following are conspicuous:

Sium cicutæfolium.	Hemlock Water-Parsnip.
Rudbeckia laciniata.	Green-headed Coneflower.
Cicuta maculata.	Water Hemlock.
Campanula americana.	Tall Bellflower.
Trillium sp.	Wake-robin.
Arisæma triphyllum.	Jack-in-the-pulpit.
Viola palmata.	Early Blue Violet.

A small brook flows through this forest, and empties into the East Branch of the Chicago River. The banks of the brook are low, from six inches to a foot above the water, and are thickly lined with low-growing plants and flowers.

Lymnæa caperata is apparently the only mollusk which inhabits this brook.

Station XXVII.

Small pools in depressions caused by heavy rains. These pools overflow into the brook mentioned under Station XXVI. The only life observed in these pools was a mollusk (*Aplexa hypnorum*) and a leech. The mollusks were observed crawling over the dead leaves on the bottom of the pool or swimming, shell downward, on the surface of the water. The leech was found on the surface of the leaves.

Station XXVIII.

(Plate XXI.)

The whole area of Station XXVI is covered with old stumps and logs, all half rotten, with the bark "started" and on many logs partly peeled off. There is also an abundance of the usual forest debris of small sticks, leaf mold, fallen trees, etc. In the spring these half-decayed relics are partly hidden by the long grass, vines and flowers which abound in this area. The logs and stumps are further ornamented by huge fungus growths. Life is very abundant in this station. The following species were noted.

MOLLUSKS.

Pyramidula alternata.	Found under old logs and crawling over the surface of the ground.
Polygyra thyroides.	

Succinea avara.	On old logs, sticks, etc., above the water.
Vitrea hammonis.	On old logs, in crevices and under "started" bark; also in moss.
Vitrea indentata.	
Helicodiscus parallelus.	
Vertigo ovata.	
Carychium exile.	
Zonitoides arboreus.	
Euconulus fulvus.	On rather dry bark on ground.
Agriolimax campestris.	On wet bark and leaves; in dry weather under "started" bark and under logs.

INSECTS.

Insects were not abundant in species, but individuals were numerous of the few species observed. These were secured under bark of rotting logs.

BEETLES.

Penthe obliquata. Adult.
Copris anaglypticus. Adult.
Elater sp. Larva.

MYRIAPODA.

Lithobius sp. Centipede.

BIRDS.

The following summer-resident birds were observed at this station:

American Woodcock.	Nesting.
Red-shouldered Hawk.	Nesting.
American Sparrow Hawk.	Nesting.
Screech Owl.	Nesting.
Yellow-billed Cuckoo.	Nesting.
Downy Woodpecker.	
Northern Flicker.	
Nighthawk.	
Crested Flycatcher.	
Wood Pewee.	
Phœbe.	
Blue Jay.	
American Crow.	
Cowbird.	
American Goldfinch.	

Song Sparrow.
Rose-breasted Grosbeak.
Indigo Bird.
Scarlet Tanager.
Tree Swallow.
Red-eyed Vireo.
Cerulean Warbler.
Ovenbird.
Yellow-breasted Chat.
American Redstart.
Catbird.
Brown Thrasher. Nesting.
White-breasted Nuthatch.
Chickadee.
Wood Thrush.
American Robin.

Station XXIX.

A wide ditch beside road near Station XXVII. The water was stagnant and the animal life consisted of one mollusk (*Physa gyrina*) and a leopard-frog (*Rana pipiens*).

D. GLENWOOD BEACH RIDGE.

(Stations XXX–XXXIV.)

Station XXX.

Heavy woods on west bank of East Branch of the Chicago River. The surface rises somewhat abruptly at first and then becomes level. The area is rather heavily timbered and the ground is covered with a large amount of forest debris. In the early spring the ground is almost carpeted with flowers such as the early blue violet (*Viola palmata*).

The principal forest trees are as follows:

Quercus bicolor.	Swamp White Oak.
Ulmus americana.	American Elm.
Carya ovata.	Shellbark Hickory.
Ostrya virginiana.	Hop Hornbeam.
Populus tremuloides.	American Aspen.
Acer saccharum.	Sugar or Rock Maple.

The following mollusks were observed:

Philomycus carolinensis. Common.
Polygyra albolabris. Rare.
Polygyra thyroides. Common.
Zonitoides arboreus. Common.
Vitrea hammonis. Common.
Helicodiscus parallelus. Rare.

Philomycus lives under large logs, as do also the Polygyras. The small helices are abundant under "started" bark. All of the *Polygyra thyroides* were dentate.

VERTEBRATES.

Avian life was very abundant in this station and the following species were noted:

Red-shouldered Hawk.	Nesting.
Screech Owl.	
Yellow-billed Cuckoo.	Nesting.
Red-headed Woodpecker.	
Northern Flicker.	
Nighthawk.	
Crested Flycatcher.	
Wood Pewee.	
Blue Jay.	
American Crow.	Nesting.
Cowbird.	
American Goldfinch.	Nesting.
Indigo Bunting.	Nesting.
Towhee.	
Rose-breasted Grosbeak.	
Scarlet Tanager.	
Chipping Sparrow.	
Yellow Warbler.	Nesting.
Ovenbird.	
Catbird.	Nesting.
Wood Thrush.	Nesting.
Brown Thrasher.	Nesting.
American Robin.	Nesting.

Station XXXI.

A small pool about a quarter of a mile from the river, and apparently the head of one of the streams flowing into the river in the spring. The small depression is choked up with dead leaves in the

summer and fall. Under these leaves *Aplexa hypnorum* is very abundant. The bordering vegetation is the same as that surrounding the pools mentioned under Station XXXII.

The following mollusks were observed:

Aplexa hypnorum. Common.
Succinea avara. Rare.

Station XXXII.

(Plates XXII., XXIII., and XXIV.,1.)

A pond about three hundred by one hundred feet, situated on the edge of a rather dense forest of American elm, shellbark hickory and swamp white oak trees. The pond is bordered on the north by the heavy forest, on the east by the open forest, on the west by a steep ridge and on the south by an open field. Unlike the ponds previously considered, the aquatic vegetation is scant and confined to a few scattering Iris at the north end. The bottom of the pond is composed of sticky blue clay. The pond is very interesting, lying, as it does, at the very base of the steep ridge and differing so markedly from the other ponds of this region in the almost total absence of cattails (*Typha*) and other reeds. Plate XXII. shows its location at the base of the ridge and Plate XXIV., 1, shows its condition in September after a prolonged period of drouth. In the early spring, the water extends to the trunks of the trees, as shown in Plate XXIII., which was, however, photographed in September, 1909. Comparison between this plate and Plate XXIV., 1, will illustrate the effect of a dry and a wet season on the ponds and pools in this area.

Only a few species of mollusks were observed in the pond.

At the north end, under wet leaves, in a low area subject to inundation, *Ancylus parallelus* was found in considerable numbers attached to the under surface of the dead leaves.

The following species of trees were noted about the pond:

Carya ovata.	Shellbark Hickory.
Populus tremuloides.	American Aspen.
Quercus bicolor.	Swamp White Oak.
Quercus rubra.	Red Oak.
Ulmus americana.	American Elm.
Tilia americana.	American Basswood.
Acer saccharum.	Rock Maple.
Salix longifolia.	River-bank Willow (in pond).

Vegetation at the north end:

Iris versicolor.	Great Blue Flag.
Cephalanthus occidentalis.	Button-bush.

MOLLUSKS.

Musculium partumeium. Common.
Planorbis trivolvis. Common.
Ancylus parallelus. Common.
Segmentina armigera. Common.

INSECTS IN POND.

Hydroporus undulatus.	Water-beetle.
Graphoderes liberus.	Water-beetle.

LOWER VERTEBRATES.

The only aquatic vertebrate seen was the Western Painted Tortoise (*Chrysemys marginata*), which was very abundant.

AVES.

The following birds were observed about the pond.

Green Heron.
Kingfisher.
Red-headed Woodpecker.
Flicker.
Crow.

Station XXXIII.

A large area in the woods, about four hundred feet north of Station XXXII, subject to periodic inundation. The area covered, appears to be two hundred feet long and thirty or more feet wide. The forest is quite dense, and is composed of the same kinds of trees as those recorded for Station XXXII. The wet area is sparsely covered with tall grass and reeds and other water-loving plants.

Among others, the following are conspicuous:

Iris versicolor.	Large Blue Flag.
Cephalanthus occidentalis.	Button-bush.
Sparganium eurycarpum.	Broad-fruited Bur-Reed.

The mollusks noted below were observed:

Planorbis trivolvis. Rare.
Succinea avara. Common.
Polygyra albolabris. A few observed under logs.

The absence of *Lymnæa caperata* as well as of *Sphærium occidentale* and *Musculium* is noteworthy.

Station XXXIV.

(Plate XXIV., 2.)

Open fields and meadows north of the Shermerville road and west of the East Branch of the Chicago River, on rather high ground. The fields are allowed to grow grass for hay. The meadow clover (*Trifolium pratense*) is the most conspicuous plant, with the addition of the buttercup (*Ranunculus acris*) in the spring. In many places in these fields and meadows there is an abundance of old pieces of wood, small pieces of board fences, rotting stumps and other debris, under which the smaller land mollusks abound.

This station yielded the following species.

MOLLUSKS.

Agriolimax campestris.
Bifidaria contracta.
Bifidaria pentodon.
Euconulus fulvus.
Strobilops virgo.
Zonitoides arboreus.

Several species of beetles and a myriapod were found associated with the mollusks, as follows.

BEETLES.

Coccinella 9-notata.
Platynus punctiformis.
Euphoria inda.

MYRIAPODA.

Lithobius sp. Centipede.

BIRDS.

The birds noted below were observed in and about the fields:

Red-headed Woodpecker.
Northern Flicker.
Chimney Swift.
Kingbird.
Blue Jay.

Bobolink; nesting.
Meadowlark; nesting.
Bronzed Grackle.
Field Sparrow; nesting.
Song Sparrow.
Barn Swallow.
Brown Thrasher; nesting in *Cratægus* bush near road.
American Robin.

E. NORTH BRANCH OF THE CHICAGO RIVER.

(Stations XXXV, XXXVI.)

Station XXXV.

Swampy, ditch-like overflow (from the river) on east side of railroad embankment, north of Shermerville. The water is shallow and stagnant for the most part. *Iris versicolor* was the conspicuous plant.

Three species of mollusks were abundant:

Physa gyrina.
Planorbis trivolvis.
Lymnæa caperata.

Station XXXVI.

(Plate XVIII.,2.)

The river. No opportunity presented itself for examining the bed of this river for pelecypods. It is used for sewage purposes, and is, therefore, a difficult stream to study.

Two species of fresh-water pulmonates were observed in abundance:

Physa gyrina.
Planorbis trivolvis.

Summary.

A study of the two appended tables reveals some interesting facts. In Table I (terrestrial species), Station XXVIII yields the largest number of species (11), and Station V follows with eight species. These habitats are the heavy woods where there is an abundance of forest debris. The Succineas are present in the majority of stations, *retusa* and *avara* being most frequently seen. The

small zonitoids, the pupoids and *Philomycus* seem to be the least widely distributed in this limited area. The last was observed in but one habitat.

The typical molluscan societies and their habitat relations may be summed up as follows.

In swamp with *Typha* or *Iris*.

Succinea retusa, *Succinea avara*, *Agriolimax campestris*.

On low ground subject to overflow.

Agriolimax campestris, *Polygyra thyroides*, *Polygyra fraterna*, *Pyramidula alternata*, *Zonitoides arboreus*, *Vitrea hammonis*.

On higher grounds, raised above overflow.

Succinea ovalis, *Agriolimax campestris*, *Polygyra albolabris*, *Philomycus carolinensis*.

On dry ground.

Strobilops virgo, *Helicodiscus parallelus*, *Vitrea indentata*, *Euconulus fulvus*, *Bifidaria contracta*, *B. pentodon*.

Living under "started" bark, etc.

Zonitoides, *Vitrea*, *Strobilops*, *Helicodiscus*, *Vertigo*, *Euconulus*, *Bifidaria* and *Carychium*. *Pyramidula* is frequently found under "started" bark, and *Polygyra albolabris* haunts holes and large crevices in dry weather.

Table II (fluviatile species) is also of interest. Station XXI, the East Branch of the Chicago River, yields nine species. The highest number of species from any other habitat is seven, which number was observed in Stations IV and XI. Both are summer-dry ponds. *Physa gyrina* is the most abundant species, occurring in all but six of the fluviatile habitats. The naiads are the least abundant, occurring only in the East Branch of the Chicago River.

The habitat relations of the molluscan societies may be summarized as follows.

Found in all varieties of habitat.

Physa gyrina.

In large summer-dry ponds.

Physa gyrina, *Planorbis trivolvis*, *Planorbis parvus*, *Planorbis exacuous*, *Segmentina armigera*, *Musculium partumeium*, *Ancylus parallelus*, *Lymnæa reflexa*.

In small pools of very transient character.

Lymnæa caperata, *Aplexa hypnorum*, *Sphærium occidentale*.

In the river, which does not run dry.

Sphærium stamineum, *Musculium transversum*, *Lampsilis*, *Anodonta*, *Anodontoides*, *Physa gyrina*, *Planorbis trivolvis*, *Ancylus rivularis*.

Semiaquatic; on the edges of river and pools.

Lymnæa parva sterkii.

In brooks and overflow from river.

Lymnæa caperata.

TABLE I. Terrestrial Species.

	STATION NUMBER																			
	II	III	IV	V	VII	VIII	IX	X	XII	XIV	XV	XVI	XVII	XIX	XXIV	XXVIII	XXX	XXXI	XXXIII	XXXIV
Carychium exile																*				
Vertigo ovata																*				
Bifidaria contracta																				*
Bifidaria pentodon																				*
Strobilops virgo														*						*
Succinea avara	*	*	*	*		*			*		*	*				*		*	*	
Succinea retusa	*	*	*		*		*	*	*	*										
Succinea ovalis						*			*											
Succinea ovalis optima				*																
Philomycus carolinensis																	*			
Pyramidula alternata				*		*										*				
Helicodiscus parallelus																*	*			
Agriolimax campestris	*					*	*						*	*	*	*				*
Zonitoides arboreus				*		*								*	*	*	*			*
Euconulus fulvus																*				*
Vitrea hammonis				*												*	*			
Vitrea indentata															*	*				
Polygyra albolabris				*		*											*		*	
Polygyra thyroides				*					*							*	*			
Polygyra fraterna				*		*			*											
Total of Species	3	2	2	8	1	7	2	1	5	1	1	1	1	3	3	11	6	1	2	6

TABLE II. FLUVIATILE SPECIES.

	STATION NUMBER																														
	I	II	III	IV	VI	VII	IX	X	XI	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	XXII	XXIII	XXV	XXVI	XXVII	XXIX	XXXI	XXXII	XXXIII	XXXV	XXXVI
Physa gyrina	*	*	*	*	*	*	*	*	*		*	*	*		*	*	*	*	*	*	*			*				*	*
Aplexa hypnorum				*					*	*		*											*		*				
Planorbis trivolvis	*		*		*	*	*											*	*							*	*	*	*
Planorbis parvus				*														*											
Planorbis exacuous										*			*																
Segmentina armigera	*		*	*		*	*	*	*		*		*													*			
Lymnæa reflexa	*	*	*			*	*		*		*		*		*														
Lymnæa caperata				*					*	*		*				*					*	*						*	
Lymnæa parva sterkii				*															*										
Musculium partumeium	*		*			*	*	*	*				*													*			
Musculium transversum																		*											
Sphærium occidentale				*			*		*	*		*	*	*		*													
Sphærium stamineum																		*											
Lampsilis parva																		*											
Anodonta grandis																		*											
Anodontoides ferussacianus																		*											
Ancylus parallelus																										*			
Ancylus rivularis																		*											
Total of Species	5	2	5	7	2	5	6	3	7	4	3	4	6	1	2	3	1	9	3	1	2	1	1	1	1	4	1	3	2

	STATION NUMBER																														
	XXXVII	XXXIX	XXXXI	XXXXII	XXXXIII	XXXXV	XXXXVI	XXXXVII	XXXXVIII	XXXXIX	L	LI	LII	LIII	LIV	LV	LVI	LVII	LVIII	LIX	LX	LXI	LXII	LXIII	LXIV	LXV	LXVI	LXVII	LXVIII	LXIX	LXXI
Physa gyrina		*				*	*			*																					
Aplexa hypnorum			*																												
Planorbis trivolvis				*	*	*	*																								
Planorbis parvus																															
Planorbis exacuous																															
Segmentina armigera				*																											
Lymnæa reflexa																															
Lymnæa caperata						*																									
Lymnæa parva sterkii																															
Musculium partumeium				*																											
Musculium transversum																															
Sphærium occidentale																															
Sphærium stamineum																															
Lampsilis parva																															
Anodonta grandis																															
Anodontoides ferussacianus																															
Ancylus parallelus																															
Ancylus rivularis																															
Total of Species	1	2	1	2	1	3	2	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Taxonomy.

It has been urged by some taxonomists that the ecological study of nature has no bearing upon the subject of taxonomy, and that little, if any, aid can be secured from this subject in unraveling the mysteries of specific differences. This opinion, however, does not appear to be based on the facts which have been gathered from this source. On the contrary, the study of ecology has proven an aid of great value in drawing specific and varietal lines and in ascertaining the true character and value of taxonomic characters; and it is quite logical that this should be the case, because the environment reacts upon the organism, causing the latter to be modified to fit the environmental conditions. This is especially true of fresh-water mollusks, which respond to every change of habitat.

Two interesting facts bearing upon the taxonomy of the fresh-water pulmonates have been discovered during the field work in connection with the present study. In 1821 Thomas Say described a large, long-spired *Physa* as *Physa gyrina* (Pl. XXV, Fig. 9–13). In 1866, G. W. Tryon described a small, short-spired *Physa* as *Physa oleacea* (Pl. XXV, Fig. 14–17). It was noted as the field work progressed, that these two species were always associated, and the fact soon became apparent that one was but the immature stage of the other, or, in other words, that *oleacea* was the half-grown shell of *gyrina*. To confirm this theory, a large *gyrina* was broken down until it became a perfect *oleacea*. *Gyrina* has five whorls, while *oleacea* has a trifle more than four. The evidence seems conclusive.

A *Lymnæa* attaining the size of an inch or more, lives in the intermittent or summer-dry ponds. It has been called both *Lymnæa palustris* and *Lymnæa reflexa*. It differs from *palustris* in having a narrower shell, and it is notable for developing within the outer lip a heavy rib or varix. It also appears to live exclusively in this type of habitat, the heavy varices being caused by the periodic formation of an epiphragm during the time when the pond is dry. As many as three of these may be found in a year. This habitat indicates that the age of the Lymnæas (as well as of certain Physas which inhabit such an environment) can not be ascertained by the number of these varices on the shell. These varices have been observed in a young shell six or seven millimeters in length, and as many as six of them have been counted on a shell thirty millimeters in length. It is believed that the formation of these varices is due to

the exigencies of the habitat. The following interesting conclusion has gradually been reached as the studies on these Lymnæas progressed: the smallest, narrow forms with acute spire are *Lymnæa palustris michiganensis* Walker (Pl. XXV; Fig. 8); the larger form with more rounded whorls is *Lymnæa reflexa crystalensis* Baker (Pl. XXV, Fig. 2–3); and the fully mature form is *Lymnæa reflexa* Say (Pl. XXV, Fig. 1). In this instance a study of the ecological relations of the Mollusca in the area in question has shown the relationship of these three forms,—a relation which probably would not be discovered from a few isolated specimens in the study. It is also probable that Pilsbry's *Succinea ovalis optima* is the old or senile stage of *ovalis* (see Pl. XXV, Fig. 18–20).

To aid those ecologists who are not intimately acquainted with the mollusks and who may desire to use this class of animals in their field work, a systematic catalog of the Mollusca of the area is appended. Descriptions and figures of the majority of the species of mollusks which live in northeastern Illinois will be found in the writer's monograph of the "Mollusks of the Chicago Area,"* and a reference to plate and figure in that work is made for most of the species herein recorded.

This catalog includes two classes, three orders, fourteen families, twenty-three genera and thirty-eight species and varieties, all living within an area three miles long and one half mile wide.

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* Bull. Nat. Hist. Surv. Chi. Acad. Sci., No. III.

SYSTEMATIC CATALOG OF THE MOLLUSCA.

Class PELECYPODA.

Order PRIONODESMACEA.

Superfamily Naiadacea.

Family UNIONIDÆ.

Genus Lampsilis Rafinesque.

Lampsilis parva (Barnes). Moll. Chi. Area, Pl. XIII, Fig. 3, Station XXI.

Genus Anodonta (Bruguière) Lamarck.

Anodonta grandis Say. Moll. Chi. Area, Pl. II.
Station XXI. The shells of *grandis* are unusually thick and solid and of a rich greenish-brown color.

Genus Anodontoides Simpson.

Anodontoides ferussacianus (Lea). Moll. Chi. Area, Pl. V, Fig. 2.
Station XXI.

Order TELEODESMACEA.

Superfamily Cyrenacea.

Family SPHÆRIIDÆ.

Genus Sphærium Scopoli.

Sphærium stamineum Conrad. Moll. Chi. Area, Pl. XXVII, Fig. 1.
Station XXI.

Sphærium occidentale Prime. Moll. Chi. Area, Pl. XXVII, Fig. 10.
Stations IV, IX, XI, XIII, XV, XVI, XVII, XIX. *Occidentale* is almost always, at least in the area under consideration, an inhabitant of transient pools and ditches.

Genus Musculium Link.

Musculium partumeium (Say). Moll. Chi. Area, Pl. XXVII, Fig. 6.
Stations I, III, VII, IX, X, XI, XVI, XXXII. The young of *partumeium* somewhat resemble immature *Musculium truncatum*. This species (*partumeium*) is quite characteristic of the summer-dry pools of northern Illinois.

Musculium transversum (Linsley). Moll. Chi. Area, Pl. XXVII, Fig. 5.
Station XXI. *Transversum* is characteristic of the rivers, which do not entirely dry up in the summer. It is never found, in this area in the summer-dry ponds.

Class GASTROPODA.

Subclass Euthyneura.

Order PULMONATA.

Suborder BASOMMATOPHORA.

Superfamily Hygrophila.

Family PHYSIDÆ.

Genus Physa Draparnaud.

Physa gyrina Say. Pl. XXV, Fig. 9–17.
Stations I, II, III, IV, VI, VII, IX, X, XI, XIV, XV, XVI, XVIII, XIX, XX, XXI, XXII, XXIII, XXV, XXIX, XXXV, XXXVI. *Physa gyrina* is characteristic of nearly all the aquatic habitats of the area. A study of the material, collected at different seasons, between April and November, shows that two species have been founded on age variation. The smaller forms (Pl. XXV, Fig. 14–17) are Tryon's *oleacea* and are immature. The larger forms (Pl. XXV, Fig. 9–13) are mature and represent Say's *gyrina*. The figures illustrate well the degree of elongation of the spire as the shell matures. The two forms were always found associated together. This discovery illustrates the value of ecological studies.

Genus Aplexa Fleming.

Aplexa hypnorum (Linné). Moll. Chi. Area, Pl. XXXII, Fig. 16.
Stations IV, XI, XIII, XV, XXVII, XXXI. *Hypnorum* is usually found in transient ponds or pools, associated with *Lymnæa caperata* and *Sphærium occidentale*.

Family LYMNÆIDÆ.

Subfamily LYMNÆINÆ.

Genus Lymnæa Lamarck.

Subgenus *Galba* Schrank.

Lymnæa caperata Say. Moll. Chi. Area, Pl. XXX, Fig. 18.
Stations IV, XI, XIII, XV, XIX, XXV, XXVI, XXXV.

Lymnæa parva sterkii Baker. Pl. XXV, Fig. 21.
Stations IV, XXII.

Subgenus *Stagnicola* Leach.

Lymnæa reflexa Say. Pl. XXV, Fig. 1–8.
Stations I, II, III, VII, IX, XI, XIV, XVI, XVIII. The study of this species has revealed some very interesting results. Three forms of

Lymnæas have been described which at first sight appear quite distinct. These are *Lymnæa reflexa* Say, *Lymnæa reflexa crystalensis* Baker, and *Lymnæa palustris michiganensis* Walker. The summer-dry ponds studied yield all three forms, and it is at once apparent that they represent age variation only, *michiganensis* being quite immature (figures 7–8), *crystalensis* being three-quarters grown (figures 2–3), and *reflexa* representing the fully mature mollusk (figure 1). The Oregon and Washington forms cited by Walker (Nautilus, VI, p. 33) are probably the young of *Lymnæa proxima rowellii*, with which *reflexa* has been confused by western conchologists. The figures on the plate indicate the age variation.

Family PLANORBIDÆ.

Genus PLANORBIS Müller.

Subgenus *Helisoma* Swainson.

Planorbis trivolvis Say. Moll. Chi. Area, Pl. XXXII, Fig. 7–10.
Stations I, III, VI, VII, IX, XXI, XXII, XXXII, XXXIII, XXXV, XXXVI.

Subgenus *Hippeutis* Agassiz.

Planorbis exacuous Say. Moll. Chi. Area, Pl. XXVI, Fig. 5.
Stations XIII, XVI.

Subgenus *Gyraulus* Agassiz.

Planorbis parvus Say. Moll. Chi. Area, Pl. XXVI, Fig. 7.
Stations IV, XXI.

Genus SEGMENTINA Fleming.

Subgenus *Planorbula* Haldeman.

Segmentina armigera (Say). Moll. Chi. Area, Pl. XXX, Fig. 32.
Stations I, III, IV, VII, IX, X, XI, XIV, XVI, XXXII.

Family ANCYLIDÆ.

Genus ANCYLUS Geoffroy.

Subgenus *Ferrissia* Walker.

Ancylus rivularis Say. Moll. Chi. Area, Pl. XXX, Fig. 29.
Station XXI.
Ancylus parallelus Haldeman. Pl. XXV, Fig. 22.
Station XXXII.

Superfamily Akteophila.

Family AURICULIDÆ.

Genus Carychium Müller.

Carychium exile H. C. Lea. Moll. Chi. Area, Pl. XXVI, Fig. 4.
Station XXVIII.

Suborder STYLOMMATOPHORA.

MONOTREMATA.

ORTHURETHRA.

Family PUPILLIDÆ.

Genus Vertigo Draparnaud.

Vertigo ovata Say. Moll. Chi. Area, Pl. XXX, Fig. 13.
Station XXVIII.

Genus Bifidaria Sterki.

Bifidaria contracta (Say). Moll. Chi. Area, Pl. XXX, Fig. 8.
Station XXXIV.

Bifidaria pentodon (Say). Moll. Chi. Area, Pl. XXX, Fig. 12.
Station XXXIV.

Genus Strobilops Pilsbry.

Strobilops virgo (Pilsbry). Pl. XXV, Fig. 23.
Stations XIX, XXXIV.

HETERURETHRA.

Superfamily Elasmognatha.

Family SUCCINEIDÆ.

Genus Succinea Draparnaud.

Succinea avara Say. Moll. Chi. Area, Pl. XXX, Fig. 25.
Stations II, III, IV, V, VIII, XII, XV, XVI, XXVIII, XXXI, XXXIII.

Succinea retusa Lea. Moll. Chi. Area, Pl. XXX, Fig. 24.
Stations II, III, IV, VII, IX, X, XII, XIV.

Succinea ovalis Say. Moll. Chi. Area, Pl. XXX, Fig. 22.
Stations VIII, XII. Quite typical, with broad aperture and greenish colored epidermis.

Succinea ovalis optima Pilsbry. Pl. XXV, Fig. 18–20.
Station V. The large form so abundant in Station V, appears to be Pilsbry's *optima*, the large individuals of which are quite characteristic; the smaller specimens approach very closely to typical *ovalis*, having the peculiar greenish color. Specimens from this region would seem to indicate that *optima* is the senile stage of *ovalis*.

SIGMURETHRA.

Superfamily AULACOPODA.

Family PHILOMYCIDÆ.

Genus PHILOMYCUS (Rafinesque) Ferussac.

Philomycus carolinensis (Bosc.). Moll. Chi. Area, Pl. XXX, Fig. 1.
Station XXX.

Family ENDODONTIDÆ.

Subfamily ENDODONTINÆ.

Genus PYRAMIDULA Fitzinger.

Subgenus *Patula* Haldeman.

Pyramidula alternata (Say). Moll. Chi. Area, Pl. XXVIII, Fig. 23–24.
Stations V, VIII, XXVIII.

Genus HELICODISCUS Morse.

Helicodiscus parallelus (Say). Moll. Chi. Area, Pl. XXVIII, Fig. 25.
Stations XXVIII, XXX.

Family LIMACIDÆ.

Genus AGRIOLIMAX Mörch.

Agriolimax campestris (Say). Moll. Chi. Area, Pl. XXVIII, Fig. 13.
Stations II, VIII, IX, XVIII, XIX, XXIV, XXVIII, XXXIV.

Family ZONITIDÆ.

Subfamily ARIOPHANTINÆ.

Genus ZONITOIDES Lehmann.

Zonitoides arboreus (Say). Moll. Chi. Area, Pl. XXVIII, Fig. 9.
Stations V, VIII, XIX, XXIV, XXVIII, XXX, XXXIV.

Subfamily ZONITINÆ.

Genus EUCONULUS Reinhardt.

Euconulus fulvus (Müller). Moll. Chi. Area, Pl. XXVIII, Fig. 17. Stations XXVIII, XXXIV.

Genus VITREA Fitzinger.

Vitrea hammonis (Ström). Moll. Chi. Area, Pl. XXVIII, Fig. 10. Stations V, XXVIII, XXX.

Vitrea indentata (Say). Moll. Chi. Area, Pl. XXVIII, Fig. 11. Stations XXIV, XXVIII.

Superfamily HOLOPODA.

Family HELICIDÆ.

Subfamily POLYGYRINÆ.

Genus POLYGYRA (Say) Pilsbry.

Section *Triodopsis* Rafinesque.

Polygyra albolabris (Say). Moll. Chi. Area, Pl. XXIX, Fig. 6 Stations V, VIII, XXX, XXXIII.

Polygyra thyroides (Say). Moll. Chi. Area, Pl. XXIX, Fig. 2. Stations V, XII, XXVIII, XXX. About half of the adult specimens have the parietal tooth more or less developed.

Section *Stenotrema* Rafinesque.

Polygyra fraterna (Say). Moll. Chi. Area, Pl. XXX, Fig. 3. Stations V, VIII, XII. *Fraterna* exhibits two quite distinct forms: one is small and quite umbilicated; the other is larger and either imperforate or only slightly umbilicated. The umbilicated form is larger than *Polygyra monodon* (Rackett). The two forms live in the same area and intergrade more or less completely.

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Plate VI.

Skokie stream showing characteristic vegetation, consisting of *Salix longifolia*, *Typha latifolia* and *Sagittaria latifolia*. Station I. Photograph taken September 10, 1909. (Baker.)

General view of Skokie Marsh, showing the "islands." Looking southeast. Station II. Photograph taken September 10, 1909. (Baker.)

Plate VIII.

Fig. 1. Nearer view of the "islands" showing conspicuous vegetation, *Typha latifolia* and *Calamagrostis canadensis* surrounding the "islands." Photograph taken September 5, 1908. (Woodruff.)

Fig. 2. In Skokie Marsh, showing height of bluejoint grass, *Calamagrostis canadensis.* Photograph taken September 5, 1908. (Woodruff.)

Plate IX.

Wooded area on west edge of Skokie Marsh, showing pond-like area in center occupied by *Typha latifolia*. Stations III–V. Photograph taken September 5, 1908. (Woodruff.)

Large marshy pond west of Northwestern Railroad cut-off and south of the Glencoe Road. Station VII. The characteristic vegetation is *Iris versicolor* and *Typha latifolia*. The forest is seen in the background. View looking south. Photograph taken September 10, 1909. (Baker.)

Plate XI.

A nearer view of the pond shown in Plate X. The heavy central growth of *Typha* is conspicuous. Photograph taken September 10, 1909. (Baker.)

Plate XII.

Fig. 1. The same pond (Pl. X.) from the east, looking west. The heavy growth of *Iris* is noteworthy. Photograph taken September 5, 1908. (Woodruff.)

Fig. 2. Nearer view of the pond shown in Plate XIII., showing heavy growth of *Typha latifolia* which had been cut by the farmer when that picture was taken. Photograph taken September 5, 1908. (Woodruff.)

Small pond west of Northwestern Railroad cut-off, north of open field. Station XIV. The vegetation is principally *Typha*, *Iris* and *Cephalanthus*. View looking north. Photograph taken September 10, 1909. (Baker.)

Open area in forest near Station XIV. The ground is covered with leaves, under which such molluscan species as *Lymnæa caperata*, *Aplexa hypnorum* and *Sphærium occidentale* may be found. Photograph taken September 5, 1908. (Woodruff.)

Plate XV.

Plate XVI.

Small pond in woods bordering east bank of East Branch of the Chicago River. Station XVIII. The prominent vegetation is *Cephalanthus occidentalis*. Photograph taken September 10, 1909. (Baker.)

Plate XVII.

Fig. 1. Station XVIII. Photograph taken September 5, 1908. A comparison of this figure with the previous plate will illustrate the difference in rainfall in 1908 and 1909. When the photograph was taken the bottom of the pond was dry and sun-baked. (Woodruff.)

Fig. 2. East Branch of the Chicago River, looking south from Glencoe road. Photograph taken May 18, 1908. Note the width of the river. (Woodruff.)

Plate XVIII.

Fig. 1. East Branch of the Chicago River, looking north from flood-plain. Photograph taken September 5, 1908. Compare the river bed with Plate XVII, 2. These two plates well illustrate spring and fall conditions in this area. (Woodruff.)

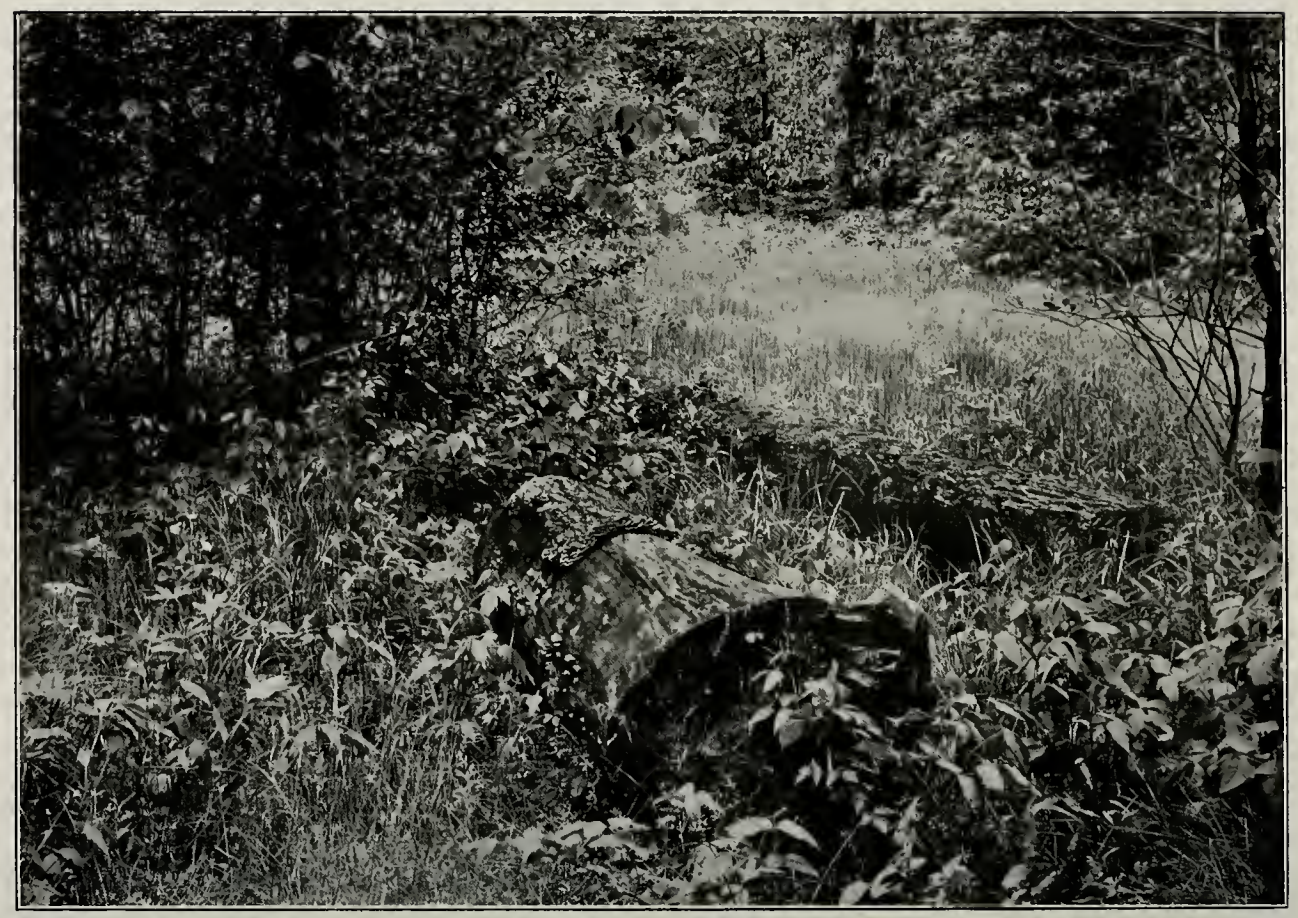
Fig. 2. North Branch of the Chicago River, looking north from Shermerville. Photograph taken at high-water stage. May 18, 1908. (Woodruff.)

Plate XIX.

Flood-plain, East Branch of the Chicago River, looking north. The characteristic vegetation is *Iris versicolor*. Photograph taken May 18, 1908. (Woodruff.)

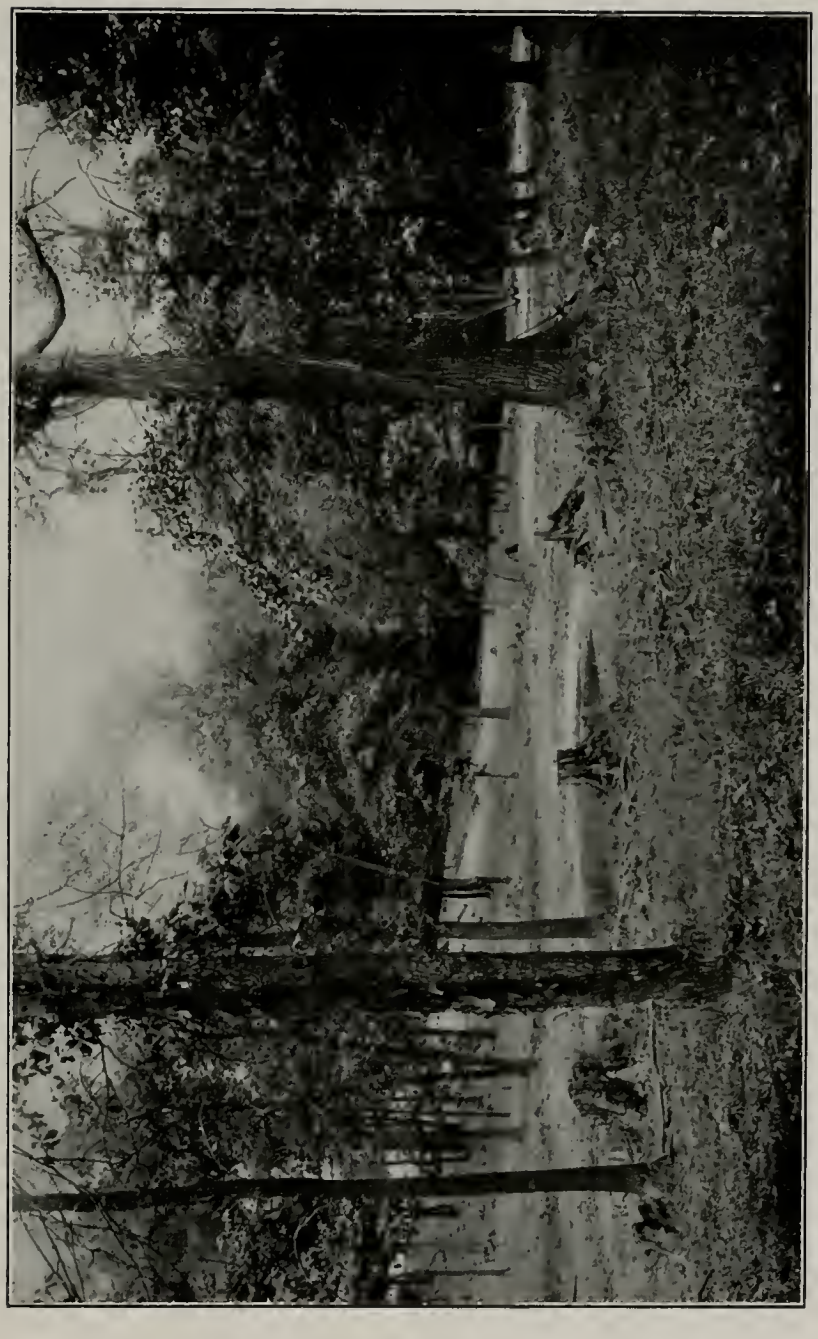
Plate XX.

Area north of Glencoe road and west of the East Branch of the Chicago River. An open forest with an abundance of ground vegetation. *Rudbeckia laciniata* and *Trillium* are the notable ground plants. Photograph taken May 18, 1908. (Woodruff.)



Old log habitat. Station XVIII, area same as that shown in Plate XX. Photograph taken May 18, 1908. (Woodruff.)

Plate XXII.



Pond in woods, one mile west of East Branch of the Chicago River. Note the absence of aquatic vegetation, such as *Iris*, *Typha*, *Cephalanthus*, etc. The forest trees, *Carya*, *Quercus* and *Ulmus* are conspicuous. View looking north. Photograph taken September 5, 1908. (Woodruff.)

Plate XXIII.

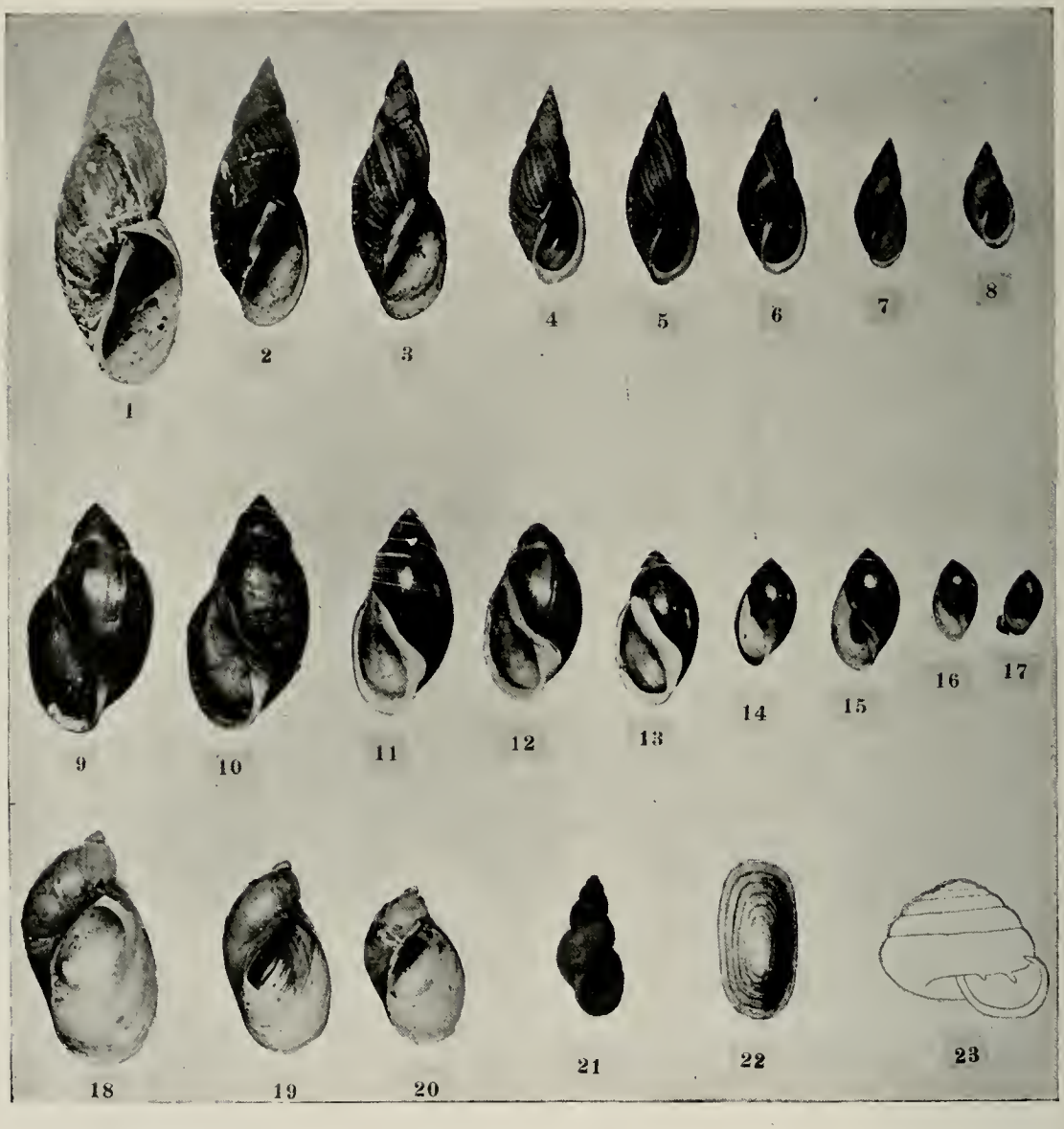
The same pond as that shown in Plate XXII. Fall condition in 1909, after a season of good rainfall. Photograph taken September 10, 1909. (Baker.)

Plate XXIV.

Fig. 1. The same pond as that shown in Plate XXII. Usual fall condition, after a season of dry weather. Photograph taken September 5, 1908. (Woodruff.)

Fig. 2. Open fields north of Glencoe road, near Shermerville. These fields are used as pastures for cattle. Photograph taken May 18, 1908. (Woodruff.)

Plate XXV.



Some Skokie mollusks

1. *Lymnæa reflexa* Say. Adult.
2, 3. *Lymnæa reflexa crystalensis* Baker. Immature *reflexa*.
4–8. *Lymnæa palustris michiganensis* Walker. Juvenile *reflexa*.
9–13. *Physa gyrina* Say. Adult.
14–17. *Physa oleacea* Tryon. Immature *gyrina*.
18, 19. *Succinea ovalis optima* Pilsbry. Possibly senile form of *ovalis*.
20. *Succinea ovalis* Say.
21. *Lymnæa parva sterkii* Baker.
22. *Ancylus parallelus* Hald. (After Fig. 6, Pl. I., Hald. Monogr.)
23. *Strobilops virgo* (Pilsbry). (After Fig. 120, Walker's Moll. Mich.)

Figures 1—20 enlarged 1½ diameters; fig. 21 enlarged 3 diameters; fig. 22 greatly enlarged; fig. 23 enlarged about 10 diameters.