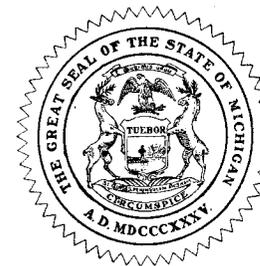


MICHIGAN GEOLOGICAL AND BIOLOGICAL SURVEY.

Publication 20.
Biological Series 4.

MISCELLANEOUS PAPERS
ON THE
ZOOLOGY OF MICHIGAN.

PREPARED UNDER THE DIRECTION OF
ALEXANDER G. RUTHVEN
CHIEF NATURALIST



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LETTERS OF TRANSMITTAL.

To the Honorable the Board of Geological and Biological Survey of the State of Michigan:

Gov. Woodbridge N. Ferris.
Hon. Fred L. Keeler.
Hon. Thomas W. Nadal.

Gentlemen:—I have the honor to transmit herewith some miscellaneous papers on the zoology of Michigan, prepared under the direction of Dr. Alexander G. Ruthven, Chief Naturalist, with the recommendation that they be printed and bound as Publication 20, Biological Series 4.

Very respectfully,

R. C. ALLEN,
Director.

Sir:—I present herewith for publication six papers on the zoology of Michigan, by Thomas Hankinson, Roy J. Colbert, Arthur T. Evans, Crystal Thompson, and Arthur W. Andrews. The investigations upon which these papers are based are a part of or supplement the biological work of the Survey, and the data which they contain materially increases our knowledge of the fauna of the State.

Respectfully,

ALEXANDER G. RUTHVEN,
Chief Naturalist.
R. C. ALLEN, Director,
Michigan Geological and Biological Survey.

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OBSERVATIONS ON THE FISHES OF HOUGHTON COUNTY,
MICHIGAN.

THOMAS L. HANKINSON,
STATE NORMAL SCHOOL, CHARLESTON, ILLINOIS.

OBSERVATIONS ON THE FISHES OF HOUGHTON COUNTY,
MICHIGAN.

THOMAS L. HANKINSON.

During the latter half of August, 1905, the writer made a study of the fish in a number of small lakes in Houghton County, Michigan, for the Michigan Geological and Biological Survey. Most of the work was done on lakes lying along the Copper Range Railroad between Stonington and Winona, two small stations nearly ten miles apart and in general between seventeen and one-half and twenty-seven and one-half miles southwest of Houghton by rail. Only two lakes at any distance from this ten-mile stretch of railroad were examined—Kratt Lake, about two miles southeast of Winona, and Bear Lake, about seven and one-half miles north of Houghton in the sand dune region of Lake Superior.

As it was impossible in the time devoted to the work to make a detailed study of all of the fish environments in each lake, attention was principally confined to one kind of habitat—the shallow water, three feet or less in depth, about the shores and islands. Each habitat was seined with a six foot "common sense" seine, and in addition to observations on abundance, notes were made on the ecological distribution. A complete series of the fish taken in each place has been deposited in the Museum of Zoology, University of Michigan.

The writer is indebted to A. C. Lane, former State Geologist, for helpful suggestions in the course of the work, to A. G. Ruthven for assistance in the preparation of this paper for publication, and to the following persons for aid in identifying material: C. A. Davis, seed plants; A. G. Ruthven, reptiles and amphibians; S. E. Meek, three species of minnows; Edwin Linton and H. B. Ward, fish parasites; F. S. Collins, algae; J. P. Moore, leeches; N. A. Harvey, sponges.

LOCAL DISTRIBUTION OF FISH.

Stonington Lakes. Three small lakes close to the station of Stonington on the Copper Range Railroad are called the Stonington Lakes in this paper. Each of these lakes is surrounded by thick forest except where they come close to the railroad embankment. They are in general oblong in shape, and the largest is perhaps a quarter of a mile

in length. As in all of the lakes of this densely forested region south of Houghton, the water has an umber color, and the bottom material of the shoals is similar to that found in the shallow water of the other lakes—a firm sand tinged with the color of the water.

The lakes were examined and a number of collections made on August 25. No detailed study of the vegetation was attempted, but the following plants of special interest were noted:

Marchantia polymorpha L.—Growing in abundance on beaches.

Drosera rotundifolia L.—Abundant on the shore and extending out on partly floating logs.

Equisetum fluviatile L.—Growing in patches, and in places forming distinct zones along the water's edge.

Ericaulon articulatum (Huds).—Forming patches on the bottom in shallow water.

Myriophyllum Farwellii Morong.—On submerged portions of logs.

Potamogeton sp.?—In patches in deeper water.

Brasenia Shreberi Gmel.—In patches.

Gloiothrixia Pisum (Ag.) Thuret.—An alga forming gelatinous colonies in shallow water.

Conspicuous aquatic invertebrates noted were:

Spongilla lacustris (Linn.).—On brush and other submerged objects near shore.

Macrobdella decora (Say).—Apparently the common leech of the northern lakes about Houghton.

Caddice worms.—Common on the bottom of shoals. Their cases were made of sticks.

Two amphibians occurred in some numbers around the shores, *Rana septentrionalis* Baird and *Rana pipiens* Schreber.

The fish observed were:

Chrosomus erythrogaster.—Abundant in schools in both lakes.

Pimephales promelas.—Abundant in large schools in both lakes.

Couesius plumbeus.—One taken in the south lake.

Catostomus commersonii.—One caught in the south lake.

Pygosteus pungitius.—Eight taken in the middle lake.

Eucalia inconstans.—Two found in the middle lake.

South Twin Lake. This lake is located about three miles northeast of Winona, on the Copper Range Railroad. It is somewhat over a mile long and a half mile wide, and receives several small streams. The outlet (Plate VIII) is Misery Creek, which flows to the west into Lake Superior (Fig. 1). The lake is completely surrounded by the forest except for a small clearing about the single building on its shore (Plate II). A well-marked beach, continuous with a broad shoal of compact

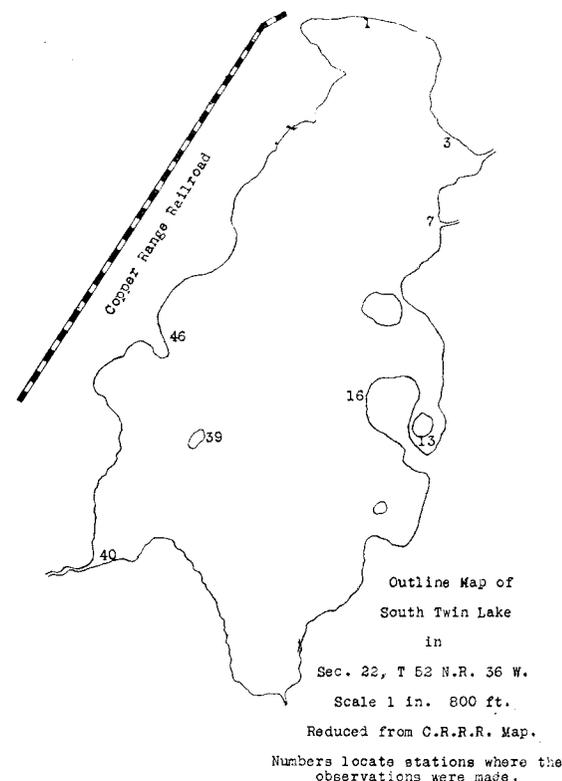


Figure 1.

sand or gravel, is present in most places. The water and bottom are tinged with umber.

South Twin lake received the most attention of the two. Stations were located in typical habitats and rather detailed studies were made at these places. Here again, the work was principally confined to the shallow water. Upon the beaches were sedges, rushes, and many other plants, forming in most places a thin growth of vegetation. A distinct zone of low shrubs, chiefly *Myrica Gale* (L.) and *Chamaedaphne calyculata* (L.) Moench, almost completely surrounds the lake just outside the beach region. Outside this is a zone of high bushes, and then comes the timber region, which is mainly composed of hardwoods but also includes many conifers, conspicuous among which are some large white pines.

The plants noted on the shoal were:

Bulrushes.—Formed a scant growth over many shoals. Thick patches were unusual.

Sparganium sp?—Often formed a thick growth in shallow water.

Ericaulon articulatum (Huds).—A rather conspicuous growth in places where there were but a few inches of water.

Lobelia Dortmanna L.—Found growing with the *Ericaulon*.

Potamogeton.—Several species grew on the shoal, principally on the outer part.

Brasenia purpurea Casp.—Patches were often present on deeper shoals.

Habitat Distribution of Fish in South Twin Lake.

Station 1. This is the shoal and adjacent shore at the extreme north end of the lake. The shallow water area is comparatively extensive with a bottom of hard sand. Over this is a scant growth of rushes, which form the only conspicuous vegetation. The shore zones of plants are distinct, but the low bush or heath zone practically covers the beach (Plate II).

Fishing with the hand seine was done on the morning of August 28 in water that was mostly between one and two feet in depth. The water temperature was 70° F. Fish were few and were not moving on the shoal: those taken were found resting beneath objects such as overhanging bushes, an old row boat and pieces of water-logged bark. The following species were collected:

Rhinichthys atronasmus lunatus.—Several taken.

Semotilus atromaculatus.—Several small specimens taken.

Micropterus salmoides.—One small specimen 4.2 cm. long was caught.

Station 3. This is a shoal which differs from that of Station 1 in being much narrower, a depth of three feet being reached about thirty or forty feet out from the shore. The shore features are similar to those of Station 1, and this is also true of the bottom which is composed of a similar hard, reddish sand with little vegetation (a few rushes and other plants). Many logs (Plate III) were floating near the shore. Collecting was done with the six-foot minnow seine in water three feet or more in depth and there was no difficulty in getting a representative collection of fishes for they showed little fear of the net.

The invertebrates found were:

Macrobdella decora.—This large leech was common.

Dragon-fly nymphs and eggs of *Tetragoneuria* sp.—The latter were in long strings of jelly-like substance.

Caddice worms.

The fish taken were:

Semotilus atromaculatus.—Small specimens found in water less than a foot deep.

Chrosomus erythrogaster.—Many in shallow water near shore. A large, compact school was seen in three feet of water.

Rhinichthys atronasmus lunatus.—Chiefly in the shallow water near shore.

Couesius plumbeus.—Three small specimens.

Leuciscus neogeus.—One taken.

Catostomus catostomus.—About a dozen small ones were taken and one comparatively large specimen, nearly a foot long, was found sucking on the submerged part of a floating log on the wood freshly bared by the stripping off of a portion of the bark.

Eucalia inconstans.—One taken.

Micropterus salmoides.—Small specimens under four inches in length were common in a few inches of water near shore.

Perca flavescens.—Small specimens under three inches in length were common. They were confined to the deeper part of the shoal in two or three feet of water and were found in compact schools.

The first three species of fish mentioned in this list were closely associated and tended to school together.

Station 16. A stretch of shore different from that of any other part of the lake is found at this station (Plate IV). The beach is unusually broad with low bushes scattered over it, and the shoal is also peculiar in that the bottom is covered with large pebbles over which no fish were found. The only place where fish were seen was in a shallow beach pool which was connected with the lake by a short, narrow channel. This little bay is scarcely more than a square yard in area and only an inch or so in depth. Many small fish were observed, and as the writer approached, they began to hasten through the little channel to the lake. A collection of these fish contained representatives of *Semotilus atromaculatus*, *Rhinichthys atronasmus lunatus*, *Couesius plumbeus*, *Eucalia inconstans* and *Lepomis cyanellus*. All were small individuals of their species, and the *Semotilus* was most abundant, only one of each of the last four species being taken.

Station 13. As shown on the map, this station is at the end of a little bay. There is a diversity of conditions, but the whole region is a shoal with more aquatic vegetation than any of the stations yet described. In places the water reaches a depth of about four feet. The bottom is mostly hard and sandy, but close to the south end of the bay there is a thin layer of humus over the sand. Plate V shows a part of the eastern portion of the bay.

Rushes were abundant, and there was a good sized patch of *Brasenia Shreberi*.

The following invertebrates were found in this habitat:

Spongilla lacustris (Linn.) and *Spongilla fragilis*, Leidy.—These two

formed a conspicuous green growth on the submerged branches of a tree that had fallen into the water. This tree can be seen in Plate V.

Macrobdeella decora.—A few were seen and collected.

Two species of fish were found, *Catostomus catostomus* (one small specimen) and *Micropterus salmoides* (small specimens, less than two inches long), the latter being common.

Station 7. *Sparganium* (Plate VI), growing in patches in one to two feet of water, covered much of the bottom of the shoal called Station 7. Except for many long slender leaves floating on the surface, the plants were submerged at the time studied. Beyond this growth, toward deep water, was a zone of pond weeds (*Potamogeton Nuttallii* and perhaps other species of the genus), followed by a zone of water lilies, which occupied the deepest part of the shoal and extended out to the beginning of deep water. A small, sandy delta at the mouth of a little creek entering the lake at this point broke the *Sparganium* zone.

The following fish were caught on the shoal, but a representative collection could not be made on account of the denseness of the vegetation: *Semotilus atromaculatus*, *Rhinichthys atronasmus lunatus*, *Lepomis cyanellus*, *Micropterus salmoides*. Only a few small specimens of each of the listed species were taken. Ten of the small *Semotilus* caught were infested with a protozoan parasite, *Myxobolus*. Many small fishes were seen.

Station 46. The shoal with the greatest amount of plant life of any visited is on the west side of the lake and just north of a small point of land. This is called Station 46. No attempt will be made to describe the complex association of plants found in this habitat, but an idea of its general character may be had from Plate VII. The water is mostly three or four feet deep and the sand is covered by several inches of humus.

As at Station 7, the abundance of vegetation did not permit careful seining. Many fish, including some large *Semotilus atromaculatus* 100-120 mm. long, were seen, showing that this was a favorite fish habitat, and even from the small amount of data obtained it was evidently the type most favored by shoal fish. A noteworthy feature was the great abundance of red-bellied leeches, *Macrobdeella decora*, which, while found at other stations in some numbers, were nowhere so abundant as on this shoal.

The following fish were found at this station:

Semotilus atromaculatus.—Many seen, none taken.

Leuciscus neogaeus.—Three small specimens collected.

Micropterus salmoides.—Many small bass were seen but none were

captured. The habitat undoubtedly represented an important feeding ground for them.

Perca flavescens.—One small specimen taken.

Deep Water Region.—As previously stated, the deep water region, by which is meant all of that extensive portion of the lake surrounded by the relatively narrow shoals, was scarcely examined in any of the lakes, but in this lake, a little hook and line fishing, done just off the shoal called Station 1, yielded seven *Perca flavescens* (130-160 mm. long); and just off the lily zone of Station 7, in deep water, two rather large *Lepomis cyanellus* (150-180 mm. long) and a *Micropterus salmoides* (265 mm. long) were taken.

Stream at Station 7. The stream already referred to as entering the lake at this station is a very small one, and fish were found only close to its mouth, in a deep pool (as deep as four feet in places). Satisfactory collecting could not be done with a net, but a number of good sized *Semotilus atromaculatus* (10-15 cm. long) were caught there with a hook and line baited with worms.

Station 40. This is the area about the head of Misery Creek, the principal and perhaps the only outlet of the lake. The general character of the region is shown in Plate VIII. The water is very deep at the source of the creek, but about a bridge and for a considerable distance below it, the stream is shallow enough to permit fishing with the small seine. In the center of the stream the depth averages perhaps three feet. The bottom is of hard sand covered in places with considerable brush and other forest debris. Fish tended to keep under the bridge, where they were abundant; few were found in the other part of the creek visited. The following species were noted and collected:

Chrosomus erythrogaster.—Abundant; many large specimens, 60-70 mm. long were taken.

Semotilus atromaculatus.—Abundant; many large specimens, 120 or more mm. long, were taken. As many as two dozen of these large chubs were caught at a haul with the six-foot seine.

Rhinichthys atronasmus lunatus.—Abundant; many large specimens, some 100 mm. long, were collected.

Leuciscus neogaeus.—Two were taken, each about 70 mm. long.

Couesius plumbeus.—Common. They were mostly about 50 mm. long.

Perca flavescens.—Five were taken, 50-70 mm. in length.

Micropterus salmoides.—One taken, about 40 mm. long.

North Twin Lake. This lake lies to the north and east of South Twin Lake and is considerably the larger of the two. Very little work was

done there, only about an hour being spent in collecting along the south end. It appeared to be surrounded by unbroken forest except at the south end where lumbering was going on. The bottom and vegetation seemed to be like those of South Lake. Many fish were observed in the shallow water area, and the following five species were taken: *Chrosomus erythrogaster*, *Semotilus atromaculatus*, *Rhinichthys atronasmus lunatus*, *Catostomus catostomus*, *Lepomis cyanellus*. With the exception of *Rhinichthys atronasmus lunatus*, which was very common, only a few specimens of each species were caught.

Kratt Lake. Kratt Lake is located about two miles southeast of Winona, mostly south of Sections 33 and 34, Township 52. It is surrounded by dense forest except for the clearing about an inhabited house. It is smaller but similar to South Twin Lake in the character of the bottom and vegetation; and the shoal, as far as observed, is narrower. The same brown-stained water and bottom sand was found as in the other forest lakes visited. The sand beach is more or less obscured by the zone of low bushes, outside of which is a zone of high bushes and beyond this the timber region. The small shrubs bordering the beach, and in places covering it, seemed to be entirely of two species—*Myrica Gale* and *Chamaedaphne calyculata*.

The following strictly aquatic plants were found: *Sparganium* sp? (forming large, dense, submerged patches in places), *Potamogeton natans* L., *Fontinalis antipyretica* L., *Myriophyllum Farwellii*, *Utricularia vulgaris* L., *Tolypothrix tenuis* Kutz, *Batrachospermum* sp?

Sponges were abundant but none were collected.

Only the following two species of fish were found:

Lepomis cyanellus.—This species was very abundant, and took a baited hook greedily. In fact, the great abundance and voracity of this sunfish was a prominent characteristic of this lake. In a short time, seventy individuals around 15 cm. in length were caught. They seemed to be most abundant in the deep water just off the shoal. In the shallow water a few small specimens (20-30 mm. in length) were taken, but no other species were found in this shoal region.

Perca flavescens.—One small specimen, about 100 mm. long, was taken by hook.

All of the fish taken in Kratt Lake were very dark in color with a decided umber tinge like that of the water.

Bear Lake. Bear Lake is out of the region of the other lakes studied and already considered. It is in the brush-covered sand dune area

about a half mile from Lake Superior and about seven and a half miles directly north of Houghton. The lake is nearly a mile long with an average width of perhaps a quarter of a mile and presents conditions very different from those in the lakes in the forest south of Houghton. The water is clear and the sand unstained. The shoal is variable in extent; in some places it is narrow and in others one can wade out a hundred feet or so from shore.

Bulrushes were more or less abundant in different parts of the shallow water region, and formed dense and extensive patches. There was also a growth of stoneworts on the bottom, associated with some gelatinous and filamentous green algae which appeared to be chiefly *Zygnema* and *Spirogyra*.

Two small crayfish, *Cambarus* sp?, were taken here, the only place in the county where they were found.

Only the shoal was fished, on August 23, but an attempt was made to get a representative collection. The following species were obtained:

Pimephales notatus.—Rather common.

Abramis chrysoleucas.—One small specimen (30 mm. long) taken.

Notropis cayuga.—This species was common and occurred in large schools. The specimens were mostly from 60-70 mm. long.

Perca flavescens.—Small specimens about 40 mm. long were common in shallow water.

Etheostoma iowae.—A number were found on the sandy bottom.

The fish found in Bear Lake were of normal coloration and not umber-tinged as were all of those found in the umber-colored water of the forest lakes.

CONCLUSION.

As has already been stated, the work upon which this paper is based was only a reconnaissance made for the purpose of obtaining a general knowledge of the fishes and fish environments in the lakes of the region. Study was centered on the shoals since in that habitat more species, and thus a better representation of the fauna, could be obtained in the time that could be given to the work. The main value of the report must then be the additional data on the distribution of the species in the state and the general information on the fish faunas of the lakes of this region which it contains.

Five general conclusions may be drawn from the ecological data given above and that contained in the list of species which follows.

(1). The forest lakes examined, which have apparently very similar conditions, have quite different fish faunas.

(2). All of the fishes from the stained waters of the forest lakes are very dark in color, their bodies being tinged with the same color as the water.

(3). In August the shoal fishes are generally most abundant where there is most aquatic vegetation.

(4). Fish enemies in the form of parasites appear to be very frequent in the lakes examined.

(5). South Twin Lake is one of the northern lakes that may be advantageously studied to determine its suitability as an environment for the black bass. The young evidently thrive there, and one of size was caught which was in very good condition. The many minnows in the lake might furnish a large quantity of available food for the bass.

LIST OF SPECIES.

The following list comprises only the species actually secured or observed by the writer, and, as has been said, is principally confined to the shoal species. It is of course incomplete, but it contains additional data on the distribution of the species. The nomenclature and the order of consideration are, with a few modifications, those used in Jordan and Evermann's Fishes of North and Middle America. The millimeter numbers given refer to the length of the fish, which was taken from the tip of the snout to the posterior end of the caudal fin.

1. *Catostomus catostomus* (Forster). Long-nosed Sucker.—Found only in Twin Lakes, where it appeared to be common.

2. *Catostomus commersonii* (Lacépède). Common Sucker.—A single small specimen (36 mm.) taken from South Stonington Lake.

3. *Chrosomus erythrogaster* Rafinesque. Red-bellied Dace.—Common in both Twin Lakes and in each of the two Stonington Lakes examined. In the latter, it was found schooling with *Pimephales promelas*. The specimens collected measured 21-63 mm. One fish with bright red under-parts was found.

4. *Pimephales promelas* Rafinesque. Fat-head Minnow.—Taken only at Stonington, where it was abundant in both of the lakes studied. Two hundred and four specimens (22-60 mm.) were collected. Three were found with cestodes (probably *Ligula*) filling their body-cavities and greatly distending their abdomens.

5. *Pimephales notatus* (Rafinesque). Blunt-nosed Minnow.—Found only at Bear Lake, where thirteen were taken (24-35 mm.).

6. *Semotilus atromaculatus* (Mitchill). Horned Dace.—The horned dace was only observed in Twin Lakes where it was abundant. Only small specimens, 60-70 mm. long, were found on shoals, but large ones (100-155 mm.) were in streams close to the lake. The fish were much infested with a protozoan parasite, *Myxobolus*, which produced whitish swellings of the skin and often made the fish conspicuous. Of the two hundred and thirteen specimens preserved, thirty-five were diseased

with this parasite. They are parasitized internally as well as externally, for fourteen parasitic worms, *Echinorynchus*, were found in their alimentary canals. A superficial examination was made of the digestive tracts of ten large dace (103-143 mm.) and the contents observed were as follows: elytra and other parts of beetles, pieces of dragon-fly and May-fly nymphs, small spiders, winged ants, a small amphipod, some pieces of wood, and the vertebral columns of two frogs. The two hundred and thirteen specimens preserved measured 27-155 mm.

7. *Leuciscus neogeus* (Cope).—Eight (44-70 mm.) were taken from South Twin Lake.

8. *Abramis chrysoleucas* (Mitchill). Golden Shiner.—Only one very small specimen (31 mm.) was observed. This was found in Bear Lake.

9. *Notropis cayuga*, Meek.—Common at Bear Lake but none were found elsewhere in the region. Twenty-four specimens (61-66 mm.) were taken.

10. *Rhinichthys atronasmus lunatus* (Cope). Black-nosed Dace.—Noted only in Twin Lakes, where it was present in considerable numbers. The fifty-five specimens preserved measured 25-98 mm.

11. *Couesius plumbeus* (Agassiz).—Found in some numbers in South Twin Lake. Forty-two were taken, the measurements of which were 40-50 mm.

12. *Salvelinus fontinalis* (Mitchill). Brook Trout.—A common fish in the streams. None were found in lakes, but the writer was told that they frequent the shoals in the spring, retiring into the deep water in summer, when they rarely take a hook.

A few small specimens were taken by hook in a small branch of Sleepy Creek, at Winona. On three small specimens (46-84 mm.) four large copepod parasites (probably *Lernaepoda*) were found.

13. *Esox lucius* L. Common Pike.—The writer saw fish of this species that had been taken in a small lake located some seven miles southeast of Winona. This lake is said to contain so many of these fish that it is called "Pike Lake."

14. *Eucalia inconstans* (Kirtland). Brook Stickleback.—Six specimens of this stickleback were collected at Stonington and South Twin Lake. They measured from 32-53 mm.

15. *Pygosteus pungitius* (Linnaeus). Nine-spined Stickleback.—Found only at Middle Stonington Lake where eight were taken from a single school. They measured 42-49 mm.

16. *Lepomis cyanellus* Rafinesque. Blue-spotted Sunfish.—Found in small numbers at Twin Lakes and very abundant at Kratt Lake. Those collected measured 20-166 mm. An examination of the digestive tracts of ten specimens, averaging about 120 mm. in length, showed

the fish in Kratt Lake to be feeding on animal and plant material. . . The stomach contents were as follows: insect fragments (heads of hemipterous insects and parts of beetles), pieces of wood, alga fragments, leaves of Sparganium or Eriocaulon, and water lily seeds.

17. *Micropterus salmoides* (Lacépède). Large-mouth Black Bass.—Small specimens were very abundant on shoals of South Twin Lake, but none were noticed elsewhere. Those caught measured 34-78 mm. in length. In the stomachs examined were fish bones, teeth of a minnow, entomostracans, and Chironomus larvae. One comparatively large specimen (265 mm.) was caught with hook and line in South Twin Lake.

18. *Perca flavescens* (Mitchill). Yellow Perch.—Found at South Twin Lake, Bear Lake and Kratt Lake. Small specimens were generally distributed on shoals in South Twin Lake. Some of those taken were 43-70 mm. long. None were found on the shoals of Kratt Lake or Stonington Lakes. Larger perch (133-185 mm.) were taken from deep water off the shoals in South Twin Lake, Bear Lake and Kratt Lake.

19. *Etheostoma iowae*, Jordan and Meek.—Found only in Bear Lake, where four were taken in shallow water on a sandy bottom. These were 37-45 mm. in length.

AN ECOLOGICAL STUDY OF THE FISH FAUNA OF THE
DOUGLAS LAKE REGION (MICHIGAN) WITH SPECIAL
REFERENCE TO THE MORTALITY OF THE SPECIES.

ROY J. COLBERT

THE UNIVERSITY OF TOLEDO.

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DOUGLAS LAKE REGION (MICHIGAN) WITH SPECIAL
REFERENCE TO THE MORTALITY OF THE SPECIES.

ROY J. COLBERT.

In this study of the fish fauna of the Douglas Lake (Michigan) region special attention was given to the mortality of the various species found and it is thought that the data collected in this connection have a direct bearing on the general ecology of the species involved. In order that the data on the mortality might be more easily understood, records of species frequency were taken for several typical habitats and a general survey of the intra-lake distribution of the species made. The collection of fishes from which the data were gathered includes several hundred specimens taken during the summer sessions of 1913 and 1914 at the University of Michigan Biological Station at Douglas Lake.

Opportunities for procuring data on these particular problems were especially favorable. Douglas Lake affords an ample variety of aquatic habitats which are easily accessible for study. The shores of the lake are covered with their natural growth of vegetation and timber, and as yet neither the inlets nor the outlet, Maple River, have been dredged or changed to any large extent. The lake and its adjacent waters may be divided into the following units for the purpose of this study: North Lake, that part of Douglas Lake west of Fairy Island and Robert's Point; North Fishtail Bay; Bessey Creek region together with the other small inlets of the lake; and Maple River (See map, Fig. 2). Each of these regions has a condition or set of conditions distinguishing it from the others and encouraging the predominance of certain species of fish.

The prevailing winds of the region blow from the west and north-west, hence North Lake, the part of Douglas Lake west of Fairy Island and Robert's Point, is seldom disturbed by heavy winds and waves, and the aquatic vegetation, especially *Myriophyllum* and *Potamogeton*, has a better chance to grow. This is particularly true immediately west of Fairy Island. In this region the pike-pickrel, *Esox lucius*, and the rock bass, *Ambloplites rupestris*, are very common, and along the marshy shallows of the west shore the cat fish, *Amieurus melas*, nest and are found in great abundance.

North Fishtail Bay affords two somewhat different habitats. The north portion is a quiet bay surrounded by a thick pine and cedar

forest. The water increases in depth very gradually from the shoals along the shore. The bottom here is covered with a thin layer of decayed vegetation and the yellow water lilies, *Nymphaea americana*, *Potamogeton*, and *Myriophyllum* are very abundant. This particular habitat was studied from two standpoints: (1) to ascertain the relative frequency of the various species belonging in this habitat, breeding and feeding there, and (2) to learn what fishes come into the habitat to feed. Several nests of the catfish, *Amieurus melas*, and the pumpkin seed, *Eupomotis gibbosus*, were found both summers early in July with the adults still guarding them. Several schools of small catfish were seen all through the summer in the very shallow water near the bank.

The frequency study of this habitat was made by placing a fyke net in the bay, about 100 feet from the shore, with the wings extending almost to the shore on either side and with the open mouth of the trap toward the shore. The trap in this position collected the fishes belonging to the habitat, and breeding and feeding there. The following table gives the results of six days typical collecting.

TABLE NO. 1.

Species.	Number.	Average size.	Frequency.
1. Pumpkin seed, <i>Eupomotis gibbosus</i>	63	100 m.m.	.583
2. Blue gill, <i>Lepomis pallidus</i>	24	108 m.m.	.223
3. Sucker, <i>Catostomus commersonii</i>	14	276 m.m.	.130
4. Cat fish, <i>Amieurus melas</i>	7	177 m.m.	.064

During the two summer's work, in addition to the species listed in the table, two specimens of the yellow perch, *Perca flavescens*, and one trout perch, *Percopsis guttatus*, were taken in the net. Both of these species are from deeper water and were in this habitat presumably by accident.

To determine what species enter the habitat to feed, a gill net was set across the bay just outside the fyke net. Particular care was taken to note in what direction each fish entered the net, i. e., whether it was coming in from the lake or going out into deep water. The following table gives the results of six days collecting with the gill net:

TABLE NO. 2.

Species.	Number of individuals.	Direction.		Average size.
		In.	Out.	
1. Sun fish, <i>Eupomotis gibbosus</i>	18	0	18	121 m.m.
2. Sucker, <i>Catostomus commersonii</i>	14	4	9	294 m.m.
3. Pickerel pike, <i>Esox lucius</i>	6	6	0	360 m.m.
4. Blue gill, <i>Lepomis pallidus</i>	3	0	3	126 m.m.

It will be seen from Table No. 2 that all *Eupomotis gibbosus* and *Lepomis pallidus* were inside the enclosed area and were caught going out. *Catostomus commersonii*, however, were taken on both sides of the net and near the bottom where they feed. The frequency of this particular species all over the lake, except in very deep water, is practically the same, and as expected it occurs in both shallow and deep water. *Esox lucius*, however, belongs in a different habitat in deeper water. Since none were taken in either the fyke net or on the inside of the gill net, it is quite evident they visit the habitat for feeding. The nets were emptied every morning and evening, and about as many of the various species were taken at one time as another, except *Esox lucius*, which in every instance was gilled at night during the usual time of feeding.

The combined frequency of all species collected in this habitat, including visitors, as shown by the combined collections, is as follows:

TABLE NO. 3.

Species.	Average size.	Frequency.
1. Pumpkin seed, <i>Eupomotis gibbosus</i>	111 m.m.	.534
2. Blue gill, <i>Lepomis pallidus</i>	117 m.m.	.180
3. Sucker, <i>Catostomus commersonii</i>	285 m.m.	.180
4. Catfish, <i>Amieurus melas</i>	177 m.m.	.047
5. Trout perch, <i>Percopsis guttatus</i>	110 m.m.	.006
6. Yellow perch, <i>Perca flavescens</i>	120 m.m.	.007
7. Pickerel-pike, <i>Esox lucius</i>	360 m.m.	.039
8. Bowfin, <i>Amia calva</i>	700 m.m.	.007

The south bay of North Fishtail Bay presents a situation more nearly like that of the lake proper. It gets about the same amount of wind and wave action; its bottom is sandy and drops abruptly from a narrow, shallow shoal to a depth of 40 feet. It has, however, along the edge of the step-off and in the shallows of the south side, where the wind and waves have less sweep, a considerable patch of yellow water lilies, *Nymphaea americana* and *Potamogeton*. The fyke net was placed in this situation for a period of ten days with the open mouth of the trap toward the shore. The catch, therefore, while it represents the relative frequency of the species in the habitat, was not large. The result of the collections is as follows:

TABLE NO. 4.

Species.	Number.	Average size.	Frequency.
1. Pumpkin seed, <i>Eupomotis gibbosus</i>	5	148 m.m.	.217
2. Large-mouthed black bass, <i>Micropterus salmoides</i>	3	173 m.m.	.131
3. Small-mouthed black bass, <i>Micropterus dolomieu</i>	1	210 m.m.	.043
4. Sucker, <i>Catostomus commersonii</i>	4	332 m.m.	.173
5. Catfish, <i>Amieurus melas</i>	2	200 m.m.	.087
6. Blue gill, <i>Lepomis pallidus</i>	3	116 m.m.	.131
7. Rock bass, <i>Ambloplites rupestris</i>	3	131 m.m.	.131
8. Yellow perch, <i>Perca flavescens</i>	2	145 m.m.	.087

The fish taken from this habitat were larger than those of the same species taken from the north bay. The presence of both the large-mouth black bass, *Micropterus salmoides*, and the small-mouth black bass, *Micropterus dolomieu*, in the ratio of three to one, is a characteristic feature of this habitat.

The lake proper has four types of habitats, each of which must be dealt with separately: (1) the shallows and shoals; (2) the deep water near the step-off; (3) the mid-lake portion not exceeding 20 feet in depth; and (4) the deep cold water below the 20 foot line which includes most of South Fishtail Bay. (See map, Fig. 2).

In the shoals and shallows of South Fishtail Bay schools of young perch, *Perca flavescens*, shiners, *Notropis hudsonius*, *N. cayuga*, and *N. cornutus*, young suckers, *Catostomus commersonii*, blunt-nosed minnows, *Pimephales notatus*, and an occasional individual of the Johnny darter, *Boleosoma nigrum*, are found. Each of these species, however, is very abundant on the more rocky shoals between Grapevine and Bogardus Points, on the east side of Fairy Island, and along the northeast side of the lake (See map, Fig. 2). The relative frequency of these various species is seen in the following table, the combined results of seven different long-shore seining made at various times during the sessions of 1913 and 1914:

TABLE NO. 5.

Species.	Number.	Average size.	Frequency.
1. Yellow perch, <i>Perca flavescens</i>	642	40-60 m.m.	.381
2. Sucker, <i>Catostomus commersonii</i>	360	30 m.m.	.214
3. Hudson's shiner, <i>Notropis hudsonius</i>	344	20-60 m.m.	.204
4. Johnny darter, <i>Boleosoma nigrum</i>	285	20-40 m.m.	.169
5. Common shiner, <i>Notropis cornutus</i>	34	20-60 m.m.	.020
6. Blunt-nosed minnow, <i>Pimephales notatus</i>	11	30 m.m.	.008
7. Cayuga shiner, <i>Notropis cayuga</i>	5	30 m.m.	.003
8. Pumpkin seed, <i>Eupomotis gibbosus</i>	1	10 m.m.	.0006

Practically all of the records included in Table 5 were adults of the species, excepting the perch, suckers, and pumpkin seeds. The adults of these three species frequent the deeper water of the lake, but lay their eggs in the shallows where the young remain until they are large enough to avoid the enemies commonly found in the deeper waters. Since the young suckers and perch are so abundant they form a very important part of the life of this habitat.

Just over the step-off, in water ranging from 10 to 20 feet deep in situations where the aquatic vegetation is more or less abundant, the trout perch, *Percopsis guttatus*, and yellow perch, *Perca flavescens*, are very abundant. Here also the schools of the log perch, *Percina caprodes*, are found, but the last species is by no means as abundant as the other two. The largest schools of the log perch were found



Figure 2.

near the east shore of South Fishtail Bay, where during the first two weeks of July they were seen spawning in the shallow water. Adult minnows are also fairly frequent in this habitat. As will be seen later, the great majority of adult yellow perch thrown upon the beach by the waves were stranded while feeding on the trout perch in this habitat, practically every individual having a half-swallowed trout perch in its mouth.

Over the submerged sand bar and on either side of it, where the reeds, *Scirpus* spp., grow, also between Grapevine Point and Fairy Island, where the various water plants grow to within four to six feet of the surface, the habitat is slightly different. Here the bass, both *M. dolomieu* and *M. salmoides*, the pickerel-pike, *Esox lucius*, and the rock bass, *Ambloplites rupestris*, are abundant. A trammel net placed with one end barely on the sand-bar, i. e. in about 10 feet of water, and the other end extending into water forty feet deep gave the following results during both sessions:

TABLE NO. 6.

Species.	Average size.	Depth of water.	Number.	Frequency.
1. Rock bass, <i>Ambloplites rupestris</i>	135 m.m.	10-15 ft.	52	.305
2. Sucker, <i>Catostomus commersonii</i>	310 m.m.	At all depths	38	.222
3. Pumpkin seed, <i>Eupomotis gibbosus</i>	110 m.m.	7-10 ft.	28	.164
4. Pickerel-pike, <i>Esox lucius</i>	440 m.m.	20-40 ft.	21	.123
5. Catfish, <i>Amieurus melas</i>	320 m.m.	At all depths	17	.099
6. Small-mouthed black bass, <i>Micropterus salmoides</i>	380 m.m.	20-40 ft.	10	.058
7. Yellow perch, <i>Perca flavescens</i>	160 m.m.	10-20 ft.	3	.017
8. Large-mouthed black bass, <i>Micropterus salmoides</i>	390 m.m.	20-40 ft.	2	.012

Aside from the fishes taken in the trammel net at a depth exceeding 20 feet, and listed in Table No. 6, the lake whitefish, *Argyrosomus artemis cisco* and the ling, *Lota maculosa*, are known to occur in very deep water. During the summers of 1913 and 1914, dead lake whitefish were found. Each had an injury on the ventral side of the body, near the caudal fin. This injury resembled the scar made by the lake lamprey. Many other species of fish were taken, as will be seen later, with the same type of injury. At the close of the 1914 session of the Biological Station a large specimen of the ling, *Lota maculosa*, was found almost dead under a beached boat near the Station dock after a heavy wind storm. This species belongs to the deep water near the thermocline, at a depth varying from 35 to 40 feet or more.

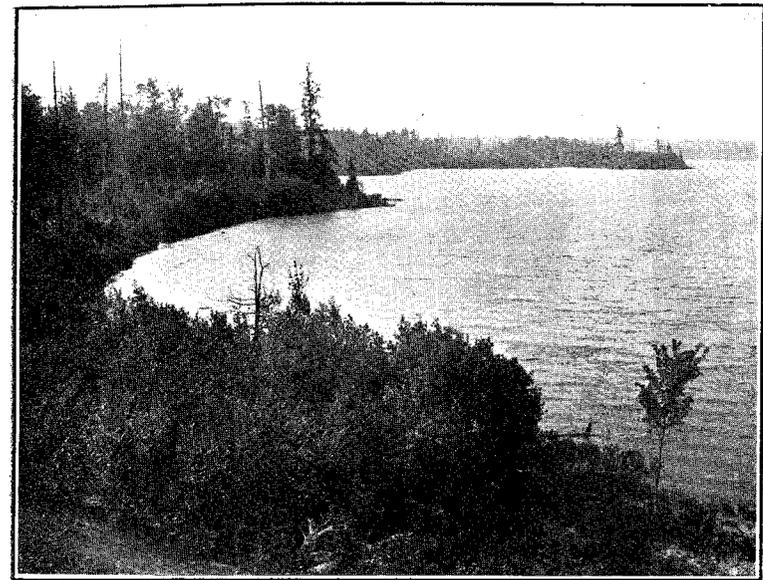
In addition to the lake itself, Bessey Creek, the other smaller inlets and the outlet, Maple River, are important habitats for fishes. Bessey Creek is a sluggish stream varying from one to eight feet in depth. The bottom is covered with a deep layer of loose decayed vegetable matter and ooze. A considerable amount of high grass, rushes, *Scirpus americanus*, and white water lilies, *Castalia odoratum*, grow in the shallow water near the bank, and in many places in mid-stream. The banks are well wooded and shady. By frequent observations and seining it was found that the mud minnow, *Umbra limi*, is the dominant species of this habitat. The creek was seined several times and the combined data of the seinings are given below:

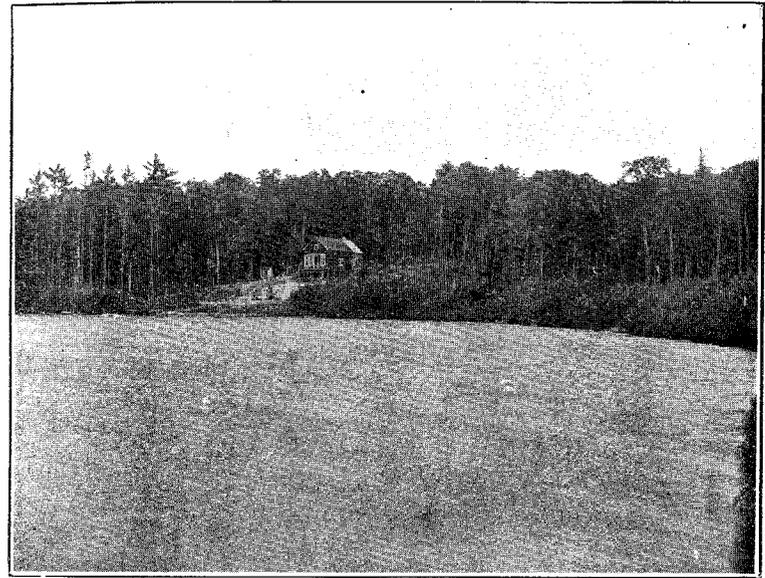
TABLE NO. 7.

Species.	Number	Average size.	Frequency.	Place in stream.
1. Mud minnow, <i>Umbra limi</i>	190	85 m.m. (adults)	.626	Distributed over bottom.
2. Yellow perch, <i>Perca flavescens</i> .	30	100 m.m. (young)	.099	Near surface, mid-stream.
3. Blue gill, <i>Lepomis pallidus</i>	18	60 m.m. (young)	.060	Mid-stream.
4. Pumpkin seed, <i>Eupomotis gibbosus</i>	17	62 m.m.	.057	Mid-stream.
5. Cayuga shiner, <i>Notropis cayuga</i>	13	25 m.m.	.043	Mid-stream.
6. Rock bass, <i>Ambloplites rupestris</i> .	12	102 m.	.040	Mid-stream.
7. Catfish, <i>Amiurus melas</i>	8	142 m.m.	.026	At bottom of mid-stream.
8. Pickerel-pike, <i>Esox lucius</i>	8	145 m.m. (young)	.026	Under grass along bank.
9. Large-mouthed black bass, <i>Micropterus salmoides</i>	4	30 m.m. (young)	.014	Mid-stream.
10. Sculpin, <i>Cottus icталops</i>	1	48 m.m.	.004	Mid-stream.
11. Iowa darter, <i>Etheostoma iowae</i> .	1	14 m.m.	.004	Mid-stream.

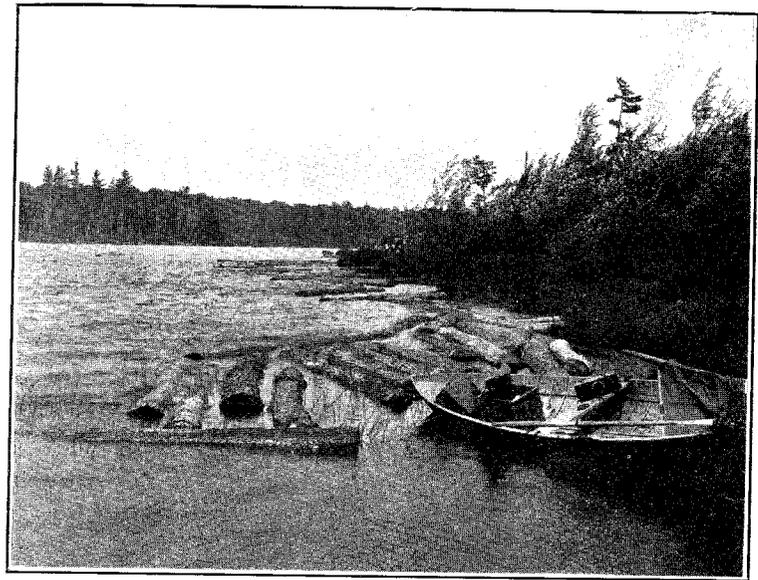
As shown by the table *Umbra limi* is by far the most frequent species in this habitat.

Maple River and the small streams coming into the lake, other than Bessey Creek, have been placed in the same group as regards type of habitat because they are more or less swift and clear, and offer about

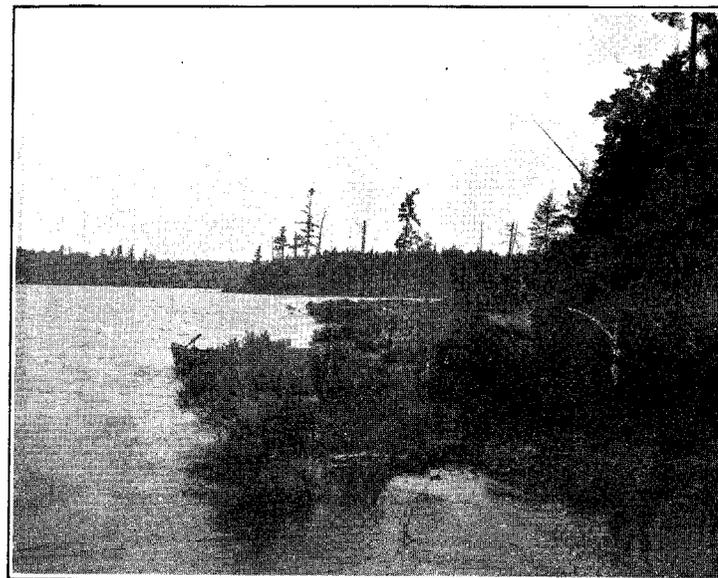
GENERAL VIEW OF EAST SHORE OF SOUTH TWIN LAKE, LOOKING
SOUTH FROM STATION 1.



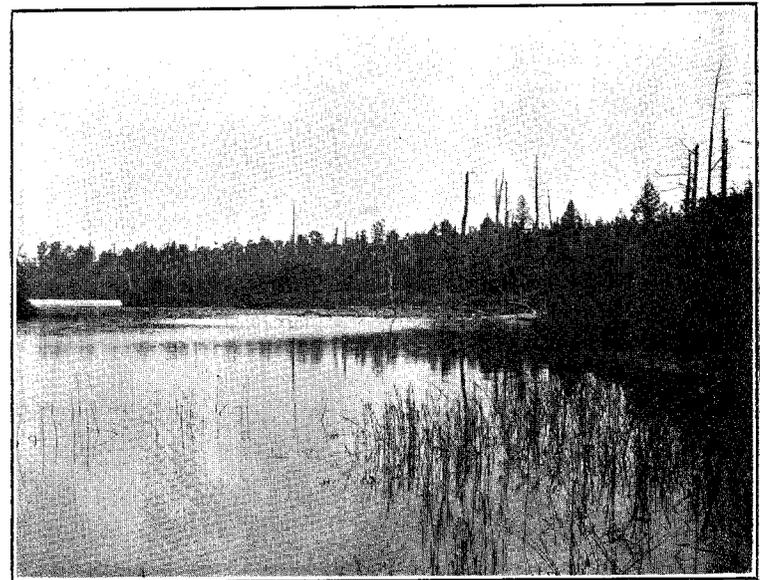
SOUTH TWIN LAKE, LOOKING NORTHWEST, SHOWING BROAD SHOAL WITH
A SCANT RUSH GROWTH AND THE ZONES OF SHORE VEGETATION.



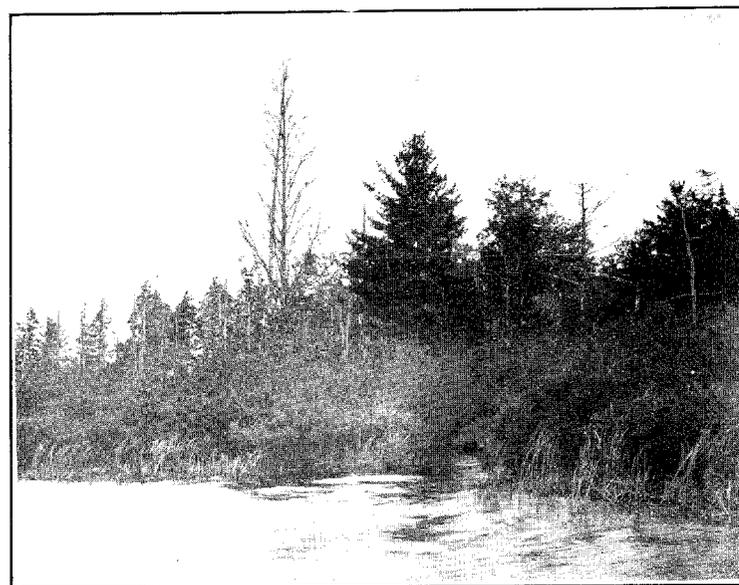
SOUTH TWIN LAKE, STATION 3, LOOKING NORTHWEST, SHOWING THE
REGION FISHED AS FAR AS THE RUSHES EXTEND.



SOUTH TWIN LAKE, LOOKING NORTH, SHOWING AN UNUSUALLY BROAD
BEACH BUT WITH MANY ENCROACHMENTS OF THE SMALL SHRUB ZONE.



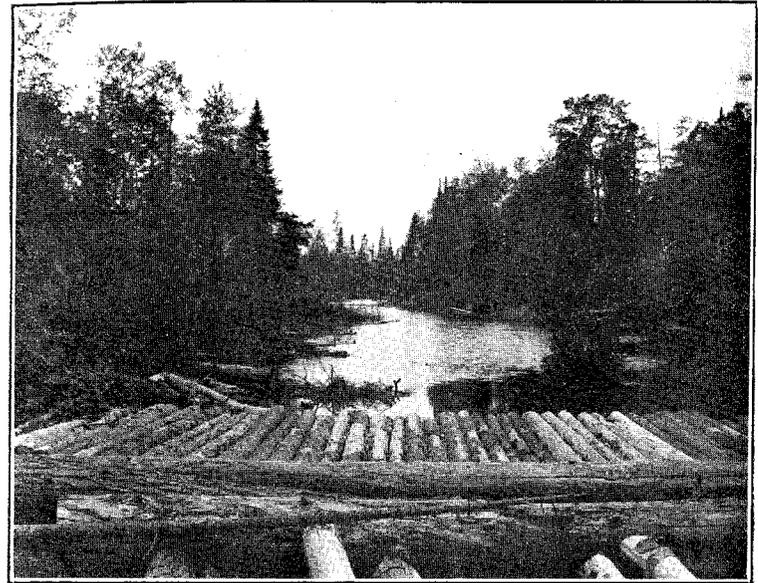
SOUTH TWIN LAKE, STATION 13, LOOKING NORTH.



SOUTH TWIN LAKE, STATION 7, LOOKING EAST. FLOATING SPARGANIUM
LEAVES NOT SHOWN ON ACCOUNT OF WAVES.



SOUTH TWIN LAKE, STATION 46, LOOKING NORTHWEST.



SOUTH TWIN LAKE, STATION 40, LOOKING WEST. MOUTH OF MISERY
CREEK.

the same sort of conditions. These stream beds are gravel or clear sand, and if a mucky bottom exists at all, it is near the banks or in holes and bayous along the stream. In these places the *Umbra limi* and small *Amieurus melas* are abundant. Aside from these situations, however, Maple River and the small clear streams afford a group of species different from those found in any other habitat of the region. The brook trout, *Salvelinus fontinalis*, is abundant along the small inlets and in Maple River five miles down stream from the lake. Besides *Salvelinus fontinalis*, several other species, which did not occur in the other habitats, were found in Maple River in abundance. *Etheostoma iowae*, *Notropis whipplii*, *Semotilus atromaculatus*, and *Rhinichthys atronasus* were taken in numbers. *Cottus ictalops* is also more abundant in Maple River than in Bessey Creek.

From the foregoing studies of the several habitats the fish fauna of Douglas Lake and connecting streams may be seen to include the following 26 species, of which 23 (marked *) occur in the lake proper:

TABLE NO. 8.

1. Bowfin, *Amia calva*.*
2. Common sucker, *Catostomus commersonii*.*
3. Catfish, *Amieurus melas*.*
4. Hudson River shiner, *Notropis hudsonius*.*
5. Common shiner, *Notropis cornutus*.*
6. Cayuga shiner, *Notropis cayuga*.*
7. Blue shiner, *Notropis whipplii*.
8. Horned dace, *Semotilus atromaculatus*.
9. Black-nosed dace, *Rhinichthys atronasus*.
10. Blunt-nosed minnow, *Pimephales notatus*.*
11. Pickerel-pike, *Esox lucius*.*
12. Mud minnow, *Umbra limi*.*
13. Brook trout, *Salvelinus fontinalis*.*
14. Lake whitefish, *Argyrosomus artedi cisco*.*
15. Trout perch, *Percopsis guttatus*.*
16. Log perch, *Percina caprodes*.*
17. Iowa darter, *Etheostoma iowae*.*
18. Johnny darter, *Boleosoma nigrum*.*
19. Yellow perch, *Perca flavescens*.*
20. Rock bass, *Ambloplites rupestris*.*
21. Large-mouthed black bass, *Micropterus salmoides*.*
22. Small-mouthed black bass, *Micropterus dolomieu*.*
23. Pumpkin seed, *Eupomotis gibbosus*.*
24. Blue gill, *Lepomis pallidus*.*
25. Ling, *Lota maculosa*.*
26. Sculpin, *Cottus ictalops*.*

With this determination of the fish fauna of the Douglas Lake Region and the general distribution of the species in mind, the study of the mortality of the species was begun. To this end one mile of beach was laid off along the east side of South Fishtail Bay (See map, Fig. 2). This section of beach was chosen because it receives the full sweep of the wind from across the entire lake, hence most floating fish, even on the far side of the lake, are eventually beached somewhere within this mile. This strip of beach was gone over each evening and all of the beached fish collected, identified, measured, examined, and buried. The study of the beached fish was continued for a period of 40 consecutive days (July 10 to August 19, 1913), and was supplemented by a study of the beached fish on all shores of the lake. The following table gives the results of the 40 days collecting on the mile of beach:

TABLE NO. 9.

Species.	Smallest.	Largest.	Size of majority of individuals.	Number injured.	Beached while feeding.	Other causes.	Total number beached.
1. Yellow perch, <i>Perca flavescens</i> .	25 m.m.	280 m.m.	100 m.m.	11	71	2,782	2,864
2. Trout perch, <i>Percopsis guttatus</i> .	30 m.m.	120 m.m.	80 m.m.	17		701	718
3. Cayuga shiner, <i>Notropis cayuga</i> .	30 m.m.	120 m.m.	70 m.m.	3		68	91
4. Sucker, <i>Catostomus commersonii</i> .	130 m.m.	400 m.m.	300 m.m.	1		5	56
5. Rock bass, <i>Ambloplites rupestris</i> .	70 m.m.	235 m.m.	140 m.m.	1		24	30
6. Blue gill, <i>Lepomis pallidus</i> .	60 m.m.	220 m.m.	90 m.m.	2		28	30
7. Common shiner, <i>Notropis cornutus</i> .	50 m.m.	195 m.m.	100 m.m.	1		10	19
8. Hudson River shiner, <i>Notropis hudsonius</i> .	30 m.m.	70 m.m.	60 m.m.	1		17	18
9. Small-mouthed black bass, <i>Micropterus dolomieu</i> .	120 m.m.	220 m.m.	140 m.m.	1	10		10
10. Pumpkin seed, <i>Eupomotis gibbosus</i> .	80 m.m.	330 m.m.	200 m.m.	1		9	10
11. Catfish, <i>Ameiurus melas</i> .	150 m.m.	350 m.m.	160 m.m.	3		7	7
12. Log perch, <i>Percina caprodes</i> .	140 m.m.	210 m.m.	150 m.m.	1			3
13. Pickerel-pike, <i>Esox lucius</i> .	80 m.m.	165 m.m.	80 m.m.	1			1
14. Large-mouthed black bass, <i>Micropterus salmoides</i> .	120 m.m.	120 m.m.	165 m.m.	1			1
15. Large-mouthed black bass, <i>Micropterus salmoides</i> .	120 m.m.	120 m.m.	120 m.m.	1			1
Total.				42	82	3,735	3,859

In looking for the causes of death of the fish listed in Table 9, the following are at least to be considered: (1) mechanical injury; (2) injury through attacks of other species, (3) the beaching of individuals while pursuing or swallowing prey, (4) accidental beaching while attempting to escape enemies, (5) disease and parasites.

The total number of individuals of all species showing definite external injuries was low, something less than one-tenth of one per cent, and as may be seen in Table 9 these were distributed rather evenly among the several species in proportion to the total number beached. Many apparently normal fish, free from parasites and without any sign of injury, were beached which may have been killed by wave action either well out in the lake or at the edge of the shoal water where the high waves break.

Few if any specimens showed unmistakable injuries due to the attacks of other species. A few suckers bore circular wounds resembling lamprey marks but these wounds were of such a nature that they might have been due to any of several other causes.

In the "beached while feeding" column only those individuals were listed which were found with prey in the mouth. *Perca flavescens* was the heaviest loser in this way. Seventy-one beached specimens of this species had half-swallowed individuals of *Percopsis guttatus* in their mouths, and the Percopsidae in almost every case were adults. In addition to the specimens taken with prey in the mouth undoubtedly other individuals are beached while pursuing prey. *Catostomus commersonii*, a bottom feeder, is known to come into shallow water at night while feeding and individuals of this species might easily be beached by a sudden storm.

The beaching of small fishes while attempting to escape larger pursuing fishes was on more than one occasion observed. The young suckers, Notropi, and other young fishes are constantly preyed upon by the larger carnivorous species and schools of the small fish are often forced to the shore line by the pursuers. Here an incoming wave completes the beaching.

Parasites certainly play an important part in the death of a large number of the individuals reaching the beach. With very few exceptions all of the *Centrarchidae* beached, i. e. *Ambloplites rupestris*, *Lepomis pallidus* and *Eupomotis gibbosus* were infected in the gill chambers with parasitic Copepods. Often this infection was very heavy although some specimens bore but a few of the gill parasites. Many suckers and Cyprinids contained worm cysts in the body wall and in the skin. The parasitic worms were not examined, but Dr. La Rue (see report of the Director of the Biological Station for 1912) reports a variety of forms and a heavy infection of several species of fish.

It is understood that Table No. 9 does not give complete data on the death rate of the species of the lake but it is considered suggestive. In spite of the fact that many dead fish are eaten by water birds before reaching shore and that the fish successfully caught and eaten by other species can not be estimated, the data in Table 9 indicate a critical size in the life of several species of fishes. Those fishes about two-thirds grown (see table for length of majority of individuals) were most often beached. Again, as might be expected, the species most abundant in the lake proper were represented on the beach by the largest number of individuals. On the other hand those species found in the more restricted habitats were represented by fewer individuals, and those confined to streams by none.

In order that these data might be verified a trip was made covering the entire shore line of the lake of 15 miles in a single day. On this trip all beached fishes were measured, examined and identified. The data collected are given in Table 10.

TABLE NO. 10.

Including a study of the shores about the whole lake (Aug. 3, 1913).

Species.	Average size.	Number.
1. Small-mouthed black bass, <i>M. dolomieu</i>	240 m.m.	1
2. Large-mouthed black bass, <i>M. salmoides</i>	350 m.m.	1
3. Yellow perch, <i>Perca flavescens</i>	103 m.m.	551
4. Pumpkin seed, <i>Eupomotis gibbosus</i>	103 m.m.	1
5. <i>Notropis cayuga</i>	110 m.m.	2
6. Hudson River shiner, <i>Notropis hudsonius</i>	78 m.m.	10
7. Common shiner, <i>Notropis cornutus</i>	107 m.m.	7
8. Cat fish, <i>Ameiurus melas</i>	204 m.m.	11
9. Common yellow sucker, <i>Catostomus commersonii</i>	290 m.m.	177
10. Rock bass, <i>Ambloplites rupestris</i>	132 m.m.	31
11. Log perch, <i>Percopsis guttatus</i>	97 m.m.	72
12. Pike-pickrel, <i>Esox lucius</i>	537 m.m.	5
13. Blue gill, <i>Lepomis pallidus</i>	98 m.m.	10
14. Lake whitefish, <i>A. a. cisco</i>	140 m.m.	2
Total.....		881

NOTE:—Several dead specimens of "Johnny darter" (*Boleosoma nigrum*) were observed lying among the pebbles in the shallows about Grape-vine Point and Fairy Island. Because of their lack of an air-bladder they are not thrown upon the beach as are the other species of dead fish but they remain in their habitat and are for the most part eaten by the crayfish.

The figures in Table 10 show the same relations of species as those in Table 9, the true lake forms being the ones most often beached.

In conclusion it may be said that *Perca flavescens*, *Percopsis guttatus*, *Catostomus commersonii* and *Notropis cayuga* were the forms most often beached.

The writer wishes to thank Dr. Max M. Ellis for suggestions and help in this work.

DRAGONFLIES OF THE DOUGLAS LAKE REGION, MICHIGAN.

ARTHUR T. EVANS

DRAGONFLIES OF THE DOUGLAS LAKE REGION,
MICHIGAN¹.

ARTHUR T. EVANS

A partial list of the Odonata of the Douglas Lake Region (Cheboygan County, Michigan) was prepared by Miss Abigail O'Brien in 1910². This report includes twenty-three species. An opportunity of listing the Odonata of this region more fully was afforded the writer during the summer of 1914 while at the University of Michigan Biological Station on Douglas Lake. The collections date from July 2 to August 21. During the course of the collecting as many individuals of each species were taken as possible. Forty-three species were secured.

The writer wishes to thank Professor Max M. Ellis for suggestions in the preparation of this report; Professor Frank Smith for specimens and records from Indian River; Professor T. D. A. Cockerell for the loan of several reprints; and also the many students at the Biological Station who were kind enough to furnish material for identification.

TOPOGRAPHY OF THE REGION.

The Douglas Lake Region with its small streams, lakes, marshes, and stagnant bogs, together with its forested, burned over, and open areas presents varied and suitable habitats for a number of species of Odonata. Specimens were taken from many habitats, both adults and nymphs being collected. Efforts were made to capture a number of adults which appeared new to the region. These efforts were unsuccessful in several cases, but the aquatic collections yielded nymphs of several species new to the region so that in all a fairly representative series of the Odonata species was secured. Collections were made from the following habitats.

Bessey Creek, one of the small streams flowing into Douglas Lake, forms a very desirable habitat for a number of species. This stream is of uniform width, averaging about fifteen feet. It has an average depth of about two and one-half feet, with a maximum depth of about five feet and a minimum depth of about one foot. For the most part the stream flows through a thickly wooded area with trees overhanging in many places while here and there are open areas. In many places

¹Contribution No. 25 from the University of Michigan Biological Station.
²Rept. Mich. Acad. Sci., 1911, pp. 144-145.

vegetation is common in the stream. The bottom is of decayed vegetable matter with a thick cover of plant debris. The stream flows into the lake through a broad embayment which is well overgrown with reeds and flags.

Maple River, the only outlet to Douglas Lake, is in many ways very different from Bessey Creek. This stream does not flow through a wooded area but through a more open burned-over area. The stream is about twenty feet wide in its widest part and is on an average about two feet deep. Its current is swift but as it flows through a sandy country the water is very quiet. The bottom of this stream is of marl with some vegetation. About two miles from the lake, down the river, collections were made in a situation quite different from the river. The stream at this second station flows through an area from which the trees have been cut or burned as at its source, but the water is swifter and the bed of the stream is of coarse gravel and small rocks.

Bryant's Bog is a relic bog which has been cut off from the lake by the throwing up of a sand-bar. Although the whole bog occupies about ten acres only about one-half an acre is covered by open water. The water is about 18 feet in the shallowest part. The bog has no known outlet, although there is undoubtedly more or less loss of water through the very sandy, porous soil which surrounds it. The small size and great depth of this bog together with its location in a more or less sheltered place makes the water quiet. The dominant plant about the bog is *Chamaedaphne calyculata* (Linnaeus) the so-called "leather leaf." On account of its depth few plants grow from the bottom of the pool although the *Chamaedaphne* grows out into the water about the edge of the bog for several feet. This vegetation in the water makes an excellent habitat for a number of species which are abundant upon the submerged portions. Such species as *Tramea lacerata* Hagen and *Anax junius* Drury were found in numbers in this situation. The low shrubbery and a few large trees near this habitat supply a very desirable foraging ground for a number of the imagos.

Smith's Bog, located about two miles south of the Station, is another situation from which a number of specimens were obtained. The marshy area, although called a bog, is quite different from Bryant's Bog. It is located in an open area of about forty acres, the water covering about ten acres. In the water and about the edge of the bog for about one hundred feet is a thick growth of rushes of several species. There are a few trees standing, and over the whole area are old logs lying in or near the water. The depth of the water is probably not more than four or five feet in the deepest parts. Nymphs were found to be abundant in the water while the adults were also common.

Burt Lake, about one and one-half miles south of Douglas Lake, constitutes another of the habitats from which collections were made. On the north shore of this lake is Reese's Bog which is densely wooded and occupies an area of several hundred acres. This bog has no area completely inundated but the whole is more or less wet and there are several small outlet streams. The tamarack growth over the whole area is very dense with here and there narrow roads passing through it. Collections were made along the shore of the lake as well as along the roads leading through the bog.

North Fishtail Bay, a quiet and shallow little bay on the north shore of Douglas Lake, together with the pools and open areas in the adjoining woods, formed another of the situations collected from. A large number of both nymphs and adults were collected from this habitat.

From the shallow waters along the shore of the lake near camp and about the docks a number of species were secured which were not found elsewhere. Also the aspens near the Station were found to contain adults, some of which were seen nearly a mile from the water.

TAXONOMY.

Keys have been made for all species collected and all previously reported from the region, except those included in the difficult genus *Enallagma* Charpentier. Where a genus includes more than one species in the Douglas Lake Region, a key for the various species collected and previously reported is offered. Under the species head short discussions of the habitats, time of appearance, and abundance are given when the data were obtained. The nomenclature offered by Muttkowski³ is followed. Free use has been made of certain other published reports on Odonata (see bibliography) to which the writer wishes to acknowledge his obligations.

KEY TO THE SUBORDERS AND FAMILIES OF THE ODONATA OF THE DOUGLAS LAKE REGION (MICHIGAN).

Imagos.

- A. Front and hind wings similar in outline, spatulate and distinctly narrowed at the base, not held horizontally when at rest; head much wider than long; whole insect of a more or less trail appearance.

Suborder ZYGOPTERA

- B. Wings rich black or dusky brown, or if hyaline with bright red or brown areas at the bases.

Family Agrionidae

- BB. Wings hyaline—bluish or transparent.

Family Coenagrionidae

³Bull. Public Mus. Milwaukee, I, 1910-1911, pp. 1-208.

- AA. Front and hind wings dissimilar, held horizontally when at rest.
Suborder ANISOPTERA
- C. Triangles of the front and hind wings similar, first and second series of anti-cubitals not coinciding, except the first and another thick one.
Family Aeshmidae
- CC. Triangles of the front wings, with the long axis of the triangle at right angles to the long axis of the wings; triangles of the hind wings with the long axis coinciding with the axis of the wing.
Family Libellulidae
- Nymphs.*
- A. Last abdominal segment with terminal, leaf-like gills.
Suborder ZYGOPTERA
- B. Basal segment of the antennae much elongated.
Family Agrionidae
- BB. Basal segment of the antennae short.
Family Coenagrionidae
- AA. Last abdominal segment ending in five, short, spine-like appendages.
Suborder ANISOPTERA
- C. Labium flat, not concealing the front of the head.
Family Aeshmidae
- CC. Labium spoon-shaped, covering most of the front part of the head.
Family Libellulidae

FAMILY AGRIONIDAE.

KEY TO THE GENERA OF AGRIONIDAE.

Imagos.

- A. Imagos with wings of a rich black or dusky brown color; basal spaces in all of the wings without cross veins.
Agrion
- AA. Imagos with large red or brown areas at the bases of the wings, if the wings are hyaline, basal spaces with cross veins.
Hetaerina

Nymphs.

- A. Median cleft of the median labial lobe extending far below the base of the lateral labial lobes.
Agrion
- AA. Median cleft of the median labial lobe not extending below the base of the lateral labial lobes.
Hetaerina

GENUS *AGRION* FABRICIUS.*Imagos.*

- A. Apical third of the hind wings black or cloudy.
A. aequabile
- AA. Wings uniformly black or smoky brown.
A. maculatum

Nymphs.

- A. Basal segments of the antennae one-third longer than the head is wide.
A. aequabile
- AA. Basal segment of the antennae equal to or less than the width of the head.
A. maculatum

Agrion aequabile (Say). Pl. IX, Fig. B.—Adults and nymphs of this species were taken on Bessey Creek, and at the station on Maple River, about two miles down stream from the source. Although a number of both adults and nymphs were taken in both situations the adults were rather uncommon on Maple River. The nymphs in general were found clinging to the vegetation in the stream, seeming to prefer the swifter parts.

Agrion maculatum Beauvois. Pl. IX, Fig. D.—This species was taken in both the adult and nymph stages in the same situations as *Agrion aequabile*. The adult with its handsome black or smoky wings is easily distinguished when once seen, while the nymph with its sprawling legs is easily recognized.

GENUS *HETAERINA* HAGEN.

Hetaerina americana Fabricius. Pl. IX, Fig. A.—None of the nymphs of this beautiful dragonfly were collected but adults were taken by Dr. Max M. Ellis at the station some distance down Maple River. The brilliant red at the bases of the wings of the males and the pale brown at the bases of the wings of the females will distinguish this species at once.

FAMILY COENAGRIONIDAE.

KEY TO THE SUBFAMILIES OF COENAGRIONIDAE.

Imagos.

- A. Vein M_3 arising from vein M_1 and 2 nearer the arculus than the nodus.
Subfamily Lestinae
- AA. Vein M_3 arising from vein M_1 and 2 nearer the nodus than the arculus.
Subfamily Coenagrioninae

Nymphs.

- A. Lateral labial lobes trifid at the distal end, movable hook of the labium bearing raptorial setae.
Subfamily Lestinae
- AA. Lateral labial lobes bifid at the distal end, movable hooks of the labium without raptorial setae.
Subfamily Coenagrioninae

SUBFAMILY LESTINAE.

A single genus, *Lestes*, is known from the subfamily Lestinae at Douglas Lake. Since the females of the genus are so very much alike no key has been made to distinguish them, the following key being only for the determination of the males. Also no key has been made for the determination of the nymphs as their great similarity makes identifica-

tion very difficult. It might be well to state that *L. forcipata* and *L. rectangularis* have either five or six raptorial setae while *L. unguiculata* and *L. uncatu* normally have seven setae. There seems to be no very definite way to distinguish between each of the two species which have been thus separated. The nymph of *L. disjuncta*, the only other species of *Lestes* known from Douglas Lake, is unknown.

GENUS *LESTES* LEACH.*Imagos.*

- A. Males metallic green.
 B. Inferior appendages of the male viewed from above exhibiting a sigmoid curve.
L. unguiculatus
 BB. Inferior appendages of the male viewed from above strongly dilated at the apex.
L. uncatu
 AA. Males blackish brown.
 C. Apex of the inferior appendages of the male declined.
L. rectangularis
 CC. Apex of the inferior appendages not declined.
 D. Inferior appendages of the male viewed from above slightly widened at the tip; proximal tooth on the inner edge of the superior appendage larger than the other.
L. forcipatus
 DD. Inferior appendages of the male not widened at the tip; the two teeth on the superior appendage about equal.
L. disjunctus

Lestes rectangularis Say.—A number of adults of this species were taken both from the beach pool, which is located west of North Fishtail Bay, and from Smith's Bog. Nymphs taken from the same habitat as the adults were identified as *L. rectangularis* although they are very similar to *L. forcipata* Rambur.

Lestes forcipatus Rambur.—This species was taken by Miss Abigail O'Brien during the summer of 1910. She reports that a number of adults were taken on August 19 but does not state the locality from which they were secured. No adults were taken in the collections upon which the present report is based, and since the nymphs of this species are so much like those of *L. rectangularis* they were not determined.

Lestes unguiculatus Hagen.—One adult of this species and a number of nymphs were taken on Maple River. The nymphs of this species are very similar to those of *L. uncatu* Kirby.

Lestes uncatu Kirby.—Neither adults nor nymphs were referred to this species although it is possible that some of the nymphs identified as *L. unguiculatus* may be *L. uncatu*. A number of adults were collected by Miss O'Brien in 1910.

Lestes disjunctus Selys.—This species was not taken at Douglas Lake in 1914 but was reported as common in 1910.

SUBFAMILY COENAGRIONINAE

KEY TO THE GENERA OF COENAGRIONINAE.

Imagos.

- A. No postocular spots; dorsum bronzy green. Nehalennia
 AA. Light, round or ovoid, postocular spots.
 B. Sexes unlike in color, female with the orange of the abdomen covering less than the three basal segments of the abdomen; males chiefly black or green with a bifid process on the apical margin of the 10th abdominal segment; pterostigma rhomboidal. Ischnura
 BB. Color of the males and females similar, females somewhat lighter; no upturned bifid process on the apical margin of the 10th abdominal segment. Enallagma

Nymphs.

- A. Labium with one mental setae and a rudimentary second one; antennae six jointed. Nehalennia
 AA. Labium with three to five mental setae; antennae seven jointed.
 B. Labium with four to six lateral setae; usually three mental setae on each side. Enallagma
 BB. Labium with five or six lateral setae; four mental setae. Ischnura

GENUS *NEHALENNIA* SELYS.

Nehalennia irene Hagen.—This species was not taken in any of the collections at Douglas Lake during the summer of 1914 but was reported as common during July and August, 1910.

GENUS *ENALLAGMA* CHARPENTIER.

Two species of this genus, the males of which may be distinguished by the following key, are known from the Douglas Lake region.

Imagos.

- A. Dorsum of segment two blue with an apical black spot. *E. carunculatum*
 AA. Dorsum of segment two black. *E. exulans*

Enallagma carunculatum Morse.—This species was reported to be common in the region throughout the summer of 1910. No habitat data were given.

Enallagma exulans Hagen.—Specimens of these nymphs were taken on Maple River. They were found clinging to the vegetation near shore in very little water. The species has also been found in the water of North Fishtail Bay.

GENUS *ISCHNURA* CHARPENTIER.*Imagos.*

- A. Segments eight and nine of the abdomen blue with a black stripe on each side.
I. verticalis
- AA. Segments eight and nine of the abdomen black.
I. posita

Nymphs.

- A. Labium with six lateral setae on each side.
I. verticalis
- AA. Labium with five lateral setae on each side.
I. posita

Ischnura verticalis (Say).—This species was taken from the swifter water of the station about two miles down Maple River.

Ischnura posita (Hagen).—This species was taken from the same habitat as *I. verticalis*.

FAMILY AESHNIDAE.

This family is represented in the Douglas Lake region by two sub-families.

Imagos.

- A. Eyes distinctly separated above on the middle of the head.
Subfamily Gomphinae
- AA. Eyes meeting above in the middle line of the head.
Subfamily Aeshninae

Nymphs.

- A. Antennae four jointed, broad and flat; superior appendage not notched at the apex.
Subfamily Gomphinae
- AA. Antennae six or seven jointed; superior appendage notched at the apex.
Subfamily Aeshninae

SUBFAMILY GOMPHINAE.

Imagos.

- A. Both triangles with a cross vein
Gomphoides
- AA. Both triangles without a cross vein, (except the discoidal triangle in Hagenius).
B. First and second anal veins angulated toward each other at the cross vein of the anal loop, which contains from three to five cells.
C. Discoidal triangle without cross veins; anal loop three celled.
Ophiogomphus
- CC. Discoidal triangle four sided, with cross veins; anal loop three to five, usually four celled.
Hagenius
- BB. First and second anal veins nearly parallel; anal loop one or two celled.
D. Hind femora with five to seven long spines in addition to the usual short ones.
Dromogomphus
- DD. Hind femora with the usual short spines but with no long ones.
Gomphus

Nymphs.

- A. Middle legs closer together at the base than the fore ones; inner wing cases strongly divergent.
Gomphoides
- AA. Middle legs as far apart as the fore ones.
B. Inner wing cases strongly divergent.
Ophiogomphus
- BB. Inner wing cases parallel.
C. Third antennal joint flat, subcylindrical or broadly oval; body broad and flat.
Hagenius
- CC. Third antennal joint subcylindrical, more than twice as long as thick.
D. Dorsal hooks short but with acute spiny tips.
Dromogomphus
- DD. Dorsal hooks sometimes present, but obtusely pointed, usually absent excepting a median tooth on the ninth segment.
Gomphus

GENUS *GOMPHOIDES* SELYS.

Gomphoides obscurus (Rambur).—The nymphs of this species were taken at the station on Maple River about two miles below the source. They seem to prefer the swifter parts of the stream, clinging to and crawling over the vegetation and rocks.

GENUS *HAGENIUS* SELYS.

Hagenius brevistylus Selys. Pl. IX, Fig. F.; Pl. X, Figs. B, D.—Nymphs of this queerly designed species were taken many times during the summer. They were found in Maple River, Bessey Creek and in the beach pool near North Fishtail. The nymphs were taken from the first layers of ooze along the bottom. No adults were taken.

GENUS *OPHIOGOMPHUS* SELYS.

Ophiogomphus carolus Needham.—Nymphs of this species were found only in Maple River. Like those of *Gomphoides obscurus* they were found in the relatively swift water on submerged vegetation, logs and rocks. No adults were taken.

GENUS *GOMPHUS* LEACH.*Imagos.*

- A. Face entirely yellow.
B. Tibia yellow externally; posterior abdominal segments not dilated.
G. spicatus
- BB. Tibia black externally.
C. Posterior end of the abdomen dilated.
G. ventricosus
- CC. Posterior end of the abdomen not dilated.
G. descriptus

- AA. Face transversely banded with black.
 D. Yellow of the thoracic dorsum reduced to two narrow, oblique, isolated, yellow stripes.
G. scudderi
 DD. Yellow stripes of the thoracic dorsum broader; anterior face of the hind femora yellow.
G. vastus

Nymphs.

In the following key *Gomphus ventricosus* is not included since the nymph of that species is unknown.

- A. Four pairs of lateral spines.
 B. Dorsal hooks more or less apparent on segments two or three to nine.
G. descriptus
 BB. Dorsal hooks represented only by teeth on the posterior margins of eight and nine.
 CC. Lateral spines on nine about as long as the tenth segment.
G. vastus
 CC. Lateral spines on the ninth segment about half as long as segment ten.
G. scudderi
 AA. Three pairs of lateral spines, the first pair very small.
G. spicatus

Gomphus spicatus Hagen.—Nymphs of this species were taken in Maple River near its source. Their habitat is probably the stream vegetation. No adults were taken.

Gomphus ventricosus Walsh.—This species was reported from the region in 1910 but did not occur in any of the 1914 collections.

Gomphus descriptus Banks.—Only the nymphs of this species were taken at one station on Maple River.

Gomphus scudderi Selys.—This species was not taken in 1914 although adults were reported from the region in 1910.

Gomphus vastus Walsh.—Nymphs of this species were taken in Bessey Creek where they seemed to prefer the bottom of the stream and the lower parts of the vegetation.

SUBFAMILY AESHNINAE.

Large numbers of nymphs representing six of the eight species of this subfamily found in the Douglas Lake region were collected, but the adults of only four species were taken. These species *Epiaeschna heros* (Fabricius), *Basiaeschna janata* (Say), *Aeshna constricta* Say and *Anax junius* Drury were very common.

Imagos.

- A. Upper part of the arculus equal to or longer than the lower part; anal loop five to seven sided.
 B. Radial sector forked.
 C. Radial sector forked near the middle.
Epiaeschna
 CC. Radial sector forked beyond, i. e. apicad to the middle.
Aeshna

- BB. Radial sector not forked.
 D. Space between the arculus and the base of the wing crossed by from two to six cross veins; anal triangle, in the male, three to five celled.
Boyeria
 DD. Space between the arculus and the base of the wing free or crossed by but a single cross vein.
Basiaeschna

- AA. Upper part of the arculus shorter than the lower; the upper sector rising about midway between the lower sector and the median vein above.
Anax

Nymphs.

- A. Five pairs of lateral spines.
 B. Antennae six jointed.
Epiaeschna
 BB. Antennae seven jointed.
 C. Lateral labial lobes scarcely tapering, subtruncate at the tip.
Boyeria
 CC. Lateral labial lobes tapering to an incurved tooth.
Basiaeschna
 AA. Three or four pairs of lateral spines.
 D. Four pairs of lateral spines, the anterior pair small.
Aeshna
 DD. Three pairs of well developed spines.
Anax

GENUS *EPIAESCHNA* HAGEN.

Epiaeschna heros (Fabricius).—Adults of this large species were common throughout the summer in various habitats. These dragonflies were found along Maple River and Bessey Creek, about the bogs, over the lake, about a mile from shore, and back in the aspens a mile or more from water. One specimen was taken about seven-thirty p. m., in the late twilight, as it was flying swiftly about one of the roads through Reese's Bog. Adults of this species were especially abundant in the vicinity of Smith's Bog.

GENUS *BOYERIA* MACLACHLAN.

Boyeria vinosa (Say).—The nymphs of this species were taken in numbers from the submerged vegetation at Bryant's Bog. No adults were captured.

GENUS *BASIAESCHNA* SELYS.

Basiaeschna janata (Say).—The nymphs of this dragonfly were found on vegetation in Bessey Creek and the adults were caught along both Maple River and Bessey Creek.

GENUS *AESHNA* FABRICIUS.

Imagos

- A. Anal triangle of the hind wing of the male usually consisting of three cells; genital valve of the female strongly elevated at the apex.

A. constricta

- AA. Anal triangle of the hind wing of the male usually consisting of two cells; genital valve of the female not strongly elevated at the apex.
 B. A black line on the fronto-nasal suture; hamular processes short and broad.

A. interrupta

- BB. No black line on the fronto-nasal suture.

*A. canadensis**Nymphs.*

- A. Mentum of the labium distinctly more than half as broad at the base as at the apex.
 B. Lateral labial lobes squarely truncate, the outer apical angle scarcely rounded.

A. interrupta

- BB. Lateral labial lobes not truncate, but curving to a prominent, apical hook.

A. canadensis

- AA. Mentum of the labium not, or scarcely, half as broad at the base as at the apex.

A. constricta

Aeshna constricta Say.—Nymphs of this species were taken in Bessey Creek and Bryant's Bog. Prof. Frank Smith also collected several specimens in Indian River, the outlet, at the extreme southern end of Burt Lake about nine miles from my Burt Lake station.

Aeshna interrupta Walker.—This species was reported from Douglas Lake in 1910, one specimen being taken on August 18.

Aeshna canadensis Walker.—This species was reported common to the region during the summer of 1910. Neither nymphs or adults were taken during the summer of 1910.

GENUS ANAX LEACH.

Anax junius (Drury). Pl. IX, Fig. E.; Pl. X, Figs. E, F.—Both adults and nymphs of this dragonfly were common all summer. Nymphs were taken from the submerged vegetation at Smith's Bog, Bryant's Bog and the beach pool near North Fishtail Bay, usually in water which was relatively quiet. The adults of the species were taken in various situations about the water as well as in the aspens near the lake.

GENUS DROMOGOMPHUS SELYS.

Dromogomphus spinosus Selys.—One specimen of this species, undergoing exuviation, was taken on the dock near camp.

FAMILY LIBELLULIDAE.

KEY TO THE SUBFAMILIES OF LIBELLULIDAE.

Imagos.

- A. Sectors of the arculus distinctly separated. Subfamily Cordulinae
 AA. Sectors of the arculus in close proximity or completely fused for a short distance from the arculus. Subfamily Libellulinae

Nymphs.

- A. Lateral abdominal appendages more than half as long as the inferiors; hind femora longer than the head is wide. Subfamily Cordulinae
 AA. Lateral abdominal appendages less than half the length of the inferiors; hind femora generally as long as the head is wide. Subfamily Libellulinae

Subfamily Cordulinae.

KEY TO THE GENERA OF CORDULINAE.

Imagos.

- A. Triangle of the hind wing placed considerably beyond the arculus. *Macromia*
 AA. Triangle of the hind wing retracted to the level of the arculus or even passing it.
 B. Triangle of the hind wing with a cross vein. *Epicordulia*
 BB. Triangle of the hind wing without a cross vein. *Tetragoneuria*
 C. Wings with black basal markings.
 CC. Wings clear. *Cordulia*

Nymphs.

- A. Head with a prominent, pyramidal horn. *Macromia*
 AA. Head without a prominent, pyramidal horn.
 B. Lateral setae four or five. *Epicordulia*
 BB. Lateral setae seven. *Tetragoneuria*
 C. Abdomen with large dorsal hooks.
 CC. Abdomen without dorsal hooks. *Cordulia*

GENUS MACROMIA RAMBUR.

Macromia illinoensis Walsh. Pl. IX, Fig. C; Pl. X, Fig. A.—This spider-like nymph was only taken twice, once on Maple River and once in the shallow water along the lake shore near camp. The nymphs taken on Maple River were from vegetation along the shore but the specimens taken at camp (these may have been wave-washed individuals) were found on the piles of the dock. No adults were taken.

GENUS EPICORDULIA SELYS.

Epicordulia princeps (Hagen).—This species was found to be rather rare, only a few nymphs occurring in the collections from Maple River.

GENUS TETRAGONEURIA HAGEN.

Tetragoneuria spinoso (Hagen).—Nymphs of this species were taken in Maple River, Bryant's Bog, and the beach pool west of North Fish-

tail Bay. They were found among the submerged vegetation in fairly deep water. No adults were secured. The eggs of this species, which are laid in strings, were found attached to aquatic vegetation both in North Fishtail Bay and at the mouth of Bessey Creek.

GENUS *CORDULIA* LEACH.

Cordulia shurtleffi Scudder.—Nymphs of this species were taken in Bessey Creek although they appear to be rather uncommon, judging from the number appearing in the collections. These nymphs were found along the shore in debris of various sorts.

Subfamily *Libellulinae*.

KEY TO THE GENERA OF LIBELLULINAE.

Imagos.

- A. Triangle of the fore wing not placed distinctly beyond the level of the apex of the triangle of the hind wing; ends of pterostigma not distinctly divergent.
 - B. Sectors of the arculus, veins M_1 to 3 and M_4 , in the fore wing more or less completely fused for a short distance beyond the arculus; triangle of the fore wing not greatly produced posteriorly, normally containing but a single cross-vein.
 - C. Vein Cu_1 of the hind wing departing from the triangle at the hind angle.
 - D. Sectors of the arculus contiguous but incompletely fused for a distance beyond the arculus; wings generally spotted with yellow or reddish brown.
 - DD. Sectors of the hind wing distinctly fused for a distance beyond the arculus.
 - Celithemis
 - Sympetrum
 - CC. Vein Cu_1 of the hind wing migrating a little way up the outer side of the triangle.
 - Pachydiplax
 - BB. Sectors of the arculus of the fore wing contiguous but not completely fused beyond the point of their departure from the arculus.
 - Libellula
- AA. Triangle of the fore wing placed distinctly beyond the level of the apex of the triangle of the hind wing.
 - Tramea

Nymphs.

- A. Basal segment of the hind tarsus more than half as long as the second segment.
 - B. No dorsal hooks.
 - Pachydiplax
 - BB. With dorsal hooks at least on the middle abdominal segments.
 - C. Abdomen ovate.
 - D. Lateral spines long and straight.
 - Celithemis
 - DD. Lateral spines short and more or less incurved.
 - Sympetrum
 - CC. Abdomen lanceolate; five to ten lateral setae.
 - Libellula
 - AA. Basal segment of the hind tarsus only half as long as the second segment; lateral setae ten or more.
 - Tramea

GENUS *CELITHEMIS* HAGEN.

Celithemis eponina (Drury).—Nymphs of this species were collected in the aquatic vegetation in Bessey Creek. Their frequent appearance in collections from Bessey Creek marks the species as a rather common form. No adults were taken.

GENUS *SYMPETRUM* NEWMAN.*Imagos.*

- A. Superior appendages of the male with a prominent, inferior, median tooth; vulvar lamina of the female divided by a median cleft into two lobes.
 - B. Wings with the basal half flavescent.
 - S. assimilatium*
 - BB. Wings flavescent only at the extreme base, or at least not beyond the nodus.
 - C. Branches of the genital hamules of the male enclosing an oval notch, outer branch twice as stout as the inner, both equally curved.
 - D. Median inferior tooth of the superior male appendages bearing two or three minute teeth and preceded by four large coarse teeth; inferior appendage of the male with a terminal recurved hook.
 - S. scoticum*
 - DD. Median inferior tooth of the superior male appendages simple, and preceded by three coarse teeth; terminal hook of the inferior appendage not recurved.
 - S. rubicundulum*
 - CC. Branches of the genital hamules of the male enclosing a short rounded notch, the inner branch more sharply incurved, the outer branch about four times as thick as the inner.
 - S. obtrusum*
 - AA. Superior appendages of the male without a prominent, inferior, median tooth, but with several small, inferior, subequal, pointed denticles, wings flavescent only at the base.
 - S. costiferum*

Nymphs.

- A. Dorsal hooks of abdominal segments six to eight long and sharp, about as long as their respective segments; lateral spines straight.
 - S. costiferum*
- AA. Dorsal hook of abdominal segments six to eight shorter than the segments bearing them and less pointed than in the preceding species.
 - S. assimilatium*
 - S. rubicundulum*
 - S. obtrusum*

Owing to the incompleteness of the knowledge of the nymphs in this genus the above key gives the diagnostic characters of but one species. No description of the nymph of *S. scoticum* (Donovan) was found.

Sympetrum assimilatium (Uhler).—Reported from the region in 1910, a male and female being taken *in coitu*, as well as a number of other specimens.

Sympetrum rubicundulum (Say).—This species was common near North Fishtail Bay and at Smith's Bog. Adults were abundant in a little relic bog near North Fishtail. Nymphs were taken in numbers from Bessey Creek, the North Fishtail beach pool and at Smith's Bog.

Sympetrum scoticum (Donovan).—Reported on August 11, 1910. No habitat data given.

Sympetrum obstrusum (Hagen).—This species was reported as common in the region from July 23 to August 20, 1910. No habitat data were given. It was not included in the 1914 collections.

Sympetrum costiferum (Hagen).—Reported in 1910.

GENUS *PACHYDIPLAX* BRAUER.

Pachydiplax longipennis (Burmeister).—One nymph of this species was collected about two miles down stream from the lake in Maple River, where it was found among trash and vegetation along the shore.

GENUS *LIBELLULA* LINNE.

KEY TO THE SPECIES OF *LIBELLULA*.

- Imagos.*
- A. Wings with no nodal spots. *L. cyanea*
 - AA. Wings with large nodal spots. *L. pulchella*
- Nymphs.*
- A. Dorsal hooks on the seventh and eight abdominal segments long and sharp; lateral setae six. *L. cyanea*
 - AA. Dorsal hooks on the seventh and eighth abdominal segments rudimentary; lateral setae eight or nine. *L. pulchella*

Libellula cyanea Fabricius.—The nymphs of this species were collected at the station on Maple River about two miles down from the lake. They were taken among trash along shore.

Libellula pulchella Drury.—This species was taken in both the nymph and the adult stages. They were found common about North Fishtail Bay as well as on Maple River. The nymphs were taken in trashy situations along the shore; the adults flying about near the shore.

GENUS *TRAMEA* HAGEN.

Tramea lacerata Hagen.—Nymphs of this species were among the most common forms collected. A single dip of the net through the submerged vegetation in Bryant's Bog would usually yield twenty or more of the nymphs. The nymphs were also found in both Smith's and Reese's Bogs. Although large numbers of nymphs were collected no adults were obtained.

DISCUSSION AND SUMMARY.

The suborder *Anisoptera*, which contains some of the largest and most handsome dragonflies, includes the majority of species of Odonata at present known from the Douglas Lake Region. (See Table 1). Of the forty-three species which have been collected in the region thirty are Anisoptera. The nymphs of the *Anisoptera* occupy every type of habitat suitable for Odonata from the stagnant bog to the swiftly flowing streams, and adults of this group were found flying about through the aspens a mile or more from water as well as some distance from the shore over the lake. In general the adults of *Anisoptera* are very alert and so active on the wing that their capture in many cases is almost impossible. On the other hand, however, in certain places which were infrequently visited, as Smith's Bog, the adults seemed less shy and were easily captured as they hovered before one.

TABLE 1.—SUMMARY OF SPECIES.

Suborder ZYGOPTERA.....	13		
I. Agrionidae.....		5	
1. <i>Agrion</i>			2
2. <i>Hetaerina</i>			1
II. Ceonagrionidae.....		10	
3. <i>Lestes</i>			5
4. <i>Nehalennia</i>			1
5. <i>Ischnura</i>			2
6. <i>Enallagma</i>			2
Suborder ANISOPTERA.....	30		
III. Aeschnidae.....		16	
7. <i>Gomphoides</i>			1
8. <i>Hagenius</i>			1
9. <i>Ophiogomphus</i>			1
10. <i>Gomphus</i>			5
11. <i>Epiaeschna</i>			1
12. <i>Boyeria</i>			1
13. <i>Basiaeschna</i>			1
14. <i>Aeshna</i>			3
15. <i>Anax</i>			1
16. <i>Dromogomphus</i>			1
IV. Libellulidae.....		14	
17. <i>Macromia</i>			1
18. <i>Epicordulia</i>			1
19. <i>Tetragoneuria</i>			1
20. <i>Cordulia</i>			1
21. <i>Celithemis</i>			1
22. <i>Sympetrum</i>			5
23. <i>Pachydiplax</i>			1
24. <i>Libellula</i>			2
25. <i>Tramea</i>			1
Total.....			43

In connection with the above table it is interesting to note that the forty-three species listed represent a rather rich Odonata fauna for the region studied, since Williamson⁴ records but eighty-three species (forty-three Zygoptera and forty Anisoptera) from the entire state of

⁴Rept. Ind. Dept. Geol. Nat. Resources, 1900, p. 233.

Indiana and Muttkowski⁵ records four hundred ninety-four species and subspecies from North America.

The data gathered, coming from varied habitats as they do, make possible an ecological study of the nymphs. These habitat relations have been incorporated in Table 2.

TABLE 2.—HABITAT PREFERENCES OF THE NYMPHS COLLECTED.

Species.	Vegetation.	No vegetation.	Bottom.		Water.		
			Muck.	Sand.	Rapid.	Slow.	Still.
ZYGOPTERA							
<i>Agrion maculatum</i>							
<i>Agrion aequabile</i>	X						
<i>Hetaerina americana</i>	X		X		X		X
<i>Lestes rectangularis</i>	X		X		X		X
<i>Lestes unguiculata</i>	X	X		X	X		X
<i>Lestes disjuncta</i>	X						X
<i>Lestes uncata</i>							X
<i>Lestes forcipatus</i>							X
<i>Enallagma carunculatum</i>							
<i>Enallagma exilans</i>	X						
<i>Ischnura posita</i>						X	
<i>Ischnura verticalis</i>	X	X		X	X	X	
<i>Nehalennia irene</i>	X	X		X	X	X	
ANISOPTERA							
<i>Gomphoides obscurus</i>							
<i>Hagenius brevistylus</i>		X	X	X	X	X	
<i>Ophiogomphus carolus</i>		X	X	X	X	X	
<i>Gomphus ventricosus</i>		X	X	X	X	X	
<i>Gomphus spicatus</i>							
<i>Gomphus vastus</i>	X	X	X		X		
<i>Gomphus descriptus</i>	X	X	X	X			
<i>Gomphus scudderi</i>	X	X	X	X			X
<i>Epiaeschna heros</i>					X	X	
<i>Boyeria vinosa</i>	X		X				
<i>Basiaeschna janata</i>	X				X		
<i>Aeshna constricta</i>	X		X			X	X
<i>Aeshna canadensis</i>	X		X	X		X	X
<i>Aeshna interrupta</i>			X			X	X
<i>Anax junius</i>							
<i>Dromogomphus spinosus</i>	X						
<i>Macromia illinoensis</i>		X	X	X	X	X	X
<i>Epicordulia princeps</i>		X	X	X		X	
<i>Tetragoneuria spinosa</i>	X	X	X	X	X	X	
<i>Cordulia shurtleffi</i>	X	X	X		X	X	
<i>Celithemis eponina</i>	X	X	X		X	X	X
<i>Sympetrum rubicundulum</i>	X	X	X		X	X	X
<i>Sympetrum assimilatatum</i>		X	X		X	X	
<i>Sympetrum obtusum</i>						X	
<i>Sympetrum costiferum</i>							
<i>Sympetrum scoticum</i>							
<i>Pachydiplax longipennis</i>	X						
<i>Libellula pulchella</i>	X	X	X	X	X	X	X
<i>Libellule cyanea</i>	X	X	X	X	X	X	X
<i>Tramea lacerata</i>	X	X	X	X		X	X
	25	20	22	14	15	20	16

It is to be noted that this table lacks data for twelve species which are known from the Douglas Lake Region.

Table 2 shows rather well the vertical distribution within the habitats and the habitat preferences. In general it may be said that the *Aesh-*

⁵Bull. Public Mus. Milwaukee, I, 1910-11, p. 6.

ninae are found almost entirely in and on the submerged aquatic vegetation or on objects not covered with mud. The nymphs were almost without exception clean, brightly colored and active. The *Gomphinae*, on the other hand, were usually found in numbers on a mud bottom in the top layers of the ooze. Specimens were, however, occasionally captured on vegetation, logs or other floating objects, a fact which might be explained as a preparation for the moulting attendant to transformation. Gomphid nymphs were almost always dully colored and more or less incrustated with mud and algae. The Libellulids were usually found in the trash and debris on the bottom of the stream or among the lower parts of the vegetation. Their preference for such situations is also shown by the large number of mud-incrustated specimens of this group collected. Some species of this family, for example, *Tramea lacerata*, were taken in water less than two feet deep at Bryant's Bog. The great depth of the water in the center of this bog, where it exceeds twenty-five feet, may account for these nymphs being nearer to the surface, clinging to the aquatic vegetation.

Without exception the Zygoptera of the region were found in aquatic vegetation rather near the surface of the water. The nymphs of some species, for example *Agrion aequabile*, frequent the swiftest parts of small streams. The preference of the Zygoptera nymphs for surface situations or rapidly moving streams may be a corollary of the oxygen relations. In this connection it was observed that the Gomphid nymphs have a very characteristic way of holding the posterior end of the abdomen turned up at a very decided angle. This habit, together with their mud-burrowing habit and the length of the tenth abdominal segment, which segment in many cases is much longer than the ninth segment, might be interpreted as an adaptation for securing a better supply of oxygen. The top layers of ooze through which the nymphs crawl generally contain decaying animal and vegetable matter from which more or less carbon dioxide is discharged; thus a nymph would be able to get more water and hence more oxygen if the end of the abdomen could be extended upward above the ooze.

University of Colorado,
October 24, 1914.

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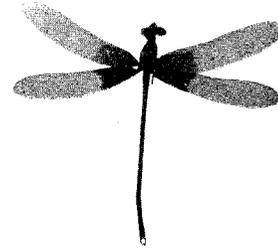
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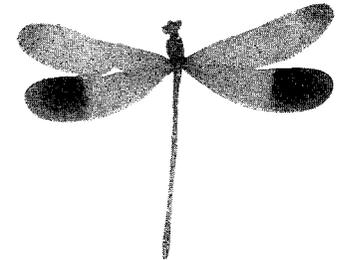
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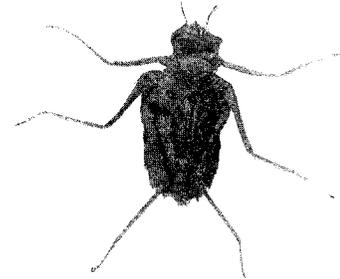
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Plate IX.



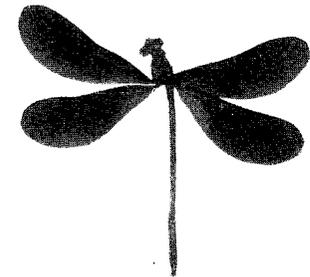
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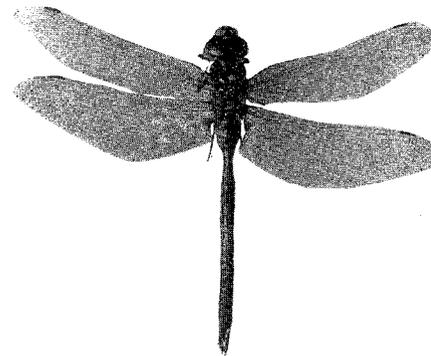
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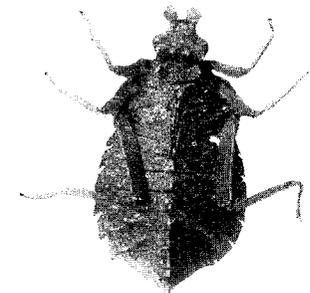
C.



D.



E.



F.

FIGURE A, ADULT OF *HETAERINA AMERICANA* (FABRICIUS).

FIGURE B, ADULT OF *AGRION AEQUABILE* (SAY).

FIGURE C, NYMPH OF *MACROMIA ILLINOIENSIS* WALSH.

FIGURE D, ADULT OF *AGRION MACULATUM* BEAUVAIS.

FIGURE E, ADULT OF *ANAX JUNIUS* (DRURY).

FIGURE F, NYMPH OF *HAGENIUS BREVISTYLUS* SELYS.

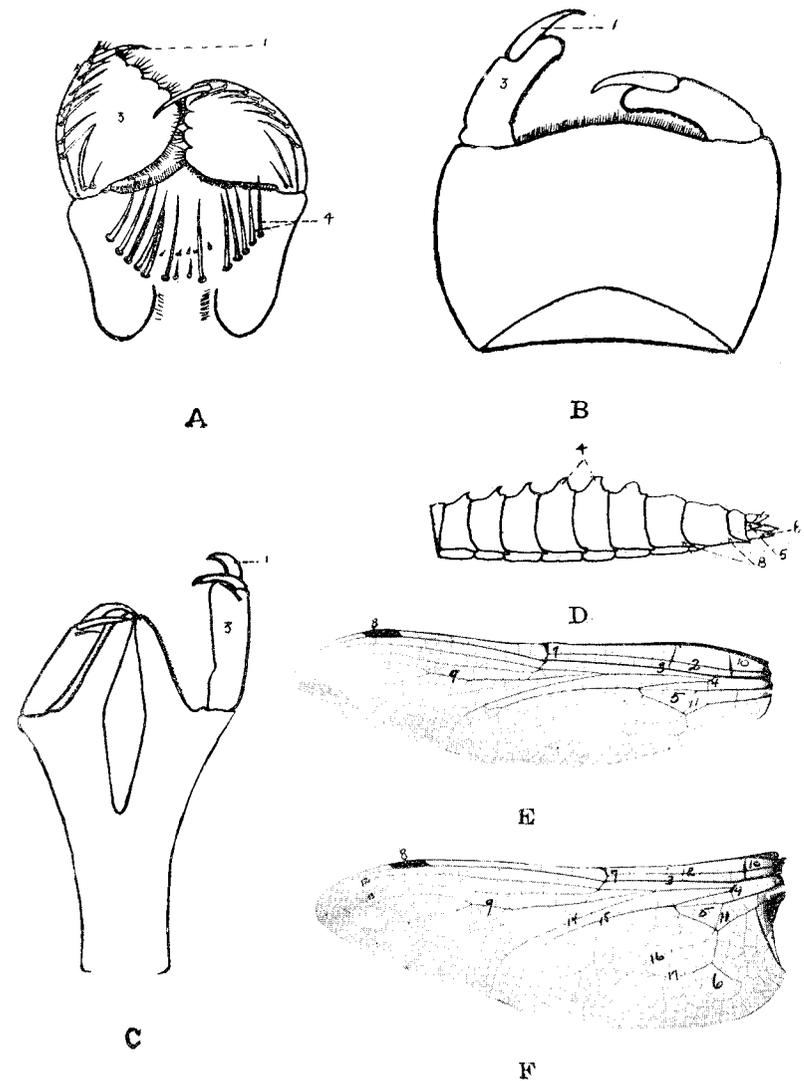


FIGURE A, LABIUM OF A NYMPH OF *MACROMIA ILLINOIENSIS* WALSH.
FIGURE B, FIGURE OF *HAGENIUS BREVISTYLUS* SELYS.
FIGURE C, FIGURE OF THE LABIUM OF *AGRION AEQUABILE* (SAY).
FIGURE D, SIDE VIEW OF THE ABDOMEN OF *HAGENIUS BREVISTYLUS* SELYS.
FIGURES E AND F, FORE AND HIND WINGS OF *ANAX JUNIUS* (DRURY).

THE REPTILES AND AMPHIBIANS OF MONROE COUNTY,
MICHIGAN.

CRYSTAL THOMPSON.

THE REPTILES AND AMPHIBIANS OF MONROE COUNTY, MICHIGAN.

CRYSTAL THOMPSON.

An expedition was sent by the Michigan Biological Survey into Monroe County during the summer of 1913 to determine the reptile-amphibian fauna of the county and to gather additional data on these groups in the southeastern part of the state.

Monroe County lies in the extreme southeastern corner of Michigan and is bordered entirely on the east by Lake Erie—which forms the outlet for the drainage system. The county as a whole is a flat plain sloping very gently to the southeast, the principal stream being the River Raisin which flows in a generally southeasterly direction and empties into the lake about 4 miles east of the city of Monroe.

Collecting was first carried on along the shores of Lake Erie, in the vicinity of Monroe Piers, and later in the summer along the river about four miles west of the city of Monroe. At Monroe Piers there is a narrow strip of sand beach back of which are hundreds of acres of overflowed marsh land. This strip of beach is partly covered with vegetation, there are a few large trees and the whole is over-run with wild grape vines. The water averages perhaps three or four feet in depth in the marshes, which are grown up with water plants. Occasionally throughout the marshes are small areas of higher land, and the bed of an electric line running out to the Piers forms a strip of dryer ground.

The region worked above Monroe is a thickly settled farming country with very little uncultivated land. About one-half mile north of the river and running parallel with it for several miles is a stretch of woodland—portions of which are not pastured or otherwise disturbed. A few small streams enter the river on the north and on the south, but with the exception of a few ponds in an old limestone quarry at Grape there are no ponds or lakes in the region worked.

The reptile-amphibian fauna is limited now, both in species and individuals. Fourteen species were taken of which six were amphibians and eight reptiles. Several features have combined to cause a scarcity of these groups. Storms are very frequent along the lake shore and during the winter and spring months the strip of sand beach is frequently entirely submerged—destroying much of the animal life. Water birds are abundant and no doubt consume great numbers of

frogs and snakes in a season; many of the amphibians taken are badly mutilated. The frogs are hunted incessantly by fishermen for bait and food and all snakes are considered harmful and killed at sight. Practically the same conditions prevail up the river. The farmers are especially zealous in their attack on snakes. The country is thickly settled—has been cultivated for years and at the present time there is very little land that remains undisturbed for more than a season. Raccoons are common in the country west of Monroe and the small streams are bordered with paths made by them in their search for food which consists partly of amphibians. The fact that there are practically no permanent ponds, those formed in the spring existing only for a very short time, means that breeding conditions are unfavorable for forms which congregate in such places to breed.

LIST OF SPECIES.

Amphibia.

1. *Necturus maculosus* Rafinesque.—A single specimen was found dead on the beach after a hard storm. The fishermen report that this species is commonly taken in the spring in their nets in the lake and that it is also frequently caught in dip nets in the river at that season.
2. *Bufo americanus* LeConte.—Nine specimens were taken, eight of which were collected along the sand beach, where they seem to be common. Only one was seen up the river. The numerous insects on the beach furnish an abundance of food.
3. *Acris gryllus* LeConte.—The call of the cricket frog was heard in the swamp back of the sand beach at the Piers but none were observed there. Seven specimens were collected from the grass at the edge of the ponds in the quarry at Grape.
4. *Chorophilus nigrilis* (LeConte).—A single specimen was taken under the bark of a fallen tree in a damp woods one-half mile north of the river and about four miles west of Monroe.
5. *Rana pipiens* Shreber.—The leopard frog is the most common amphibian of the region, although it is not present in large numbers. Thirty specimens were taken of which seventeen were collected in the marshes and along the shore of Lake Erie in the immediate vicinity of Monroe Piers. In this region they seemed to prefer the marshes and railroad embankment and were found in smaller numbers on the sand beach. West of Monroe they were collected in all of the habitats examined.
6. *Rana clamitans* Latreille.—A single specimen was taken at night

from a pond at Grape. Several others were heard at various times but they were not common.

Sauria.

7. *Eumeces quinquilineatus* (Linnaeus).—Seven individuals were taken in a woods one-half mile north of the river. The woods are apparently little disturbed and there are many fallen trees, old stumps and decaying logs. Three of the number are old individuals, and four are very recently hatched young.

Serpentes.

8. *Storeria dekayi* (Holbrook).—This species is apparently rather rare in the region, only two specimens being taken,—both in the woods north of the river.
9. *Elaphe vulpinus* (Baird & Girard) —A single specimen was collected by the roadside along the river bank on the eastern edge of the city of Monroe. We were told that formerly a "family" of these snakes lived for several years about an old stone pier up the river. The species is now only rarely seen in the county.
10. *Thamnophis sirtalis* (Linnaeus).—The gartersnake was found in all the habitats studied. They were most common along the railroad embankment where there was considerable water on either side. On the marsh side the water was shallow and contained quantities of small fish and frogs which served as food. A few were taken along the beach, but they were not common there. Farther up the river this species was only rarely found, and the farmers reported it as uncommon.

Testudinata.

11. *Platypeltis spinifera* (LeSueur).—The soft shelled turtle was found in the river but was not common; only three specimens were taken.
12. *Chelydra serpentina* (Linnaeus).—The snapping turtle is common in the river, particularly above Monroe, where it is little disturbed.
13. *Chrysemys cinerea* (Bonnaterre).—Five specimens were taken from the river. It is a common species.
14. *Graptemys geographica* (LeSeuer).—Although only five specimens were taken this seems to be the dominant turtle in the river.

RESULTS OF THE MERSHON EXPEDITION TO THE CHARITY
ISLANDS, LAKE HURON: COLEOPTERA.

A. W. ANDREWS.

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A. W. ANDREWS.

The writer was a member of the Mershon Expedition of the University of Michigan for nine days in 1910. He was on the islands from June 19 to June 26 and on July 16 and 17. During this time the beetle fauna was studied carefully with the result that 623 species were obtained with habitat data¹. The field work covered such a short period that much remains to be done, but conditions were so favorable and the results form such a considerable contribution to our knowledge of the fauna of these islands that it seems best to publish them.

The location and description of the Charities have been given by several men. Briefly, they consist of three small islands in the mouth of Saginaw Bay, and are distant about ten and eight miles from the south and north shores, respectively. Gull Island is the smallest of the group, and was not studied. Little Charity is second in size and has some forest cover. It was apparently poor in Coleoptera and received little attention. Charity Island, the largest in the group, contains about 650 acres, is densely wooded in the interior, supports a pond of about 2 acres, has extensive sand and rock beaches, and has been practically undisturbed by man. It was found to be very rich in beetles and received practically all of the writer's attention.

HABITAT DISTRIBUTION OF THE COLEOPTERA.

The northeast beach of Charity Island proved to be the most important beetle habitat. A great number of specimens were found on the logs, rocks, stones, and sand, and on the bushes which are here but a few yards from the water's edge. At the time studied the conditions favored the concentration of beetles on this shore. The wind blew steadily for twelve out of fourteen days from the northeast, and the waves washed up specimens of various species and a considerable amount of food that attracted carnivorous species. Other species were obtained by beating the bushes and trees, on the top and under boards

¹The writer is indebted to John D. Sherman, Jr., Brooklyn, N. Y., for the determination of many species of Carabidae and Dytiscidae; to A. B. Wolcott of the Field Museum of Natural History, Chicago for naming many species of Curculionidae and Elateridae, and to E. E. Swartz of the U. S. National Museum for a number of species of Curculionidae and Elateridae. He is also indebted to Captain Charles McDonald and his assistant, Joseph Singleton, of the lighthouse of Charity Island, for assistance in the field.

placed end to end on the damp sand. Many species of water beetles were taken in the rock pools.

The southwest beach was, on the other hand, a very poor place for finding Coleoptera, even when the wind and waves were from the southwest. The strip of sand running parallel with the beach was far wider in extent on this shore, but was loose and dry and supported scattered shrubs and plants of various species; the sand being so loose and dry as to make it almost an impossibility for predaceous beetles to move on the surface. The trees, shrubs and flowering plants near the shore proved to be the best habitat for beetles. Many species were found here that did not appear on the northeast shore.

The other shores with a wide sandy beach proved to be very poor beetle habitats; little or nothing being found on them except one species of Cicindela. The interior of the island was also a poor beetle habitat. Some species of Cerambycids, however, were to be seen on the blossoms of New Jersey tea which grows along or near the path running across the island.

Contrary to expectation, the light from the lighthouse did not seem to attract the beetles. It did, however, attract June flies, Ephemeroidea, in vast numbers, for Captain McDonald informed the writer that on one morning he filled over six bushel baskets with the flies collected on the lighthouse platform. A number of species were found at night on the window screens and walls of the lighthouse, attracted by the lamp and white walls on the outside of the building, and many beetles were flying about the open space of land occupied by the lighthouse, some of which were taken with the net.

The number of species taken in each habitat is as follows:

355 only on or near the northeast shore.

116 only on or near the southwest shore.

32 found on or near both northeast and southwest shores.

4 in the interior of the island.

78 near the pig-pen, at or near the lighthouse, on flowering shrubs near the path to the lighthouse, at sugar lures on trees and in a lantern trap in the clearing.

<i>Distribution by Families.</i>		
<i>Family.</i>	<i>Number of species.</i>	<i>Habitat.</i>
Carabidae.....	134.....	Northeast shore.
	12.....	Southwest shore.
	5.....	Northeast and southwest shores.
Dytiscidae and Hydrophilidae....	39.....	Northwest shore.
	12.....	In pond near southwest shore.
	7.....	Northeast and southwest shores.
Silphidae.....	3.....	Northeast shore.
	4.....	Southwest shore.
	1.....	Little Charity Island.
Staphylinidae.....	11.....	Northeast shore.
	1.....	Southwest shore.
	1.....	Interior of island.
Coccinellidae.....	13.....	Northeast shore.
	3.....	Southwest shore.
Erotylidae.....	1.....	Northeast shore.
	4.....	Southwest shore.
Histeridae.....	3.....	Northeast shore.
	6.....	Southwest shore.
Elateridae.....	16.....	Northeast shore.
	17.....	Southwest shore.
Buprestidae.....	5.....	Northeast and southwest shores.
	10.....	Northeast shore.
Lampyridae.....	4.....	Southwest shore.
	3.....	Northeast shore.
	6.....	Southwest shore.
Cleridae.....	1.....	Northeast and southwest shores.
	2.....	Northeast shore.
Lucanidae.....	2.....	Southwest shore.
	1.....	Northeast and southwest shores.
Scarabaeidae.....	3.....	Northeast shore.
	1.....	Little Charity Island.
	32.....	Northeast shore.
Cerambycidae.....	5.....	Southwest shore.
	1.....	Northeast shore and center of island.
	2.....	Northeast and southwest shores.
Cerambycidae.....	6.....	Near the pig-pen.
	21.....	Northeast shore.
	13.....	Southwest shore.
	15.....	Near lighthouse.

Distribution by families.—Continued.

Family.	Number of species.	Habitat.
Chrysomelidae.....	10.....	Northeast shore.
	25.....	Southwest shore.
Tenebrionidae.....	2.....	Northeast and southwest shores.
	5.....	Northeast shore.
	5.....	Southwest shore
Curculionidae... ..	4.....	Northeast and southwest shores.
	34.....	Northeast shore.
	6.....	Southwest shore.
Calandridae.....	3.....	Northeast and southwest shores.
	15.....	Northeast shore.

This is not a complete list of all the families found. A few of those represented by a small number of species are omitted.

Fauna of the Beaches. The writer believes that the greater part of the beetles seen on the northeast shore belonged to the island, that is bred there, and that the beetles undoubtedly washed up on this shore were either blown off the island or when flying off the shore dropped in the water when tired out and were washed ashore. As will be seen from the following data the wind was northeast twelve days out of the fourteen and the waves came from the direction of open water in Lake Huron: June 18-21 northeast, fair; June 22 southwest, fair; June 23-25 northeast, fair; June 26 southwest, cloudy; July 12-13 northeast; July 14 southwest, fair; July 15 northeast, variable, rain; July 16-17 northeast, blowing hard. Consequently the beetles would be in the water many days if they came from the mainland, and in order to strike the mile length of northeast shore on Charity Island, incredible numbers must have been scattered over the twenty mile width of Saginaw Bay. Also the low sandy shore on the mainland at Caseville ought to have received a large number if they came from the northeast, but the writer found none to speak of there.

The ability of our beetles to live in the water varies from two hours to seventy-two hours, if we except a few species of Curculionidae. By making a series of experiments the writer found the period of life in still water to be about as follows: Cicindela four hours. Twenty species of Carabidae four to twenty hours. In about twenty hours they became water-logged, most of them sinking to the bottom. *Harpalus caliginosus* lived forty-eight hours but was dead and water soaked in seventy-two hours. Elateridae, a number of species, did not live three hours. Buprestidae, some species did not live ten hours, most of them sinking to the bottom, but *Acemaedera pulchella* was alive and

active at the end of seventy-two hours. Scarabaeidae, a number of different species, died in forty to forty-eight hours. Chrysomelidae lived in the water twelve to forty-eight hours. Tenebrionidae, five or six species, lived only four to ten hours. Coccinellidae, all the various species experimented with lived forty-eight hours and were active up to that time, but were all dead in seventy-two hours and did not sink to the bottom. Curculionidae showed a rather wide range in their ability to resist the action of water, living in some cases only ten hours, others ranging from ten to seventy-two hours. *Cryptorhynchus lapathi* Linn. seemed to be very hardy, as it was in good active condition after being in water for a week.

From these experiments the writer is convinced that the beetles on the northeast shore did not come from the mainland but from the island itself, and hence we do not have in the drift an explanation of the origin of the beetle fauna of the islands. A few species may have reached the island in this way, but of the great numbers that each year fall into the lake waters along the mainland shores very few would reach the island, as the most of them would be drowned long before they had traversed the distance. Very few, at least in recent years, would be carried by drift wood, as little or none is cast up on the shores. The bay is very free of anything of that description, although in the time of extensive lumbering in the Saginaw Bay region great quantities of lumber did come ashore and probably brought some of the species that are now breeding on the island. The dung beetles found on the island must have reached the island since the lighthouse was built, as before that time they could not live there. None of the large dung beetles were found on the shore of the islands, although very common on the mainland.

It is probable that most of the species have reached the islands by flight, and that the growth of the fauna has been slow and accompanied by an elimination of unfit species. Families that require particular conditions not found on the island are apparently not represented and the species that do not make long flights, such as Cicindelidae, are very poorly represented although the conditions are apparently favorable.

The isolation of the islands is apparently not great for beetles. Little or no variation from the mainland type in color or form can be seen in specimens found. This would be expected from the short distance from the mainland.

LIST OF SPECIES.

Cicindelidae.

1. *Cicindela sexguttata* Fab. One specimen found on the sandy path, near the southwest shore, June 16.

2. *Cicindela repanda* Dej. Four specimens taken on the dry sand of the east shore. It was breeding in this locality and a number were seen on June 26.
3. *Cicindela purpurea* Oliv. One specimen found running on the rocks of the northeast shore, June 26.

Carabidae.

4. *Omophron nitidum* Lec. Nine specimens found running on the beach and under the boards and debris on the northeast beach, June 24. Fairly common.
5. *Omophron dentatum* Lec. Nine specimens found running on the beach and under the boards and debris on the northeast beach, June 24. Fairly common.
6. *Omophron americanum* Dej. Two specimens found under boards, on the northeast shore, June 19.
7. *Carabus meander* Fisch. Six specimens found running on the sand and the rocks, on the northeast beach, July 17. It did not appear in June.
8. *Carabus serratus* Say. One specimen found on the northeast shore near the lighthouse, June 20.
9. *Calosoma scrutator* Fab. Two specimens running on the wet sand and the rocks, on the northeast shore, June 20-22.
10. *Calosoma willcoxi* Lec. One specimen running on the wet sand, on the northeast beach, near the lighthouse, June 22.
11. *Calosoma frigidum* Kirby. This species was seen in great numbers running on the wet sand and on the rocks, and under the boards and debris, on the northeast shore, June 19-20. One specimen was taken at a sugar lure on a tree near the lighthouse, the night of June 26.
12. *Calosoma calidum* Fab. This species was observed running on the sand and the rocks and under the boards and debris, on the northeast shore, June 19, 22 and July 17. Not common.
13. *Elaphrus clairvillei* Kirby. Six specimens found running under debris, very active, on the northeast beach, July 17.
14. *Elaphrus riparius* Linn. Eight specimens found hunting food on beach and under the boards and debris, on the northeast shore, July 19, 22. Fairly common.
15. *Elaphrus fuliginosus* Say. Two specimens were taken; they were observed on the beach and under debris, on the northeast shore, June 19-22.
16. *Blethisa quadricollis* Hald. One specimen found under the debris, on the northeast shore, July 17, very active.

17. *Loricera caerulescens* Linn. One specimen found under the debris, on the northeast shore near the lighthouse, July 17.
18. *Scarites subterraneus* Fab. Two specimens found in cells formed in the damp sand under a board, on the northeast shore, June 25.
19. *Clivina impressifrons* Lec. Found in numbers running on the sand of the northeast shore, June 20-22. Very common.
20. *Bembidium littorale* Oliv. One specimen found under the debris, on the southwest beach near the lighthouse, July 17.
21. *Bembidium americanum* Dej. One specimen found under the debris near the water on the northeast shore, July 17.
22. *Bembidium nigrum* Say. One specimen found under boards, on the northeast beach, June 20.
23. *Bembidium scopulinum* Kirby. Four specimens taken. It was observed running on the wet mud and rocks of the northeast shore, July 17. Fairly common.
24. *Bembidium versicolor* Lec. One specimen, found under debris, on the northeast beach, June 22.
25. *Bembidium assimile* Gyll. One specimen found under log, on the northeast beach, June 20.
26. *Patrobus longicornis* Say. Six specimens found under the washed up rushes on the southwest shore, July 17. Two found under the debris on the northeast shore, July 17.
27. *Pterostichus coracinus* Newm. Four specimens running on beach and under boards and debris, on the northeast beach, June 19.
28. *Pterostichus relictus* Newm. Two specimens found under debris, on the northeast beach, June 23.
29. *Pterostichus permundus* Say. One specimen found under the debris on the northeast beach, July 17.
30. *Pterostichus sayi* Bruelle. Five specimens found under boards, on the northeast beach, June 19. One found under a board near the water on the northeast beach, July 17.
31. *Pterostichus lucublandus* Say. Two specimens found under a board, on the northeast beach, June 20.
32. *Pterostichus caudicalis* Say. Six specimens found under boards and debris, on the northeast beach, June 19 and July 17.
33. *Pterostichus luctuosus* Dej. Two specimens found under boards, on the northeast beach, June 20.
34. *Pterostichus corvinus* Dej. Four specimens found under debris, on the northeast beach, June 19.
35. *Pterostichus scrutator* Lec. Two specimens found under a board, on the northeast beach, June 20.
36. *Pterostichus mutus* Say. Two specimens found under a board, on the northeast beach, June 22.

37. *Pterostichus pennsylvanicus* Lec. One specimen found under a board, on the northeast beach, June 26.
38. *Pterostichus erythropus* Dej. Two specimens found under a log, on southwest beach, June 19. One found under a board, on the northeast beach, June 22.
39. *Amara avida* Say. Two specimens found under a board, on the northeast beach, July 17.
40. *Amara exarata* Dej. Two specimens found under a board, on the northeast beach, June 23. One specimen found under a board, on the northeast beach, July 17.
41. *Amara latior* Kirby. Two specimens found under boards, on the northeast beach, July 17.
42. *Amara angustata* Say. One specimen found running on a log, on the northeast beach, June 24. One found under a board, on the northeast beach, July 17.
43. *Amara impuncticollis* Say. Two specimens found under debris, on the northeast beach, June 20.
44. *Amara crassispina* Lec. One specimen found under debris, on the northeast beach, June 22.
45. *Amara cupreolata* Putz. Three specimens found under a board, on the northeast beach, July 17.
46. *Amara fallax* Lec. One specimen found hunting on the sand, on the northeast beach, June 21.
47. *Amara protensa* Putz. Two specimens found hunting on damp sand, on the northeast beach, June 21.
48. *Amara polita* Lec. One specimen found under debris, on the northeast beach, July 17.
49. *Amara erratica* Sturm. Four specimens found running on the sand, on the northeast beach, June 20. Two found under flat stones, on the northeast beach, June 20.
50. *Amara interstitialis* Dej. One specimen found under a flat stone, on the northeast beach, June 20.
51. *Amara obesa* Say. Two specimens found under logs, on the northeast beach, June 20. Two found under boards, on the northeast beach, June 23. Six found under boards and debris, on the northeast shore, July 17.
52. *Amara remotestriata* Dej. One specimen found under a board, on the northeast beach, June 22. Three found under boards, on the northeast beach, July 17.
53. *Amara rubica* Hald. One specimen found under debris, on the northeast shore, July 17.
54. *Amara gibba* Lec. Three specimens found under debris, near the northeast shore, July 17.

55. *Amara subaenea* Lec. Five specimens found under boards, on the northeast beach, June 20. One found under debris, on the northeast beach, July 17. Very active.
56. *Amara musculus* Say. One specimen found on the sand near a log, on the northeast beach, June 21. Three found under the debris, on the northeast beach, June 22. Two found under boards, on the northeast beach, June 23.
57. *Amara* species near *chalcea*. Two specimens found under debris, near the northeast shore, July 17.
58. *Diplochila laticollis* Lec. Three specimens found under logs, on the southwest shore, June 20. Three found under a log, on the northeast beach, June 23.
59. *Diplochila laticollis* var. *major* Lec. Three specimens found under boards and one dead in the water, on the northeast shore, June 19. Four found under debris, on the northeast shore, July 17.
60. *Diplochila impressicollis* Dej. Four specimens found in cells made in the sand, under boards, on the northeast beach, June 22. Three found under a log, on the northeast beach, June 23. One found under a board, near northeast beach, July 17.
61. *Diplochila impressicollis* var. *alternans* Casey. This species was found under boards and debris, on the northeast shore, June 19 and July 17. Fairly common.
62. *Diplochila obtusa* Lec. Three specimens found under boards, on the northeast shore, June 22. One found under a board, on the northeast shore, July 17.
63. *Dicaelus purpuratus* Bon. One specimen found under a board, on the northeast beach, June 22.
64. *Badister pulchellus* Lec. One specimen found under debris, on the northeast beach, June 25.
65. *Calathus gregarius* Say. One specimen found under debris near the water on the northeast beach, July 17.
66. *Platynus hypolithus* Say. One specimen found under a flat stone, on the northeast beach, June 21.
67. *Platynus decens* Say. One specimen found under a board, on the northeast beach, June 22.
68. *Platynus sinuatus* Dej. Two specimens found under debris, on the northeast shore, July 17.
69. *Platynus opaculus* Lec. Two specimens found under a board, on the northeast beach, June 22.
70. *Platynus tenuicollis* Lec. Two specimens found under chips, on the northeast beach, June 23. Two found under debris, on the northeast beach, July 17.

71. *Platynus cincticollis* Say. Two specimens found under a log on the northeast beach, June 20.
72. *Platynus parmarginatus* Hamilton. Two specimens found under boards, on the northeast beach, June 20.
73. *Platynus reflexus* Lec. Six specimens found under boards, on the northeast beach, June 20.
74. *Platynus extensicollis* Say. Four specimens under debris, on the southwest shore, June 22. One found under debris, on the northeast shore, July 17.
75. *Platynus extensicollis* var. *viridis* Lec. Two specimens found under a board, on the northeast shore near the lighthouse, July 17.
76. *Platynus errans* Say. Two specimens found under debris, on the northeast shore, July 17.
77. *Platynus errans* var. *subcordatus* Lec. One specimen found under debris, on the northeast beach, July 17.
78. *Platynus moerens* Dej. Two specimens found under debris, on the northeast beach, June 20. One found under debris, on the northeast beach, July 17.
79. *Platynus tenuis* Lec. Three specimens found under washed up debris, on the northeast beach, June 20. One found under washed up debris, on the northeast shore, July 17.
80. *Platynus atratus* Lec. Two specimens found under boards on the debris on the northeast beach, June 19. One found under a log, on the southwest beach, July 17. One found under a board, on the northeast beach, July 17.
81. *Platynus malanarius* Dej. Two specimens found under a log, on the northeast beach, July 17.
82. *Platynus cupripennis* Say. Ten specimens found under boards on damp sand, on the northeast beach, June 17.
83. *Platynus excavatus* Dej. One specimen found under debris, on the northeast beach, June 17. One found under debris, on the northeast shore, July 17.
84. *Platynus ferreus* Hald. Two specimens found under loose bark of water-soaked log, on the northeast shore, July 17. Two found running on wet mud on the rocks of the northeast shore, July 17; very active.
85. *Platynus bogemanni* Gyll. One specimen found on the wet sand, on the northeast shore, June 19. Two found under debris, on the northeast beach, July 17; very active.
86. *Platynus quadripunctatus* DeG. Three specimens found under debris, on the northeast beach, July 17; very active.
87. *Platynus limbatus* Say. Two specimens found under damp debris, near the northeast beach, July 17.

88. *Platynus crenistriatus* Lec. Four specimens found under debris, near the northeast beach, July 17.
89. *Platynus rubripes* Zimm. Three specimens found on a stone, on the northeast shore, June 22.
90. *Platynus punctiformis* Say. One specimen found under a board, on the northeast beach, July 17.
91. *Platynus picipennis* Kirby. Two specimens found in a cell in sand under a board, also running on the sand of the northeast beach, June 21. One found under a board, on the northeast beach, July 17.
92. *Platynus lutulentus* Lec. Two specimens found running on the sand, on the northeast beach. One found under a board, on the northeast beach, June 23.
93. *Olisthropus parmatus* Say. One specimen found under a board, on the northeast beach, July 17.
94. *Casonia pennsylvanica* Linn. Two specimens found crawling on the lighthouse walk, June 24.
95. *Galerita janus* Fab. Two specimens found under rotten log, near the southwest shore, June 24. One found under a board, on the northeast beach, July 17.
96. *Lebia grandis* Hentz. Two specimens found running on the northeast beach, June 22.
97. *Lebia atriventris* Say. One specimen found under a board, on the northeast beach, June 24.
98. *Lebia tricolor* Say. One specimen found on the sand, on the northeast beach, June 22.
99. *Lebia fuscata* Dej. One specimen taken by beating willows, near the southwest shore, June 22. One taken on a rotten log, near southwest shore, June 22.
100. *Lebia scapularis* Dej. One specimen found under a board, on the northeast beach, June 25.
101. *Lebia ornata* Say. Two specimens found under boards, on the southwest beach near the lighthouse, July 17.
102. *Callida punctata* Lec. One specimen found under the debris, on the northeast beach, June 20.
103. *Callida purpurea* Say. Two specimens under the boards, on the southwest beach near the lighthouse, July 17.
104. *Pinacodera limbata* Dej. Four specimens found under a log, on the northeast shore, June 19.
105. *Pinacodera platycollis* Say. Two specimens found under boards, near the northeast shore, July 17.
106. *Brachynus perplexus* Dej. One specimen found under debris at water's edge, on the southwest shore, July 17.

107. *Brachynus medius* Harr. Two specimens found under debris, on the northeast beach, July 25.
108. *Brachynus quadripennis* Dej. One specimen taken in a lantern trap in the woods, near the lighthouse, June 26.
109. *Brachynus cyanipennis* Say. Three specimens found under the debris, on the northeast beach, June 25.
110. *Brachynus alternans* Dej. One specimen found under a board, on the northeast beach, June 19.
111. *Brachynus cordicollis* Dej. One specimen found under debris, on the northeast beach, June 25.
112. *Brachynus ballistarius* Lec. One specimen found under a stone, on the northeast beach, June 20.
113. *Brachynus gracilis* Blatchley. Two specimens found under boards, near the northeast shore, July 17.
114. *Chlaenius erythropus* Germ. Six specimens found running, on the northeast beach, June 25.
115. *Chlaenius sericeus* Forst. Four specimens found under the boards and debris, on the northeast beach, June 19-22. Fairly common.
116. *Chlaenius diffinis* Chand. Eight specimens found running under loose debris at the edge of the water, on the northeast beach, June 17.
117. *Chlaenius solitarius* Say. Two specimens found under a board, on the northeast beach, June 20.
118. *Chlaenius impunctifrons* Say. Two specimens found under boards, on the south shore, June 23.
119. *Chlaenius tricolor* Dej. One specimen found under a board, on the northeast shore, June 20.
120. *Chlaenius nemoralis* Say. Two specimens taken under flat stones, on the northeast shore, June 20.
121. *Chlaenius pennsylvanicus* Say. Six specimens taken under debris, on the northeast shore, June 20.
122. *Chlaenius niger* Rand. Two dead specimens found under a board, on the northeast beach, June 21. One found under a board, on the northeast beach, July 17.
123. *Chlaenius tomentosus* Say. Four specimens found under boards, on the northeast beach, July 17.
124. *Brachylobus lithophilus* Say. Three specimens found under a board on the sand, on the northeast beach, June 20. Two found running under debris at the edge of the water, on the northeast beach, July 17.
125. *Lachnocrepis parallelus* Say. Six specimens found under boards, on the northeast beach, June 23.

126. *Oodes amaroides* Dej. One specimen found under debris, on the northeast beach, June 23.
127. *Oodes americanus* Dej. One specimen found under a board, on the northeast beach, July 17. One found under debris, on the northeast beach, July 17.
128. *Oodes fluviialis* Lec. Two specimens found under a board, on the northeast beach, July 17.
129. *Geopinus incrassatus* Dej. Six specimens found under boards and debris, on the northeast beach, June 19-22.
130. *Agonoderus pallipes* Fab. Eight specimens were found, some under boards, some hunting on damp sand, and others digging into the moist sand under logs and boards, on the northeast beach, July 21.
131. *Gynandropus hylacis* Say. One specimen found alive in rock pool, on the northeast shore, June 21.
132. *Harpalus autumnalis* Say. One specimen found under decaying plank, near the northeast shore, July 17.
133. *Harpalus erraticus* Say. One specimen found under a board, on the northeast beach, June 25. Four making cells in damp sand underneath boards, on the northeast shore, July 17. Very common.
134. *Harpalus caliginosus* Fab. Four specimens found under the boards and debris, on the northeast shore, June 16-25. Common.
135. *Harpalus pennsylvanicus* Dej. Four specimens found under a decaying plank, near the southwest shore, July 17.
136. *Harpalus pennsylvanicus* var. *erythropus* Dej. Two specimens found under a decaying plank, near the southwest shore, July 17.
137. *Harpalus herbivagus* Say. One specimen found under a board, on the northeast beach, June 29.
138. *Harpalus laticeps* Lec. Two specimens found under a log, on the southwest shore, July 17.
139. *Harpalus viduus* Lec. One specimen found under a log, on the southwest beach, June 22.
140. *Selenophorus opalinus* Lec. One specimen found running under debris, on the northeast beach, June 22. One found under a board, on the northeast beach, July 17.
141. *Stenolophus dissimilis* Dej. One specimen found on a flat stone, on the northeast beach, June 21.
142. *Stenolophus ochropezus* Say. One specimen found on a flat rock, on the northeast shore, June 26.
143. *Stenolophus fulginosus* Dej. One specimen found under a board, on the northeast beach, July 17.

144. *Selenophorus* sp. One specimen found under a board, on the northeast beach, June 22.
145. *Anisodactylus harrisii* Lec. One specimen found under a board, on the northeast shore, June 24.
146. *Anisodactylus rusticus* Dej. Three specimens found under some boards, and one under a stone, on the northeast beach, June 19-23. One under a board, on the northeast beach, July 17.
147. *Anisodactylus interpunctatus* Kirby. One specimen found under debris, on the northeast beach, June 23.
148. *Anisodactylus nigerrimus* Dej. Three specimens found under boards, on the northeast beach, June 19. Six running under boards and debris, on the northeast beach, July 17. One under a board, on the northeast beach, July 17.
149. *Anisodactylus discoideus* Dej. Six specimens found hunting on the sand near logs, on the northeast beach, June 21.
150. *Anisodactylus baltimorensis* Say. Two specimens found under a log, on the northeast shore, June 19. One found under a board at the water edge, southwest beach, June 20.
151. *Anisodactylus sericeus* Harr. One specimen found under a board, on the northeast beach, July 17.
152. *Anisodactylus verticalis* Lec. One specimen found under debris, on the sand of the northeast beach, June 21.
153. *Anisodactylus interstitialis* Say. Two specimens found under a log, on the northeast beach, June 20.

Dytiscidae.

154. *Laccophilus maculosus* Germ. Five specimens found in the rock pools, on the northeast shore, July 16.
155. *Coelambus inaequalis* Fab. Six specimens found in the mud of the pond, near the southwest shore, July 17.
156. *Coelambus impresso-punctatus* Sch. Two specimens found crawling on the wet rocks, on the northeast shore, June 21. Six taken by dredging pond, July 17.
157. *Coelambus turbidus* Lec. One specimen taken by dredging pond, July 17.
158. *Deronectes griseostriatus* DeG. One specimen found swimming in rock pool, on the northeast shore, June 23.
159. *Hydroporus laccophilinus* Lec. One specimen found in a rock pool, on the northeast side shore, July 17.
160. *Hydroporus undulatus* Say. Fifteen specimens taken by dredging pond, July 17.
161. *Hydroporus tristis* Payk. One specimen taken by dredging mud at edge of pond, July 17.

162. *Hydroporus dichrous* Melsh. Two specimens found in the mud of the pond, July 17.
163. *Hydroporus modestus* Aubé. Two specimens found swimming in rock pool, on the northeast shore, July 17.
164. *Ilybius ignarus* Lec. Two specimens found in a pool, on the northeast shore, June 21.
165. *Ilybius confusus* Aubé. Four specimens found swimming in a rock pool, on the northeast shore, July 17.
166. *Coptotomus interrogatus* Fab. Eight specimens found in rock pools, on the northeast shore, June 25. Seven taken by dredging pond, July 17.
167. *Matus bicarinatus* Say. Ten specimens found in the rock pools, on the northeast shore, June 23. One found by dredging pond, July 17. Six taken in rock pools, on the northeast shore, July 17.
168. *Agabetes acuductus* Harr. Two specimens taken in the rock pools, on the northeast shore, July 17.
169. *Ilybiosoma bifarius* Kirby. One specimen found swimming in rock pool, on the northeast shore, June 21.
170. *Agabus obtusatus* Say. One specimen found in a rock pool, on the northeast shore, July 17.
171. *Agabus subfuscatus* Sharp. Five specimens taken in the rock pools, on the northeast shore, June 23-24. Two taken by dredging pond, July 17.
172. *Rhantus binotatus* Harr. Two specimens were taken in the water of the bay, near some rocks, on the northeast shore, June 21.
173. *Rhantus bistratus* Bergst. Three specimens found by dredging pond, July 17.
174. *Colymbetes sculptilis* Harr. Ten specimens taken in rock pools, on the northeast shore, June 21. Three taken in rock pools, on the northeast shore, July 19.
175. *Hydaticus piceus* Lec. One specimen found in the rock pools, on the northeast shore, June 23. One found in the rock pools, on the northeast shore, July 16.
176. *Hydaticus stagnalis* Fab. One specimen found swimming in rock pool, on the northeast shore, June 22.
177. *Dytiscus fasciventris* Say. Two specimens found in the rock pools, on the northeast shore, June 23. Three taken in the rock pools, on the northeast shore, July 16.
178. *Dytiscus verticalis* Say. One specimen taken in the rock pools, on the northeast shore, July 16.
179. *Dytiscus sublimbatus* Lec. Six specimens found crawling in wet sand near the water edge, on the northeast shore, July 16.

180. *Dytiscus marginalis* Linn. Two specimens found swimming in the water of the bay, on the northeast shore, July 16.
181. *Dytiscus hybridus* Aubé. One specimen found swimming in rock pool, on the northeast shore, June 25. Six specimens found crawling in wet sand at the edge of the water, on the northeast shore, July 16.
182. *Dytiscus harrisii* Kirby. Two specimens found swimming in rock pool, on the northeast shore, June 21.
183. *Acilius semisulcatus* Aubé. Two specimens taken in the rock pools, on the northeast shore, June 21-22. Five found by dredging pond, July 17.
184. *Acilius fraternus* Harr. Three specimens taken by dredging in the pond, July 17.
185. *Graphoderus liberus* Say. Ten specimens taken by dredging pond, July 17.
186. *Cybister fimbriolatus* Say. Two specimens found in the rock pools, on the northeast shore, June 23.

Gyrinidae.

187. *Gyrinus aeneolus* Lec. One specimen found in a rock pool, on the northeast shore, July 17.
188. *Gyrinus lugens* Lec. Nine specimens found under boards and debris at the edge of the water, on the northeast shore, July 17.
189. *Dineutes emarginatus* Say. Six specimens found swimming on the surface of the pond, July 17. Common.
190. *Dineutes hornii* Roberts. Two specimens found in the rock pools, on the northeast shore, June 23.
191. *Dineutes nigrrior* Roberts. Two specimens found swimming in a rock pool, on the northeast shore, July 17.

Hydrophilidae.

192. *Helophorus lacustris* Lec. Three specimens found crawling under wet debris near the edge of the water, on the northeast shore, July 17.
193. *Helophorus lineatus* Say. Two specimens taken on the wet sand and two on a log, on the northeast shore, June 21-25.
194. *Helophorus tuberculatus* Gyll. One specimen taken under debris, on the northeast shore, July 17.
195. *Hydrochus excavatus* Lec. One specimen found crawling on wet rocks, on the northeast shore, June 21.
196. *Hydrophilus triangularis* Say. One specimen taken in a rock pool, on the northeast shore, July 17.

197. *Tropisternus nimbatus* Say. One specimen found by dredging pond, July 17. One found swimming in a rock pool, on the northeast shore, July 17.
198. *Tropisternus mixtus* Lec. Ten specimens taken by dredging among roots of the water plants in the pond, July 17.
199. *Tropisternus glaber* Hbst. One specimen found swimming in the rock pools, on the northeast shore, June 23. One in a rock pool, July 17.
200. *Tropisternus sublaevis* Lec. One specimen taken in a rock pool, on the northeast shore, June 21.
201. *Hydrocharis obtusatus* Say. Two specimens found in the water of the bay, near the northeast shore, June 21. Three crawling up from the water, July 16. One swimming in a rock pool, July 17.
202. *Berosus striatus* Say. One specimen found under a board on the wet sand, on the northeast shore, June 24.
203. *Berosus infuscatus* Lec. One specimen found on the wet rocks, on the northeast shore, June 21. Two found in rock pools, June 23. Four found in rock pools, July 17.
204. *Cymbiodyta blanchardi* Horn. Two specimens taken by dredging the pond, July 17.
205. *Philhydrus bifidus* Lec. Five specimens found in the rock pools, on the northeast shore, June 23. Fifteen found in the rock pools, on the northeast shore, July 17.
206. *Helochares maculicollis* Muls. Three specimens taken by dredging at edge of pond, July 17.
207. *Philhydrus ochraceus* Mels. One specimen taken on wet rocks, on the northeast shore, June 26. One found swimming in rock pools, on the northeast shore, July 17. One found by dredging the pond, July 17.
208. *Philhydrus cinctus* Say. One specimen found on a stone, on the northeast beach, June 17.
209. *Philhydrus hamiltoni* Horn. Four specimens taken by dredging the mud of the small pond, near southwest shore, July 17.
210. *Hydrobius tessellatus* Ziegl. Three specimens taken on the sand, on the northeast shore, June 20.
211. *Hydrobius fuscipes* Linn. Three specimens found swimming in the rock pools, on the northeast beach, June 21. Seven found in the rock pools, on the northeast beach, July 17.
212. *Creniphilus subcupreus* Say. One specimen taken in rock pool, on the northeast shore, June 26. One in pool on rocks, on northeast shore, July 17.

213. *Cercyon nigriceps* Marsh. One specimen found by dredging on edge of pond, July 17.

Silphidae.

214. *Necrophorus sayi* Lap. Two specimens found under a dead fish, on the northeast shore, June 23.
 215. *Necrophorus americanus* Oliv. One specimen found beside a dead fish, on the south shore of Little Charity, June 23.
 216. *Necrophorus pustulatus* Hersch. One specimen found under a dead fish, on the northeast beach, June 22.
 217. *Necrophorus vespilloides* Hbst. One specimen found under a dead fish, on the southwest shore, July 17.
 218. *Necrophorus tormentosus* Web. One specimen found under a dead fish, on the southwest shore, July 17.
 219. *Silpha surinamensis* Fab. Two specimens found under a dead fish, on the southwest shore, July 17.
 220. *Silpha noveboracensis* Forst. One specimen found under a dead fish, on the northeast shore, July 17.
 221. *Silpha americana* Linn. One specimen taken in decaying fungi on a log, on the southwest shore, June 26.

Staphylinidae.

222. *Creophilus villosus* Grav. Two specimens taken in a decayed pickerel, on the northeast shore, June 20. One found under a dead fish on the sand, on the northeast shore, July 17.
 223. *Staphylinus badipes* Lec. One specimen found under a board, on the northeast shore, June 26.
 224. *Staphylinus tomentosus* Grav. Two specimens taken under damp debris, near the northeast shore, June 26. Three taken under damp debris, near the northeast shore, July 17.
 225. *Philonthus sericinus* Horn. Two specimens found crawling on a log, on the northeast beach, June 25.
 226. *Philonthus umbrinus* Grav. One specimen found crawling on the beach, near the lighthouse, June 26.
 227. *Philonthus cyanipennis* Fab. Two specimens taken in fungi growing on a log, near the southwest shore, June 26.
 228. *Xantholinus emmesus* Grav. Two specimens found running under bark, on the northeast shore, June 24.
 229. *Cryptobium bicolor* Grav. Two specimens taken under debris on the rocks, on the northeast shore, June 22.
 230. *Cryptobium pusillum* Lec. One specimen found under a board, on the northeast shore, June 25.

231. *Cryptobium sellatum* Lec. One specimen found under debris, on the northeast shore, June 22.
 232. *Stilicus tristis* Melsh. Three specimens found running on damp sand near logs, on the northeast beach, June 22. Six found running under debris, on the northeast beach, July 17.
 233. *Boletobius pygmaeus* Fab. Five specimens taken in fungi, near the center of the island, June 26.
 234. *Acidota crenata* Fab. Four specimens found under cut and dried milk-weed, on the northeast shore near the lighthouse, July 17.

Coccinellidae.

235. *Megilla maculata* DeG. Two specimens taken on leaves of willow, near the northeast shore, June 26. Four found crawling on rocks, logs, and milkweed near the northeast shore, July 17.
 236. *Hippodamia 5-signata* Kirby. Five specimens found on large stones, on northeast shore, June 20. One found crawling on a log, on the northeast shore, June 24. Two found crawling on a log, on the northeast shore, July 17.
 237. *Hippodamia convergens* Guer. One specimen found on willow, on the northeast shore, June 20.
 238. *Hippodamia 13-punctata* Linn. Two specimens taken on leaves of birch, on the northeast shore, June 20. Thousands crawling on rocks and logs in about 100 feet in length of beach, hundreds mating, July 17.
 239. *Hippodamia parenthesis* Say. Seven specimens taken on leaves of basswood, on the northeast shore, June 20. One taken on leaves of willow, on the northeast shore, June 21. Thousands were observed in a small area on logs and rocks, on the northeast shore, July 17.
 240. *Coccinella trifasciata* Linn. One specimen taken on willow, on the northeast shore, June 21. One found crawling on a log, on the northeast beach, July 17.
 241. *Coccinella 9-notata* Hbst. Three specimens taken on logs, on the northeast shore, June 20.
 242. *Coccinella tricuspis* Kirby. One specimen taken by beating willow, near the southwest shore, June 24.
 243. *Coccinella sanguina* Linn. One specimen taken on a stone, on the northeast beach, June 20. Six taken on logs, rocks, and milkweeds, on the northeast shore, July 17. Common.
 244. *Adalia bipunctata* Linn. Two specimens taken on milkweed, near the lighthouse, July 17.
 245. *Harmonia picta* Rand. One male and one female specimen taken

on the flowers of Jersey tea, along the path near the lighthouse, July 17.

246. *Anatis 15-punctatus* Oliv. Five specimens (dark form) found crawling on logs, on the northeast beach, June 20. Six specimens (light form) taken from larger rocks, on the northeast beach, July 17.
247. *Anatis 15-punctatus* var. *mali* Oliv. Five specimens found crawling on logs and boards, on the northeast beach, June 25. Nine found crawling on the rocks, on the northeast beach, July 17.
248. *Psyllobora 20-maculata* Say. Five specimens taken on blossoms of red-stemmed dogwood, near the northeast shore, June 24.
249. *Chilocorus bivulnerus* Muls. Six specimens taken on leaves of willow, on the northeast shore, June 20.
250. *Brachyacantha ursina* Fab. Ten specimens taken by beating the foliage of willows, on the southwest shore, June 23.
251. *Brachyacantha 10-pustulata* Melsh. One specimen taken on the flowers of dogwood, on the northeast shore, June 24.

Erotylidae.

252. *Dacne 4-maculata* Say. Ten specimens found in fungi on trunk of tree, near southwest shore, June 21.
253. *Megalodacne fasciata* Fab. Two specimens found in fungi in the woods, near the southwest shore, July 17.
254. *Megalodacne heros* Say. One specimen taken in fungi on a log, near the southwest shore, June 24.
255. *Ischyryus quadripunctatus* Oliv. One specimen found in fungi in the woods, near the southwest shore, June 21.
256. *Tritoma thoracica* Say. Five specimens taken in fungi on logs, on the northeast beach, June 23.
257. *Tritoma flavicollis* Lec. Two specimens found in dry fungi on a log, near the southwest shore, June 22.

Cucujidae.

258. *Brontes dubius* Fab. Three specimens taken under the bark of an oak log, on the northeast shore, June 26.

Cryptophagidae.

259. *Tisactia subglabra* Casey. One specimen taken on a willow, near the northeast shore, June 21.

Mycetophagidae.

260. *Mycetophagus flexuosus* Say. Two specimens taken in fungi, near the southwest shore, June 21. Seven taken in fungi on an ash tree, near the southwest shore, June 26.
261. *Mycetophagus bipustulatus* Melsh. Five specimens found in fungi on a dead tree, near the southwest shore, June 20.
262. *Mycetophagus pluripunctatus* Lec. Four specimens taken in fungi, near the southwest shore, June 26. One found under a log, on northeast shore, June 27.
263. *Litargus tetraspilotus* Lec. One specimen found under debris, on the southwest shore, June 22.

Dermestidae.

264. *Dermestes caninus* Germ. One specimen found under a dead fish, on the northeast beach, June 26.
265. *Dermestes lardarius* Linn. One specimen taken on the floor of the lighthouse, June 22. One taken in the lighthouse, July 17.
266. *Anthrenus castaneae* Melsh. Three specimens taken on blossoms of red stemmed dogwood near northeast shore, June 26.

Histeridae.

267. *Hololepta fossularis* Say. One specimen taken on a willow, near the southwest shore, June 22.
268. *Hister foedatus* Lec. Three specimens taken in decayed fungi on a paper birch, near the southwest shore, June 23.
269. *Hister depurator* Say. One specimen found under a log, on the southwest beach, June 21.
270. *Hister sedecimstriatus* Say. One specimen taken in decayed fungi, near the southwest shore, July 17.
271. *Hister nubilus* Lec. Two specimens found under a board on the sand, on the northeast beach, June 21.
272. *Saprinus lugens* Erichs. One specimen found under debris, on the northeast shore, July 17.
273. *Saprinus fraternus* Say. One specimen taken in fungi, near the southwest shore, July 17.
274. *Saprinus fitchii* Mars. One specimen found in dried fungi, near the southwest shore, June 22. One found in fungi, on the southwest shore, July 17.
275. *Saprinus patruelis* Lec. One specimen found under a board, on the northeast beach, July 17.

Nitidulidae.

276. *Epuraea corticina* Erichs. One specimen found under debris, near the northeast beach, July 17.
277. *Phenolia grossa* Fab. One specimen taken in fungi, near the southwest shore, June 21.
278. *Ips quadriguttatus* Fab. A dark variety found feeding at sap of a sugar maple, near the northeast shore, June 23. Two specimens taken feeding at sap of a maple, near the lighthouse, July 17.
279. *Ips sanguinolentus* Oliv. Three specimens taken in decaying fungi on logs, on the southwest shore, June 21.

Lathridiidae.

280. *Enicmus minutus* Linn. Two specimens found under cut and dried milkweed, near the southwest shore, June 19.
281. *Enicmus consimilis* Mann. Two specimens taken under debris, on the northeast beach, June 24.

Byrrhidae.

282. *Cytilus sericeus* Forst. One found under a log, on the northeast shore, June 25.
283. *Cytilus trivittatus* Melsh. Two specimens taken on a log, on the northeast beach, June 20.
284. *Byrrhus americanus* Lec. Four specimens taken on the sand, on the northeast beach, June 25.
285. *Byrrhus kirbyi* Lec. One specimen found under a board, on the northeast beach, June 22.

Heteroceridae.

286. *Heterocerus brunneus* Melsh. One specimen found under a board, on the northeast beach, June 25.

Dasyllidae.

287. *Euclinetus testaceus* Lec. One specimen found in decayed fungi, near southwest shore, June 26.
288. *Prionocyphon discoideus* Say. One specimen taken in a pool on the rocks, on the northeast shore, July 17.
289. *Cyphon variabilis* Thunb. One specimen taken in fungi, near southwest shore, June 23.

Elateridae.

290. *Fornax orchesides* Newm. Two specimens found under the bark of a dead ash, near the southwest shore, July 17.

291. *Adelocera discoidea* Web. One specimen found by beating the willows, near the northeast shore, June 26.
292. *Adelocera brevicornis* Lec. Two specimens found by beating the willows, near the northeast shore, June 26.
293. *Alaus oculatus* Linn. Two specimens taken on a log, near the northeast shore at lighthouse, June 23.
294. *Alaus myops* Fab. One specimen caught flying near the lighthouse, June 23.
295. *Cardiophorus convexus* Say. One specimen found on wild grape, near the lighthouse, June 20. Another, taken at sugar lure on tree, near the lighthouse, the night of June 20.
296. *Cardiophorus cardisce* Say. One specimen taken, on the northeast beach, June 20. One found by beating a willow, near the southwest shore, June 23.
297. *Cardiophorus convexus* Lec. One specimen taken on the flowers of red-stemmed dogwood, near the northeast shore, June 23. One found under the bark of a dead oak, near the southwest shore, July 17.
298. *Cardiophorus gagates* Erichs. One specimen taken on leaves of a red oak, near the northeast shore, June 23.
299. *Cardiophorus laevicollis* Er. Two specimens taken by beating red-stemmed dogwood, near the northeast beach, July 17.
300. *Cardiophorus robustus* Lec. One specimen taken by beating branches of Norway pine, near southwest shore, June 23. One on pine, near southwest shore, July 17.
301. *Cryptohypnus abbreviatus* Say. One specimen found floating in rock pool, on northeast shore, June 26.
302. *Monocephidius suturalis* Lec. One specimen taken on the leaves of a willow, on the northeast shore, June 20.
303. *Dicrepidius corvinus* (Cand.). Three specimens found under the bark of a dead oak, near the southwest shore, July 17.
304. *Elater hepaticus* Melsh. Two specimens taken on an oak, near the southwest shore, July 17.
305. *Elater pedalis* Germ. Five specimens taken under the bark of a dead oak branch, near the southwest shore, July 17. Fairly common.
306. *Elater subtilis* Lec. One specimen found on flowers of red-stemmed dogwood, near the northeast shore, June 21. One taken by beating the branches of a white pine, near the southwest shore, June 23.
307. *Elater luctuosus* Lec. One specimen taken on flowers of Jersey tea, near the northeast shore, July 17.

308. *Elater rubricus* Say One specimen taken by beating the leaves of basswood, on the northeast shore, July 17. Seven taken on the oaks, near the southwest shore, July 17.
309. *Elater areolatus* Say Four specimens taken on the leaves and flowers of red-stemmed dogwood, on the northeast shore, June 20. Three found by beating branches of birch, near northeast shore, July 17.
310. *Drasterius elegans* Fab. Eight specimens taken on the logs, on the northeast beach, June 20.
311. *Ludius attenuatus* Say. Two specimens found by beating branches of willows, near southwest shore, June 26. One taken by beating the branches of basswood, near the northeast shore, July 17.
312. *Agriotes stabilis* Lec. Five specimens taken on the branches of white pine, near the northeast shore, June 20. Seven found on the leaves and branches of the white pine, near the southwest shore, June 21-23.
313. *Agriotes fucosus* Lec. Two specimens taken by beating the leaves of willows, near the southwest shore, June 26.
314. *Agriotes pubescens* Melsh. Two specimens taken on leaves on a Norway pine, near the southwest shore, June 24.
315. *Agriotes limosus* Lec. Five specimens taken by beating the branches of a Norway pine, near the southwest shore, June 23.
316. *Agriotes avulsus* Lec. One specimen taken on a dead branch of a yellow oak, near the southwest shore, June 22.
317. *Dolopius lateralis* Esch. Four specimens found on flowers of red-stemmed dogwood, on the northeast shore, June 20.
318. *Melanotus corticinus* Say. Two specimens found by beating foliage of yellow oak, near northeast shore, June 20.
319. *Melanotus decumanus* Erichs. Two specimens taken by beating the branches of a birch, near the northeast shore, July 17.
320. *Melanotus canadensis* Cand. One specimen taken on a branch of an oak, near the southwest shore, July 17.
321. *Melanotus glandicolor* Melsh. One specimen taken by beating willows, near the southwest shore, July 17.
322. *Melanotus communis* Gyll. Two specimens found under bark of dead oak, near center of island, June 26.
323. *Melanotus castanips* Payk. One specimen taken on a branch of a yellow oak, near the northeast shore, June 20. One found by beating a red oak, near the southwest shore, June 25.
324. *Melanotus fissilis* Say. One specimen found on an oak leaf, near the southwest shore, June 20. Two taken under the bark of a dead oak, near the southwest shore, July 17.

325. *Melanotus parumpunctatus* Melsh. Two specimens taken by beating the branches of a yellow oak, near the southwest shore, June 23.
326. *Limonius aurifer* Lec. Two specimens taken on the leaves of a willow, near southwest shore, June 21.
327. *Pityobius anguinus* Lec. One specimen found crawling on a log, on the northeast beach, June 23. One male specimen found crawling on a log and one female specimen found, on the northeast beach, June 25. Several specimens picked up on the northeast beach in August by Captain McDonald.
328. *Sericosomus viridanus* Say. Two specimens taken on a birch, near the lighthouse shore, July 17.
329. *Sericosomus silaceus* Say. One specimen taken by beating the birch, near the northeast shore, June 23. Four taken on the flowers of dogwood, on the northeast shore, July 17.
330. *Athous stabilis* Lec. Two specimens taken by beating the branches of a red oak, near southwest shore, June 23. Two taken by beating a June-berry bush, near the southwest shore, July 17.
331. *Corymbites sulcicollis* Say. One specimen taken at a sugar lure, on a tree in woods near the lighthouse, night of June 26.
332. *Corymbites propola* Lec. One specimen taken on mullein, near the southwest shore, July 17.
333. *Corymbites hieroglyphicus* Say. Two specimens taken by beating the branches of a white pine, near the southwest shore, June 23.
334. *Corymbites tessellatus* Linn. One specimen found at sap running from sugar maple, near the northeast shore, June 23.
335. *Corymbites pyrrhos* Hbst. One specimen taken by beating the branches of a white pine, near the southwest shore, June 23.
336. *Asaphes decoloratus* Say. One specimen taken in a lantern trap, in the woods near the lighthouse, June 26.
337. *Asaphes memnonius* Hbst. One specimen found under a board, on the northeast shore, July 17.

Buprestidae.

338. *Dicerca divaricata* Say. One specimen found on a dead branch of a yellow oak, near the lighthouse, June 20.
339. *Poecilonota cyanipes* Say. One specimen found crawling on an oak log, near the northeast beach, July 17.
340. *Buprestis nuttalli* Kirby. Two specimens taken on a log, on the northeast beach, July 17.
341. *Buprestis maculiventris* Say. One specimen taken on a log, on the northeast beach, June 23.

342. *Buprestis fasciata* Fab. Two specimens found crawling on a board, on the northeast beach, July 17.
343. *Buprestis fasciata* var. *langii* Mann. Two specimens taken under a log, on the northeast beach, June 25.
344. *Melanophila longipes* Say. Four specimens taken on a log, on the northeast beach, June 20. Seven found crawling on logs, boards and rocks, on the northeast shore, July 17.
345. *Melanophila fulvoguttata* Harr. Three specimens taken on a pine log, on the northeast shore, June 20. Five found crawling on logs and rocks, on the northeast shore, July 17.
346. *Agrilus otiosus* Say. Two specimens taken on a willow, near the northeast beach, June 23.
347. *Agrilus acutipennis* Mann. One specimen found on the leaves of an oak, near the northeast shore, June 23.
348. *Agrilus anxius* Gory. Two specimens taken by beating the willows, near the southwest shore, July 17.
349. *Agrilus politus* Say. Four specimens taken by beating the willows, near the southwest shore, June 23.
350. *Brachys ovata* Web. Two specimens taken by beating the branches of Norway pine, near the southwest shore, June 23.
351. *Brachys aeruginosa* Gory. Two specimens found crawling on logs under debris, on the northeast beach, June 22.

Lampyridae.

352. *Eros trilineatus* Melsh. One specimen taken by beating the willows, near the southwest shore, July 17.
353. *Lucidota atra* Fab. One specimen taken by beating the birch, near the northeast shore, July 17.
354. *Ellychnia corrusca* Linn. One specimen found by beating the willows, near the southwest shore, July 17.
355. *Photinus pyralis* Linn. Three specimens taken by beating the willows, near the southwest shore, July 17.
356. *Photinus marginellus* Lec. Two specimens taken by beating the willows, near the southwest shore, June 25.
357. *Photuris pennsylvanica* DeG. One specimen taken by beating the willows, near the southwest shore, July 17.
358. *Telephorus dentiger* Lec. Three specimens found on a small birch, near the southwest shore, June 22.
359. *Telephorus carolinus* Fab. Three specimens found by beating small birch, near the northeast shore, June 22.
360. *Telephorus scitulus* Say. One specimen taken on the blossoms of red-stemmed dogwood, near the northeast shore, June 23.

361. *Telephorus tuberculatus* Lec. Two specimens taken in the blossoms of wild rose, near the pond, July 17.

Malachiidae.

362. *Collops quadrimaculatus* Fab. One specimen found under cut and dried milkweed, on the northeast shore, near the lighthouse, July 17.
363. *Collops vittatus* Say. Five specimens taken on a mullein, near the southwest shore. Two found under dried milkweed, near lighthouse, July 17.
364. *Anthocomus flavilabris* Say. One specimen taken on the flowers of dogwood, near the southwest shore, June 22.

Cleridae.

365. *Trichodes nuttalli* Kirby. Eight specimens taken on the blossoms of wild rose, near the southwest shore, June 22. Three taken on milkweed blossoms, in clearing at lighthouse, June 23.
366. *Clerus analis* Lec. One specimen taken on a log, near the northeast shore, July 17.
367. *Clerus quadriguttatus* Oliv. One specimen captured flying, near the lighthouse, June 22.
368. *Thaneroclerus sanguineus* Say. Two specimens taken on the trunk of a dead oak, near the southwest shore, July 17.
369. *Hydnocera pedalis* Lec. Five specimens taken on flowers of dogwood, on the southwest shore, June 21. One taken on flowers of dogwood, on the northeast shore, June 23.
370. *Ellipotoma laticornis* Say. One specimen taken in the flowers of a wild rose, on the northeast shore, June 21. One taken on the blossoms of red-stemmed dogwood, near the northeast shore, June 26.

Ptinidae.

371. *Xyletinus peltatus* Harr. Two specimens taken by beating the willows, near the northeast shore, June 23.
372. *Ptilinus ruficornis* Say. Four specimens found breeding and boring in the bark of a dead oak, near the northeast shore, June 26.

Bostrichidae.

373. *Bostrichus bicornis* Web. Two specimens found under a board, on the northeast shore, July 17.
374. *Bostrichus armiger* Lec. One specimen found on a board, on the northeast shore, June 22.

375. *Bostrichus truncaticollis* Lec. One specimen found crawling on a log, near the northeast shore.

Cioidae.

376. *Cis fuscipes* Mellié. One specimen taken on the willow, on the northeast shore, June 21.

Lucanidae.

377. *Lucanus dama* Thunb. Two female specimens found on a log, near the southwest beach, June 21. Two, a male and a female, taken on the sand near a log, on the southeast beach, July 17.
378. *Lucanus placidus* Say. Three specimens found on the south beach of Little Charity, June 25. Three (two males and a female) taken on a log, near the lighthouse, the night of June 21.
379. *Dorcus parallelus* Say. Two specimens caught near the lighthouse, night of June 23.
380. *Platycerus quercus* Web. One specimen taken on a log, on the northeast shore, June 23.
381. *Platycerus depressus* Lec. Two specimens found crawling on logs, near the northeast beach, June 25.
382. *Passalus cornutus* Fab. A dead specimen picked up from the washup on the northeast beach, by Captain McDonald, in August.

Scarabaeidae.

383. *Canthon nigricornis* Say. Two specimens found near the pig-pen, June 25.
384. *Canthon laevis* Drury. One specimen taken under a board, near the northeast beach, July 17.
385. *Copris anaglypticus* Say. Three specimens found crawling on the sand, on the northeast beach, June 24.
386. *Ataenius cognatus* Lec. Six specimens found in fungi, near the southwest shore, June 22. One taken on the steps of the lighthouse, July 17.
387. *Aphodius fossor* Linn. One specimen found crawling on the ground, near the pig-pen, June 25.
388. *Aphodius hamatus* Say. One specimen found on the sand, on the northeast shore, June 20. One found under a board, on the northeast shore, July 17.
389. *Aphodius fimetarius* Linn. Three specimens taken under a board, at the pig-pen, July 17.
390. *Aphodius ruricola* Melsh. One specimen found on the sand, on

- the northeast shore, June 20. One found crawling on the sand, on the northeast shore, July 17.
391. *Aphodius foetidus* Fab. One specimen taken on the sand, on the northeast beach, June 21.
392. *Aphodius inquinatus* Hbst. One specimen found on the ground, near the pig-pen, June 22.
393. *Ochodaeus musculus* Say. One specimen taken on the sand, on the northeast beach, June 23.
394. *Bolboceras lazarus* Oliv. One specimen taken under the debris, on the northeast shore, July 17.
395. *Hoplia trifasciata* Say. Two females and one male specimens taken in the blossoms of wild rose, near southwest shore, June 25.
396. *Dichelonycha subvittata* Lec. Eight specimens found on the leaves of basswood and birch, near the northeast shore, June 20. Common.
397. *Dichelonycha albicollis* Burm. Six specimens taken on leaves of white and Norway pine, near the lighthouse, June 20. Four taken by beating a pine, near the southwest shore, July 17. Four taken on a pine, on the southwest shore, July 24. Very common.
398. *Serica vespertina* Gyll. Two specimens found on a log, on the northeast beach, June 23.
399. *Serica iricolor* Say. Two specimens found in cells formed in damp sand under a board, on the northeast beach, June 25. Two picked up, on the path to the lighthouse, July 17.
400. *Serica tristis* Lec. Two specimens taken, on the beach of the northeast shore, June 20.
401. *Serica sericea* Ill. Four specimens found on the sand, on the northeast beach, June 21.
402. *Serica intermixta* Blatchly. Four specimens found on the sand, on the northeast beach, June 21. Ten found on a log, on the northeast beach, June 23. Two found in cells in damp sand, under a board, on the northeast shore, July 17.
403. *Serica carinata* Blatchly. Two specimens found under a board, on the northeast beach, July 17.
404. *Macrodactylus subspinosus* Fab. Four specimens found on wild grape and wild rose blossoms, on the northeast shore, June 20. Very common.
405. *Diplotaxis sordida* Say. One specimen found in a cell in the damp sand under a board, on the northeast shore, June 25. Three taken in a lantern trap, in the woods, near the lighthouse, July 22.

406. *Lachnosterna nova* Smith. Two specimens taken in a lantern trap, in the woods, near the lighthouse, June 26.
407. *Lachnosterns gracilis* Burm. Four specimens found on the leaves of basswood, on the northeast shore, July 22.
408. *Lachnosterna fusca* Froh. Three specimens found on willows, near the northeast shore, June 22.
409. *Lachnosterna rugosa* Melsh. Two specimens taken on the willows, on the northeast shore, June 22. One taken in a lantern trap, in the woods, near the lighthouse, June 26.
410. *Lachnosterna albina* Burm. Four specimens found crawling, on the northeast beach, near the lighthouse. Three found dead in a washup, on the northeast beach, June 23.
411. *Anomala pubescens* Blatchly. One specimen found in the blossom of a wild rose, near the southwest shore, June 26.
412. *Strigoderma arboricola* Fab. Sixteen specimens taken while flying in a patch of reeds, growing in the damp sand, near the southwest shore. They were fairly common on the blossoms of the meadow rose, near the southwest shore, June 23.
413. *Pelidnota punctata* Linn. Three specimens taken on a wild grape vine, along the path near the lighthouse, July 17.
414. *Cotalpa lanigera* Linn. Two specimens found crawling on the sand, of the northeast beach; two on willows, near the northeast beach, and four dead in a washup, on the northeast beach, June 22.
415. *Ligyris gibbosus* DeG. One specimen taken while flying over dry land, near the northeast beach, and one found on the ground, near the pig-pen, July 17.
416. *Ligyris relictus* Say. Six specimens found crawling on the sand, near the northeast beach, June 22. Two taken in cells made in damp sand under boards, on the northeast beach, June 25. Two taken on the wing, near the lighthouse, night of June 26. Four found crawling on the sand, on the northeast beach, July 17.
417. *Aphonus tridentatus* Say. One specimen taken while flying over the sand, on the northeast shore, July 17.
418. *Xyloryctes satyrus* Fab. One male specimen found crawling on the dead leaves on the ground, in rather open woods chiefly paper birch, many of them dead and decaying, near center of the island, June 25. Three male specimens found crawling on the ground near the bank, on the northeast shore, July 17. No females were found.
419. *Euphoria fulgida* Fab. Two specimens found on the branches of a willow, near the northeast shore, July 17.
420. *Euphoria inda* Linn. One dead specimen picked up on the sand,

near the water's edge, northeast shore, June 21. One taken on the sand, of the northeast beach, June 22.

421. *Trichus affinis* Gory. Six specimens taken in the blossoms of the meadow rose, near the southwest shore, June 24.
422. *Trichus viridulus*. Two specimens found in the blossoms of a meadow rose, near the northeast shore, June 20.
423. *Parandra brunnea* Fab. Four specimens found working in dead wood of a hollow oak tree, near the southwest shore, July 17.

Cerambycidae.

424. *Orthosoma brunneum* Forst. Two specimens taken in a lantern trap in the woods, near the lighthouse, July 17. Several taken in a washup, on the northeast shore, July 17. One taken on the screen at the lighthouse, July 21.
425. *Prionus laticollis* Drury. One specimen found crawling up from the edge of the water, on the northeast beach, July 17.
426. *Tragosoma harrissi* Lec. Two specimens found on a pine log, on the northeast beach, June 22. Two taken on a pine log, near the northeast beach, July 17.
427. *Asemum moestum* Hald. One specimen taken on a log, near the northeast beach, July 17.
428. *Crioccephalus agrestis* Kirby. One specimen found crawling on a log, near the northeast beach, June 25.
429. *Crioccephalus obsoletus* Rand. Two specimens taken, on the walk at the lighthouse, night of June 24. One taken in a lantern trap in the woods, near the lighthouse, June 26.
430. *Physocnemum brevilineum* Say. One specimen found running on a log, near the northeast shore, June 26.
431. *Chion cinctus* Drury. One specimen taken, on the wall of the lighthouse, June 24.
432. *Chion cinctus* var. *garganicus* Fab. One specimen taken in the blossoms of a swamp rose, on the edge of the pond, July 17.
433. *Elaphidion villosum* Fab. One specimen taken by beating the branches of a red oak, near the southwest shore, June 26.
434. *Elaphidion unicolor* Rand. One specimen taken on a dead branch of a red oak, near the southwest shore, June 26.
435. *Elaphidion parallelum* Newm. One specimen found on an oak, near the lighthouse, July 17.
436. *Molorchus bimaculatus* Say. Six specimens found on the blossoms of red-stemmed dogwood, near the northeast shore, June 26.
437. *Purpuricenus humeralis* Fab. One specimen taken by beating a yellow oak, near the southwest shore, June 23.