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THE WATERBUGS (HEMIPTERA) OF THE  
DOUGLAS LAKE REGION, MICHIGAN<sup>1</sup>

BY ROLAND F. HUSSEY

Douglas Lake is located about seventeen miles south of Mackinaw City, in the northern tip of the southern peninsula of Michigan, about midway between Lake Huron and Lake Michigan, at an elevation of 712 feet above sea-level. It is fed by two small streams which flow into the north side of the lake, at the east and the west ends respectively, and it drains into Burt Lake, two miles to the south, through Maple River, a small winding stream which has its source in the west end of Douglas Lake. Within a radius of eight miles there are six other lakes of various sizes.

Douglas Lake is about three and three-quarter miles long, and its maximum depth is about 85 feet. The sandy beach extends out into the water for a short distance, and is terminated by an abrupt drop-off beyond which there is no emergent vegetation. Along the east shore the beach reaches its max-

<sup>1</sup> Contribution from the Biological Station of the University of Michigan.

imum width, and here there are considerable areas of sand, exposed to strong wind and wave action, and a sparse vegetation. On the east and north shores there are several beach pools in various stages of formation, from which some of the best collections of Hemiptera were made. The region about Douglas Lake is very sandy, and there are no extensive marsh areas in the vicinity; the plant associations developed on low moist ground are of the cedar-sphagnum bog type.

In the present article an attempt has been made to list as completely as possible the aquatic Hemiptera found in this part of Michigan. The hemipterous fauna of the state has as yet been studied only incidentally, in connection with other problems, and published records for the various species are very few indeed. This report is based on collections made by Miss Eva G. Miller in 1913, by Miss Miller and others in 1914, and by Miss Priscilla Butler and myself in 1918. Use has also been made of an unpublished manuscript by Miss Miller on her collection of 1913. The field work was done under the direction of Professor Paul S. Welch, in the months of July and August, during the regular session of the University of Michigan Biological Station, which is located on Douglas Lake.

The species found here were for the most part determined by the writer. Special acknowledgments are due to Professor J. F. Abbott for determination of several species of the Corixidae, and to Mr. J. R. de la Torre-Bueno for identification of several of the other forms, as well as for verification of the determinations of the writer.

#### FIELD STATIONS

In order to facilitate collection, and for convenience in keeping records, twelve stations were selected for field work, in 1913, which included the different habitat types found in the

vicinity. Collections were made at frequent intervals during the summer at most of these stations, but a few of them were visited only once or twice. The same plan was followed during the other years, though somewhat less systematically in 1914.

*Station I* was the site of the Biological Station itself, on the south-east shore of South Fishtail Bay, and was selected as a matter of convenience. Only insect drift, washed up on the bare sandy beach, was found here.

*Station II* was a portion of the east shore, about 100 yards long, where the beaches were unusually wide. It was completely exposed to wind and to wave action, and received a maximum amount of light. Here were a number of small standing pools which were cut off from the main lake by the inwash of sand and by the falling of the water level of the lake during the summer. The vegetation consisted chiefly of rushes (*Scirpus* spp.), with some *Equisetum* and a few scattered grasses and sedges. The insects found here were chiefly Diptera, tiger-beetles, ants, and grasshoppers, and were most numerous near the edge of the water. *Gerris marginatus* and *Saldula pallipes* were the only Hemiptera taken at this station.

*Station III* was a series of exposed beach pools on the east shore near North Fishtail Bay. During July, as the water level in the lake dropped rapidly, the pools at the south end of the group dried up, and most of the collecting was done in the north-east pool of the series.

At the beginning of the summer the water in this pond covered an area some thirty-five yards in diameter, and was connected directly with Douglas Lake by a narrow channel through the low sandy bank which separated the two bodies of water. Emergent and floating vegetation extended in from all sides and covered the pool, except for an open-water area

of about twenty-five by seventy feet where a wagon road cut through the pond. The maximum depth of water here was about twelve inches. In the part of the plant zone occupying the deepest water the vegetation consisted of a species of *Potamogeton*, together with *Utricularia* and scattering *Scirpus validus*; surrounding this was a zone of sedges (*Carex filiformis*), *Iris versicolor*, Phragmites, and other plants of similar habit. The bottom was quite mucky, with scattered areas of almost clean sand and of partly decayed leaves, etc. Besides the Hemiptera, frogs, tadpoles, young catfish, small crustacea, insect larvae of various orders, and certain beetles were quite abundant.

At the end of August the water in this pool was reduced to an area about five by thirty feet in extent, and the consequent concentration of the aquatic life made collecting very easy.

Some collecting was also done in the adjacent pool, about fifteen yards west of the first. This pool was a little smaller than the other, and had no direct connection with it or with the lake. The bottom here was rather marly, with *Chara*, *Equisetum*, and *Scirpus* forming the dominant vegetation. The fauna of the two pools was quite similar.

*Station IV* was the small cove at the south-west corner of North Fishtail Bay. It covered an area of about half an acre, and was partially separated from the main lake by a wooded point on the south, which curving northward in an L-shaped tongue, effectually protected this little cove from wind and waves. Trees and bushes grew down to the edge of the water on the west, south, and east.

The water here was clear, and not over eighteen inches deep in most of the cove; and, being sheltered from wave action and exposed to the sun, it tended to follow the temperature of the air more closely than did the main body of the lake. The

bottom was originally clean sand, but admixture with organic debris had made it rather mucky in places. Water-lilies grew plentifully in the deeper parts, bordered with irregularly distributed bunches of *Vallisneria* and *Potamogeton*, while sedges grew rather thickly in the shallower parts of the cove.

Amphipods, Odonata, various beetles (*Dytiscidae*, *Gyrinidae*, *Donacia*), tadpoles, frogs, and schools of young fish were common here.

*Station V* was a small oval beach pool, about twenty by sixty feet in extent, on the north shore of the lake near North Fishtail Bay. It was separated from the lake by a low sandy bank, beyond which a new beach pool was forming. The water here was only about eight inches deep, and rather turbid. The aquatic vegetation was fairly dense, and covered nearly the entire area of the pool: it consisted chiefly of *Scirpus*, *Equisetum*, and *Carex*. The fauna consisted principally of beetles, Odonata, Hemiptera, and Arachnoid forms.

*Station VI* was the larger of two adjacent beach pools on the north shore of Douglas Lake, which are known locally as the Sedge Pools. This pool, which proved to be the best station in the Douglas Lake region for collecting Hemiptera, was about 200 by 75 feet, with a central area of open water about 120 by 50 feet in extent. The water was about two feet deep in the center of the pool, and slightly turbid; and the bottom was very mucky, underlaid with sand. The aquatic vegetation around the open water was composed principally of *Nymphaea*, *Sagittaria*, *Scirpus*, *Equisetum*, and *Carex*, with some *Phragmites*, *Vallisneria*, and plants of similar habit; and along the north shore of the pond there was a thicket of willow and dogwood coming down to the water's edge. In the open water there was a small growth of submerged vegetation, consisting of a species of *Potamogeton*.

Tadpoles, insect larvae, arachnids, and mollusks were common here.

*Station VII* was the lower part of Bessey Creek, a small stream having its source in Lancaster Lake and flowing southward a distance of about a mile into the north-west corner of Douglas Lake. Near the mouth, where the collecting was done, the stream was about thirty feet wide and from five to ten feet deep, and the current was very slow. Deciduous forest trees shaded the stream, and, except for occasional mud flats, the banks were covered with a thick growth of shrubs, ferns, and grasses. In the water, along the margins, were water lilies, eel-grass, *Ceratophyllum*, and species of *Potamogeton*.

Fish, tadpoles, crayfish, insect larvae of various kinds, Hemiptera, and water beetles were the most conspicuous animals at this station.

*Station VIII* was a portion of Maple River near its source at the west end of Douglas Lake. The stream was shallower and more rapid than Bessey Creek at Station VII, and flowed through open country. The littoral vegetation was fairly dense, bushes alternating with grassy banks and sandy flats, but the stream itself was free from vegetation other than occasional stands of rushes and sedges along its edges. The bottom was sand, with small areas of debris and muck in the back-eddies.

*Station IX* was a partially filled peat bog located a short distance from the shore at the south-west side of Douglas Lake. This station is known both as Silver Lake and as Bryant's Bog, the latter name being the one more commonly used at the Biological Station. The open-water area was roughly L-shaped, surrounded and overgrown on all sides by a floating mat of *Chamaedaphne* and *Sphagnum*. There was a "false bottom"

about ten feet below the surface of the pond, and the whole bog was underlaid by a bed of peat some fifteen feet thick. The water was quite brown from long-continued leaching of organic matter. In several places there were small beds of water lilies, and in most of the pond there was a sparse growth of a species of *Potamogeton*, together with some Naias. Algae were rather plentiful.

Immature forms of Diptera and Odonata were common, as were also Hemiptera and Dytiscidae. The aquatic insects at this station were parasitized by red mites to a much greater degree than at any other station in the region.

*Station X* was the upper portion of Carp Creek, a small rapid stream fed by subterranean water coming to the surface in a number of springs about three-quarters of a mile south of Douglas Lake. The stream was heavily shaded, but what light was available penetrated to the bottom through the clear water of the creek. The bottom was sand, with only a very small amount of debris; and, except for occasional beds of *Chara*, the vegetation was confined almost entirely to the margins of the stream. As might be expected, there was a marked absence of predaceous animal forms, some surface-feeding Hemiptera being the exceptions. The immature forms of mayflies, caddis-flies, and black flies (*Simulium venustum*) were abundant.

*Station XI* was Lancaster Lake, a small body of water about a mile north of Douglas Lake, previously mentioned as the source of Bessey Creek. Collecting was done here in the marshy areas along the north and west shores. Among the rushes, reeds, and cat-tails there were occasional exposed marly flats and small pools of turbid standing water which received an abundance of light. Tadpoles, fish, amphipods, various insect larvae, Hemiptera, and water beetles were observed here.

No collecting was done at this station in 1918, and the 1914 specimens were confused with specimens from other stations, so that only the scanty records of 1913 are available for Lancaster Lake.

*Station XII* was a bog area about a mile south-east of Douglas Lake. Originally more than 250 feet in diameter, the open water has now been reduced to about 30 by 60 feet, with short narrow extensions to the north and south. The water was three or four feet deep in the center, over a very soft peat bed some fifteen feet thick. The vegetation in the open water was rather scanty, consisting of water lilies and some *Potamogeton*; and the floating mat at this bog consisted almost entirely of *Carex filiformis*, with only occasional shrubs of *Chamaedaphne*, and with no *Sphagnum* except at the north-west edge. The fauna here was very similar to that at Station IX.

In addition, one or two collections were made in 1914 at Monroe and Vincent Lakes, a short distance north of Douglas Lake; but they are not included in the present report, as no field notes were kept and the specimens were placed in vials of alcohol together with specimens from other localities.

#### DISCUSSION OF SPECIES

##### *Key to the Families of Waterbugs of the Douglas Lake Region*

1. Antennae short, concealed in cavities on ventral side of head, near eyes; forms living in water .....2  
    Antennae exposed, at least as long as head; littoral forms  
    or forms living on surface of water .....5
2. Head overlapping prothorax dorsally; body flattened above;  
    apical abdominal segments of males asymmetrical.....CORIXIDAE  
    Head inserted into prothorax; male abdomen symmetrical;  
    form of body variable .....3
3. Hind tarsi with two distinct claws; size larger, length 19 mm.  
    or more .....4  
    Hind tarsi without two distinct claws (except in *Plea*, which  
    is less than 3 mm. long); size moderate or small, length  
    less than 16 mm.; swim with ventral side upper...  
    most ..... NOTONECTIDAE



4. Apical abdominal appendages long and slender, not retractile; hind legs not flattened; body long and slender (in our forms) .....NEPIDAE  
 Apical abdominal appendages short and flattened, retractile; hind legs distinctly flattened; body broad and flat ..... BELOSTOMATIDAE
5. Head shorter than thorax and scutellum together, eyes close to thorax .....6  
 Head as long as thorax and scutellum together, much produced in front of eyes, which are remote from thorax; body very slender; usually wingless.....HYDROMETRIDAE
6. Claws of at least the front tarsi distinctly subapical, with the terminal tarsal segment more or less cleft at tip.....7  
 All tarsal claws situated apically .....8
7. Hind femora (except in females of Rheumatobates) distinctly surpassing apex of abdomen; bases of antennae more or less remote from eyes, and anterior to them.....GERRIDAE  
 Hind femora not or barely surpassing apex of abdomen; bases of antennae (in our forms, at least) contiguous to eyes or located beneath them .....VELIIDAE
8. Usually apterous; hemelytra when present with clavus membranous, similar in texture to membrane, the latter without veins; body flattened above, convex below; color usually green; length about 3 mm.; live on surface of water or on floating vegetation ..... MESOVELIIDAE  
 Usually winged; clavus not membranous, membrane with four or five long closed cells; color not green; size larger; tylus separated from frons by an impressed line; littoral forms, rarely found in same situations as the Mesoveliidae...SALDIDAE

FAMILY HYDROMETRIDAE, THE MARSH-TREADERS

This family is represented in Michigan by a single species.

GENUS HYDROMETRA LATREILLE

1. *Hydrometra martini* Kirkaldy. This interesting species was found in considerable numbers at two of the beach pools (Stations V and VI) and at Station XII, and a few individuals were taken at Station IX, where they were found on the surface of the water under the overhanging *Chamaedaphne* at the edge of the pond. Although fairly common in July, only a few individuals were seen in August. A single winged specimen was taken at Station VI on July 9, 1918.

## FAMILY GERRIDAE, THE WATER-STRIDERS

Five species, belonging to two genera, have been taken at Douglas Lake.

*Key to the Genera of Gerridae of the Douglas Lake Region*

- Inner margins of eyes convexly rounded; body comparatively paratively long and slender (Gerrinae); length 7 mm. or more .....GERRIS
- Inner margins of eyes convexly rounded; body comparatively short and broad (Halobatinae); length less than 6 mm.....2
2. Basal segment of antennae nearly as long as other three together; antennae nearly as long as body (not yet taken at Douglas Lake) .....METROBATES
- Basal segment of antennae much shorter than other three together, sometimes shorter than segments 2 and 3 together.....3
3. Fourth antennal segment longer than third; color black, dorsal surface varied with yellow; occurs on sheltered parts of lakes (not yet found at Douglas Lake).....TREPOBATES
- Fourth antennal segment not more than equal to third; antennae and hind legs of males curiously distorted; color black above, more or less marked with yellow; usually found on slow-flowing streams.....RHEUMATOBATES

## GENUS GERRIS FABRICIUS

The four species of *Gerris* occurring at Douglas Lake may be separated by the following key.

1. Basal segment of antennae longer than second and third together; usually wingless; length 12-13 mm.; occurs on running water .....*G. remigis*
- Basal segment of antennae shorter than second and third together; usually winged .....2
2. Antennae as long as half the body; 6th abdominal segment of male roundly emarginate below; length about 15 mm. ....*G. rufoscutellatus*
- Antennae less than half as long as body, not longer than head and thorax together; 6th ventral segment of male doubly emarginate; length 10 mm. or less; dorsal surface black .....3
3. Lateral border of anterior lobe of pronotum with a short longitudinal yellow line behind eye; median emargination of 6th ventral segment of male roundly rectangular; length 7-8 mm. ....*G. buenoi*
- Lateral border of pronotum concolorous; median emargination narrow and rounded; length 9-10 mm. ....*G. marginatus*

2. *Gerris remigis* Say. Found commonly in groups numbering about six to ten individuals on the back-eddies of the streams. Nymphs were found abundantly in company with the adults through July and August. A single specimen was taken on standing water at Station IV on July 7, 1918; and two winged specimens were secured on Maple River on July 11.

3. *Gerris marginatus* Say. This water-strider was found on all the beach pools, bogs, and sheltered portions of Douglas Lake, and also occasionally on back-eddies in the streams, and among bulrushes on more exposed parts of the lake. Though often taken at the same stations as *G. buenoi*, it was seldom found with that species, as it seemed to prefer more open water, while *buenoi* occurred most commonly among the vegetation. Brachypterous individuals were fairly common on Sedge Pool (Sta. VI) during July, but apterous individuals were rare.

4. *Gerris buenoi* Kirkaldy. The most abundant and widely distributed waterbug of the Douglas Lake region; found at all the stations except the rapid streams and the exposed situations on the large lake. Its habitat preferences have been mentioned under the preceding species: this was the only water-strider found commonly among *Scirpus* and *Carex* at the various pools. Apterous specimens were fairly common at Station VI during July, and two pairs of apterous adults were taken in copula, but no brachypterous individuals were observed.

5. *Gerris rufoscutellatus* Latreille. Less abundant than the two preceding species, but somewhat more common than *G. remigis*. The species was found at all the stations except the exposed parts of the large lake. On the pools and bogs it occurred in the same situations as *G. marginatus*, and, while

occasionally found in company with *G. remigis* on the streams, it appeared to prefer more slowly moving water than did that species.

The Douglas Lake specimens of *Gerris rufoscutellatus* vary somewhat in the coloration of the hemelytra, which in the majority of the individuals are concolorous. In two specimens the ground color is white, with only the nervures rufous, and other specimens show intergradation between this pattern and the typical coloration.

#### GENUS RHEUMATOBATES BERGROTH

6. *Rheumatobates rileyi* Bergroth. This little water-strider was found in great numbers on Bessey Creek, where on August 14, 1918, over one hundred adults were collected with three sweeps of a net. In the same locality, on July 25, about half a dozen nymphs of a later instar were taken on the sheltered cove in North Fishtail Bay (Sta. IV).

The adult specimens from Douglas Lake differ markedly in color from Ohio specimens of typical *rileyi* in my collection, and may possibly merit separation as a distinct variety. The connexivum and disk of the mesonotum are entirely black in the northern form, and the yellow marking of the pronotum of typical *rileyi* is here reduced to narrow marginal lines on the front and back edges connected by a moderately broad median line. Only a narrow portion at the base of the first antennal segment is yellow, and the yellow color on the coxae and trochantera of the typical form is here replaced by reddish-ochraceous. There is a small yellow or orange spot on each side of the mesothorax, just above the coxae. The mesonotum is yellow, with a brown transverse band across the anterior edge from which two obsolescent brown bands extended backward, diverging posteriorly, but not reaching the metasternal

suture; these diverging bands vary considerably in intensity in different specimens. The abdomen is slightly more narrowed behind than in typical *rileyi*, but the structure of the antennae and the hind legs of the males is the same in both forms.

In my collection I have Michigan specimens of *Metrobates hesperius* Uhler and *Trepobates pictus* (Herrich-Schaeffer), two halobatine species which are widely distributed in North America, and they may possibly occur in this vicinity. *T. pictus* is lacustrine in habits, and is found both on the open water of large lakes and on sheltered coves; and *M. hesperius*, while usually found in the same situations as that species, is also found occasionally on slow-flowing rivers.

FAMILY VELIIDAE, THE BROAD-SHOULDERED WATER-STRIDERS.

*Key to the Genera of Veliidae of the Douglas Lake Region*

- Fourth antennal segment longest; last segment of middle tarsi deeply cleft, the cleft set with feathery hairs; hind femora incrassate and spinose ..... RHAGOVELIA
- First antennal segment longest ..... MICROVELIA

GENUS RHAGOVELIA MAYR

7. *Rhagovelia obesa* Uhler. Apparently rather rare here. The only specimens taken within our limits were collected on Maple River in August, 1914. Miss Butler secured about half a dozen specimens on August 3, 1918, on a small stream about fifteen miles west of Mackinaw City, in Emmett County, where they were found in company with *Gerris remigis*.

GENUS MICROVELIA WESTWOOD

8. *Microvelia borealis* Bueno. Common. This species was most abundant at Bryant's Bog (Sta. IX), under the overhanging *Chamaedaphne* around the margins of the pond. At

several of the other stations it was found among the emergent vegetation, running about on the surface of the water. A single winged specimen was taken.

#### FAMILY MESOVELIIDAE

A single species occurs in Michigan.

#### GENUS MESOVELIA MULSANT AND REY

9. *Mesovelia mulsanti* B. White. Abundant on the weed-grown pools and ponds in the Douglas Lake region, and especially at home around the floating-leaves of the Potamogetons and water-lilies. All the specimens secured were apterous.

#### FAMILY SALDIDAE, THE SHORE-BUGS

##### *Key to the Genera of Saldidae of the Douglas Lake Region*

Pronotum conical, much narrowed anteriorly, lateral margins straight .....	SALDA
Pronotum not conical, less narrowed in front, lateral margins strongly arcuate .....	SALDULA

#### GENUS SALDA FABRICIUS

10. *Salda coriacea* Uhler. Rare in this region. Two specimens were taken with the next species by sweeping sedges near the open water at Smith's Bog (Sta. XII) on July 29, 1918.

#### GENUS SALDULA VAN DUZEE

11. *Saldula pallipes* (Fabricius). This shore-bug was found fairly commonly among the scanty vegetation along the east beach of the lake (Sta. II), and along the sandy flats beside Maple River (Sta. VIII). It was also taken occasionally by sweeping the bulrushes and sedges at several of the beach pools; but by far the largest single catch of this species (27 specimens) was made at Station XII on July 29, both by

sweeping the sedges and by picking the insects from the surface of the water, where they had probably been driven from the *Carex* by the strong wind which was blowing at the time.

FAMILY NOTONECTIDAE, THE BACK-SWIMMERS

*Key to the Genera of Notonectidae of the Douglas Lake Region*

- 1. Hind tibiae and tarsi not ciliated; abdomen not keeled; body about twice as long as wide, roundly convex above; length less than 3 mm. ....PLEA  
 Hind tibiae and tarsi ciliated; abdomen keeled and hairy; body two and one-half to three times as long as wide, much less convex above; length 5 mm. or more .....2
- 2. Fourth antennal segment much longer than third; hind tarsi with minute claws; length less than 8 mm., shape slender. BUENOA  
 Fourth antennal segment much shorter than third; hind tarsi without claws; length more than 8 mm., shape more robust ..... NOTONECTA

GENUS NOTONECTA LINNAEUS

In the following key to the species of *Notonecta* the term vertex means the anterior edge of the head between the eyes as seen from above, and the term synthlipsis is applied to the place on the dorsal side of the head, near the hind margin of the eyes, where the interocular distance is a minimum.

*Key to the Species of Notonecta in the Douglas Lake Region*

- 1. Inner margins of the eyes not greatly diverging, vertex not more than one and one-half times as wide as synthlipsis; length about 14 mm., coloration variable.....*N. insulata*  
 Inner margins of eyes more widely divergent, vertex at least twice as wide as synthlipsis .....2
- 2. Vertex two to two and one-half times as synthlipsis .....3  
 Vertex three times as wide as synthlipsis .....4
- 3. Larger species, length 12½-14 mm.; body more robust, length about 2.7 times width of pronotum; color luteous, scutellum nearly concolorous with hemelytra, which are rarely marked with dark except for a short narrow marginal vitta at base of costal area.....*N. borealis*

Smaller species, length 10-12½ mm.; body more slender, length about three times width of pronotum; scutellum usually with a large black area, hemelytra usually with a black fascia at apex of corium.....*N. undulata*

4. Small slender species, length about 9 mm.; color usually white, without dark markings .....*N. variabilis*

Large robust species, length 13 to 15 mm.; color of hemelytra bluish-black, irrorated with castaneous .....*N. irrorata*

12. *Notonecta irrorata* Uhler. This beautiful species seems to have been fairly common in 1913, especially in the calm slow-flowing waters of Bessey Creek, where a number of specimens were secured; but in each of the other years only four individuals were taken.

13. *Notonecta variabilis* Fieber. Locally abundant, especially in the lower portion of Bessey Creek (Sta. VII), where sixty-three of the sixty-seven specimens were secured. This species was found only among the vegetation, and was rarely seen at the surface of the water: by far the greater number of the specimens were taken by dredging among the Potamogeton and Ceratophyllum at the edges of the stream. It was much more abundant during August than in July.

14. *Notonecta borealis* Bueno and Hussey. This is the species which Mr. Bueno reported in 1904 from British Columbia as *Notonecta lutea* Müller, but a study of the genitalia shows it to be very distinct from that species. A description of it as a new species by Mr. Bueno and the writer will appear shortly. Mr. Van Duzee, in his Catalogue of the Hemiptera of America North of Mexico reports it also from Manitoba, and I have seen one specimen from Maine in Prof Parshley's collection. This is the first published record for the United States.

In the Douglas Lake region, though rather restricted in its local distribution, it ranks next to *N. undulata* in abundance, and at Bryant's Bog (Sta. IX), far outnumbers that species. It is particularly abundant in the peat bogs, though found also



in small numbers in the larger beach pools which have a considerable area free from emergent vegetation. Miss Miller reported thirteen specimens from North Fishtail Bay (Sta. IV), on July 26, 1913, but no others were taken there either in that year or in the other years.

Except for five specimens taken at Station XII on July 5, this species was never found in emergent vegetation or in shallow water. It was commonly seen floating at the surface of open water, ready to dive at any time; and it is the wariest *Notonecta* of my acquaintance. This was the only species of the genus of which imagoes were found early in July at Douglas Lake.

15. *Notonecta undulata* Say. The most abundant and widely distributed back-swimmer in the Douglas Lake region, common in all the quiet-water habitats except Bessey Creek. Like the last species, *N. undulata* was seldom found among the vegetation in the larger pools, but was most often observed floating at the surface in the open water, a few feet outside the plant zone. Like most of the other species of the family, *undulata* was much more abundant in the later part of the summer than early in July, imagoes being found only occasionally before about July 20.

About five percent of the specimens lacked the black fascia at the apex of the corium, and in one specimen there was no trace of black on the scutellum.

16. *Notonecta insulata* Kirby. One of the least common species of the genus in this vicinity. No specimens were secured either in 1913 or in 1914; and in 1918 only seven specimens were taken, at Stations IX and XII.

#### GENUS BUENOA KIRKALDY

The various species of this genus with which I am acquainted in life appear to have a very nicely adjusted mechanism for maintaining their position at any level in the water without

effort, and for regulating the interchange of gases between the bubble which they carry with them and the supply dissolved in the water. This promises to be a very interesting problem for future investigation.

*Key to the Species of Buenoa of the Douglas Lake Region*

- Eyes strongly projecting laterally beyond the pronotum; head with eyes wider than body at its widest point; form more slender; membrane without a black transverse spot at base ..... *B. platycnemis*
- Eyes not strongly projecting; head with eyes much narrower than widest part of body; form more robust; membrane most commonly with a large black transverse spot outside near base ..... *B. elegans*

17. *Buenoa platycnemis* (Fieber). Found in the same localities as *B. elegans*, but much less common, less than a dozen specimens being secured in 1918. My determination of this species has not been verified, as through an oversight no specimens were sent to Mr. Torre-Bueno.

18. *Buenoa elegans* (Fieber). Abundant in the peat bogs, and also found occasionally in the larger beach pool at Sedge Point. The adults were found only in the open water, and were commonly seen swimming at some little distance below the surface; but on several occasions nymphs of a *Buenoa* were found among the emergent vegetation in shallow water at Sedge Pool.

A third species of *Buenoa*, *B. margaritacea* Bueno, may possibly occur in this region also. It was described from New York, and has subsequently been reported from Florida, Illinois, and Kansas, and I have seen specimens from California and have found it very common in the vicinity of Minneapolis and St. Paul, Minnesota. It may readily be distinguished from either of the preceding species by its shorter hemelytral commisure, which is distinctly shorter than

the pronotum and scutellum combined, while in *B. platycnemis* and *B. elegans*, as represented in my collection, the commissure is from one-third to one-half longer than the combined length of the pronotum and the scutellum.

GENUS PLEA LEACH

19. *Plea striola* Fieber. Rather uncommon during July among the emergent and submerged vegetation of Sedge Pool.

FAMILY NEPIDAE, THE WATER SCORPIONS

This family is represented here by a single genus and two species.

GENUS RANATRA FABRICIUS

Juga parallel, their apices somewhat prominent; tylus distinctly longer than juga .....*R. americana*  
Juga converging anteriorly, almost touching the tylus in front; tylus slightly longer than juga .....*R. protensa*

20. *Ranata americana* Montandon. Common in all the beach pools, and found occasionally also at Stations IV, IX, and XII, during the later part of July and all of August. In the beach pools the species occurred in the emergent vegetation, and in the larger and more open bodies of water it was found under the thickly vegetated overhanging banks. Nymphs of water scorpions were found abundantly after July 10, and eggs were found imbedded in decaying bulrush stems at Station VI on July 26 and August 19.

The Douglas Lake specimens vary considerably in size and in the prominence of the subapical notch of the front femora, which in the majority of the individuals is quite distinct, in others obsolete, and in a few wanting entirely.

21. *Ranata protensa* Montandon. Mr. Torre-Bueno has identified two of the specimens sent to him as this species.

The key given above is based on Montandon's original descriptions (Bull. Soc. Sci. Bucarest, xviii, p. 185, and xix, p. 66, 1910).

FAMILY BELOSTOMATIDAE, THE GIANT WATER-BUGS

Three species of this family, belonging to two genera, have been taken here, and another may occur.

*Key to the Genera of Belostomatidae of the Douglas Lake Region*

Head not conically produced before eyes; "furrow" of membrane of hemelytra sinuate; size larger, length 40 mm. or more ..... LETHOCERUS  
 Head conically produced before eyes; "furrow" of membrane straight; smaller, length less than 25 mm. .... BELOSTOMA

GENUS LETHOCERUS MAYR

22. *Lethocerus americanus* (Leidy). Not at all common, only five adults having been secured in two seasons' collecting, and none being reported for 1914. All the mature forms were taken from the largest beach pool at Sedge Point (Sta. VI), both by dredging in the mud and by running nets through the vegetation. A single exuvium of a late nymphal instar was found at Station XII on July 29, and nymphs of a *Lethocerus* were fairly numerous in one of the pools at Station III before this pool dried up.

A specimen taken on the beach at Station I on July 4 was determined by Mr. Torre-Bueno as *Lethocerus obscurus* (Dufour), but I must confess my inability to distinguish it from *L. americanus*. It is fully as large as several of the Douglas Lake specimens of that species, measuring 49 by 18 mm., and the structure of the head does not appear to be different.

23. *Lethocerus* sp. Two specimens of a *Lethocerus* much larger than *americanus*, measuring 58 mm. and 61 mm. respectively, were taken at Station VI on August 7 and August

10, 1918. The smaller one especially is very distinct from *americanus*, and this appears to be an undescribed species, but more material is needed to decide its status definitely. Mr. Torre-Bueno writes me, "The large *Lethocerus* is one that I have received from the west—Oregon, Washington, etc."

GENUS *BELOSTOMA* LATREILLE

24. *Belostoma flumineum* Say. Common all summer in all the pools and bogs where there was submerged or emergent vegetation growing in shallow water. Males which were carrying eggs were often seen in July.

FAMILY CORIXIDAE, THE WATER BOATMEN

Representatives of two genera of this family have been found at Douglas Lake. The following key will serve to distinguish them. The strigil in *Arctocorixa* is a small but distinct elongate or elliptical plate at the dextral margin of the antepenultimate tergite of the abdomen, and in our species at least, is directed longitudinally or obliquely.

Strigil absent; basal segment of hind tarsi with a large apical black spot .....	CALLICORIXA
Strigil present in males; basal segment of hind tarsi without an apical black spot, although sometimes fringed with black hairs .....	ARCTOCORIXA

GENUS *CALLICORIXA* B. WHITE

25. *Callicorixa* sp. Three specimens of a *Callicorixa*, probably *C. kollarii* (Feiber), were taken in the Maple River below Station VIII on August 17, 1914. No others have been collected in the region.

GENUS *ARCTOCORIXA* WALLENGREN

Several specimens of the 1913 collection were sent to Professor Abbott in that year, and he identified them as belong-

ing to three species, *A. signata* (Fieber), *A. interrupta* (Say), and a new species to which he gave the name *A. nana*; but the entire collection was not determined. After examining the 1918 collection, I strongly suspect that several other species are represented in it, but I have not attempted to make any determinations in this very difficult group; and, as Professor Abbott is now in Japan, identification of these forms by a competent authority is not possible at present. Of *A. nana* Professor Abbott wrote in 1913, "It belongs to the *Arctocorixa interrupta* group, and is the smallest member of it that I have seen." No description of this species has been published as yet.

*Arctocorixa interrupta* is the most abundant water boatman in this vicinity, with *A. nana* second and *A. signata* third, the three species occurring in the 1918 collection roughly in the ratios 3:2:1 respectively. The other forms were relatively uncommon.

#### DISCUSSION

The general characteristics of the hemipterous fauna of this region can be summarized very briefly. As far as can be judged from the study of the limited area under consideration, the fauna of this part of Michigan is transitional between that of the north and north-west and that of southern Michigan—and the latter appears to be fairly typical for central North America. Careful collecting at Douglas Lake failed to show the presence of *Benacus griseus*, *Pelocoris femoratus*, *Ranata kirkaldyi*, or *Gelastocoris*, all of which are fairly common in the region about Ann Arbor; while *Plea striola*, which is very abundant at Ann Arbor, was found to be uncommon here. On the other hand, a few boreal species such as *Notonecta insulata* and *Gerris rufoscutellatus*, which occurred at Douglas Lake, are rare in the south-eastern part of Michigan. The

presence of the large *Lethocerus* links the Douglas Lake region with the far north-west, and the absence of records for these species indicates the need for careful collecting in the intervening districts.

