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THE ODONATA (DRAGONFLIES) OF LAKE
NIPISSING

BY

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ABSTRACT

Collections of Odonata, both adults and nymphs, were made at a number of stations on Lake Nipissing, chiefly near the headwaters of the French River, and representing as great a variety of habitats as possible. The sixty-two species listed are indicative of the upper limits of the Transition zone, the fauna being similar to that of the east shore of Georgian Bay, at Go-Home Bay, with the boreal element a little more pronounced. Notes on the habitats, flight, oviposition, etc., of some of the species are given. *Enallagma clausum* and *Soma-tochlora incurvata* are recorded from Ontario for the first time, the latter being new to Canada.

During the summers of 1929, 1930, and 1931 the Ontario Fisheries Research Laboratory was stationed on Frank's Bay, Lake Nipissing, Ontario. The writer enjoyed the hospitality of the staff from the 9th to the 21st of July, 1929, and revisited the station in August, 1931, remaining there from the 7th to the 10th. During these visits collections of Odonata were made, and much additional material was also collected by Messrs. F. P. Ide, W. E. Ricker, and J. P. Oughton. Specimens were also contributed by Professor J. R. Dymond and Messrs. A. L. Tester and A. M. Fallis. Most of the nymphs were collected by Mr. Oughton, who was engaged in a study of the bottom fauna of the lake. To all these gentlemen the writer wishes to express his thanks for their kind co-operation.

Lake Nipissing lies between $46^{\circ}5'$ and $46^{\circ}20'$ north latitude and between $79^{\circ}20'$ and $80^{\circ}12'$ east longitude. In general form it is long and rather narrow, its extreme length being about forty-five miles and its greatest breadth fifteen miles. It lies within the area of the Laurentian Plateau, the general character of its rocky shores being similar to that of

the Muskoka lakes and the east coast of Georgian Bay, into which Lake Nipissing is drained by the French River.

Frank's Bay is a small bay on the south side of the lake, at the headwaters of the French River. There are numerous rocky islands about the headwaters of the river and a few in the open lake. Among these islands Sandy Island is remarkable for the extent of its sandy beach and Iron Island for its boulder-strewn shore and hardwood forest.

The general character of the biota of the Lake Nipissing region is indicative of the northern limits of the Transition zone of Merriam. The odonate fauna is similar to that of the east coast of Georgian Bay in the vicinity of Go-Home Bay (Walker 1915), but the boreal element is more pronounced and there are apparently fewer austral species. More extensive and intensive collecting would be necessary, however, in order to make a satisfactory comparison between these regions. Many additional species doubtless inhabit the Lake Nipissing region, as indicated by the records from the adjacent regions of Algonquin Park (Walker 1906, and McDunnough 1921). Among these may be mentioned *Lestes eurinus*, *L. congener*, *Enallagma aspersum*, *Agrion resolutum*, *Ophiogomphus rupinsulensis*, *Lanthus albistylus*, *Gomphus descriptus*, *Somatochlora forcipata*, *Sympetrum semicinatum*, and *Leucorrhinia glacialis*.

The principal stations where collections were made by the writer are briefly described below. (In the annotated list of species these stations will be referred to by number only when place names are not otherwise readily indicated.)

Station 1. Sand Creek (also known as Bass Creek); a forest stream which we explored for a distance of about nine miles from the mouth in Frank's Bay. For the greater part of this stretch, it is very quiet and shallow with a soft, mud bottom and a clear channel, although there is abundant aquatic vegetation in many places and patches of emergent vegetation along the banks or in mid-stream. The average width is about thirty or forty feet, but there are a number of gentle rapids where it is much narrower with a sandier or stonier bottom. About a mile from the mouth is a rocky

declivity over which the stream debouches through a narrow passage, terminating in a small fall, over which a timber slide has been built. Another fall occurs about eight miles up stream. Apart from these falls there are but few rocky exposures along the course of the stream, the banks consisting for the most part of stratified clay covered with a deep humus. They are clothed with a luxuriant vegetation in which the royal fern (*Osmunda regalis*), the sensitive fern (*Onoclea sensibilis*), the tall meadowrue (*Thalictrum polygamum*) are abundant and conspicuous. Fine patches of cardinal flower (*Lobelia cardinalis*) appeared not infrequently. The trees are chiefly green and black ash, white elm, aspen poplar, paper birch, white spruce, balsam fir, and arbor vitae.

This is a fine stream for dragonflies, among the most abundant or characteristic of which are the two species of *Calopteryx*, *Enallagma exsulans*, *E. hageni*, *Ischnura verticalis*, *Aeschna umbrosa*, *Boyeria vinosa*, *Hagenius brevistylus*, *Stylurus scudderi*, *Gomphus brevis*, *G. exilis*, *Cordulegaster maculatus*, and *Somatochlora williamsoni*.

Station 2. The open marshes about the head of Frank's Bay and the mouth of Sand Creek. Not much collecting was done here but it was a good locality for species of this type of habitat. *Aeschna canadensis*, *Lestes disjunctus*, *Enallagma hageni*, and *Ischnura verticalis* are among the abundant species. *Enallagma signatum* was sometimes seen flying over the open water and was not observed elsewhere.

Station 3. The rocky shores of Frank's Bay and islands in the vicinity of the camp. Characteristic species breeding along these shores are *Argia moesta*, *Boyeria grafiana*, and, in the more sheltered coves, *Hagenius brevistylus* and *Gomphus lividus*.

Station 4. The Goose Islands, a group of four wooded islands in the open lake, three miles from the nearest point on the mainland. More than one distinct habitat is represented here, e.g., the open, rocky shores; sheltered, sandy bays; and small, sheltered lagoons. Among the noteworthy species observed here are *Enallagma clausum*, *E. boreale*, *Hagenius brevistylus*, *Gomphus brevis*, and *Macromia illinoensis*.

Station 5. Sandy Island, an island of several square miles in area, about a mile from the mainland and north of the headwaters of the French River. A considerable part of this island is sandy, the banks rising to a height of forty feet or more near the shore and there is a fine, sandy beach extending half a mile or more along the south side. The tree growth of this sandy area consists of jack-pine, red and white pine, with smaller numbers of other species such as white birch and red maple, while shrubs, such as sweet fern (*Comptonia asplenifolia*), blueberries (*Vaccinium pennsylvanicum*), and bear-berry (*Arctostaphylos uva-ursi*) are abundant. Along the beach, bog myrtle (*Myrica gale*), willows, and aspen are common. Small beds of bulrushes (*Scirpus lacuster*) grow twenty to thirty yards from the shore, and there is a lagoon, separated but not entirely cut off from the lake, by a narrow sandbar. This is practically a pond with a sandy bottom.

The most interesting species on Sandy Island was *Enallagma clausum*, which with *E. carunculatum* appeared to have come from the rush beds, while *E. boreale*, *E. hageni*, and *Ichnura verticalis* developed in the lagoon. *Gomphus exilis* and *Hagenius brevistylus* were common on Sandy Island.

Station 6. Iron Island, a smaller island in the open lake, about a mile north of Sandy Island. The bedrock, a stratified limestone, is exposed only along the shore, where it forms perpendicular walls, hollowed into miniature caves in many places and overhung by cedars and other vegetation. On the south side, where we landed, there is a beach of large angular pebbles and farther west a moderately fine sand. The island is almost entirely covered with a hardwood forest.

The only common dragonfly here was *Argia moesta*, but *Enallagma clausum* was also taken, as at all the outlying islands.

Station 7. A small rocky island, less than a mile from Iron Island, with a marsh at one end, bordering a shallow cove. The shore here was mucky and thickly grown over with horsetails (*Equisetum fluviatile*), arrowheads (*Sagittaria*), and other emergent aquatic plants. *Enallagma hageni* was exceedingly abundant here, almost to the exclusion of other

species. *E. carunculatum* and *E. clausum* occurred sparingly on the rocky part of the shore.

Station 8. "Brasenia Lake", a small lake connected by weedy channels with the north side of the French River about eight miles below Frank's Bay. It might be described as an expanded portion of a narrow bay and is typical of a very common biotic association of this region. The shore is mainly rocky but with many marshy intervals where bog myrtle and other shrubs are abundant. There is a rich aquatic vegetation, which includes a great quantity of water shield (*Brasenia Schreberi*), bladderwort (*Utricularia* sp.), *Myriophyllum*, *Potamogeton*, yellow pondlilies, and a small variety of the white waterlily (*Castalia odorata*).

Lestes vigilax, *Leucorrhinia frigida*, and *Libellula exusta julia* were among the abundant dragonflies found here.

Station 9. A sluggish creek or narrow channel connecting "Brasenia Lake" with another small lake. It was shallow with a muck bottom and largely hidden with shrubs. Towards its upper end there is a pond-like expansion with a small area of floating bog adjoining it. *Lestes disjunctus*, *Chromagrion conditum*, *Nehalennia irene*, and *Enallagma ebrium* occurred in the bog while *Nasiaeschna pentacantha* was taken over the pond-like headwaters of the creek.

Station 10. A small bog lake a short distance from stations 8 and 9 but with no permanent outlet. It is surrounded by an open bog supporting a fairly dense growth of leatherleaf (*Chamaedaphne calyculata*), wild rosemary (*Andromeda polifolia*), cranberries, pitcher-plants, and other typical bog plants. Fifteen species of dragonflies were taken here, among which may be mentioned *Lestes disjunctus*, *L. vigilax*, *Nehalennia irene*, *Enallagma ebrium*, *Aeschna canadensis*, *Dorocordulia libera*, *Tetragoneuria spinigera*, *Celithemis elisa*, *Leucorrhinia intacta*, *L. proxima*, and *L. frigida*.

Station 11. A small stream flowing into a narrow bay on the French River, in the same general locality as stations 8, 9, and 10. In the narrow bay there was floating and emergent vegetation. The lower part of the stream wanders through a somewhat open marsh with coarse tussocks growing

from blocks of mud. Wet muck where the water had stood earlier in the season occupied the spaces between the tussocks. This was the only place where *Lestes uncatatus* was observed.

Above the marsh the stream runs for the most part through a small, shady ravine, where *Calopteryx maculata* was abundant and *Argia violacea* common, and just above the marsh is a small pool, formed by a beaver dam, where, in addition to the above species, *Chromagrion conditum* and *Ischnura verticalis* occurred.

ANNOTATED LIST OF SPECIES

CALOPTERYGIDAE

1. *Calopteryx maculata* (Beauv.) Very abundant along Sand Creek on July 13, 1929, especially along the banks where the current was fairly swift. Often half a dozen would be seen at once within a few square yards. Two or three females were seen ovipositing in the eel grass (*Vallisneria spiralis*) or *Sparganium* above the water. Another ovipositing female was partly submerged but none were observed to descend completely under water. This species was also common about the same stream on July 16 and 21, 1929, and on August 7, 9, and 10, 1931, though restricted on the latter dates to the rapid parts of the stream. It flies actively on dull days if the water is warm.

On July 17, 1929, this damselfly was found plentifully along a rapid brook flowing into the French River at Station 11. Pairs were seen in courtship and in copula. In the former case the male hovers in front of the female, facing her, and sometimes two males, facing one another, would flutter and hover or fly with a swinging movement back and forth.

Exuviae were found sparingly on the banks of Sand Creek on July 13 and 16, 1929.

2. *Calopteryx aequabilis* Say. Observed on Sand Creek on the same dates on which *C. maculata* was seen and, although more plentiful on the rapid parts of the stream, it is decidedly less restricted to such waters than the latter species, being found everywhere along the banks. In the rapid

waters both species are fond of resting on emergent vegetation, such as *Sparganium*.

On two occasions on July 13, 1929, ovipositing females were seen to descend beneath the surface of the water. One of these was observed closely for about fifteen minutes, after which she emerged and flew away. When first seen she was resting on a floating ribbon of *Vallisneria*, growing in a fairly swift current (about one foot per second). She was submerged except for part of her wings and was actively thrusting the ovipositor into the plant, not only in the blade upon which she was resting but also in the neighbouring ones. She gradually descended and was soon entirely submerged. She continued to descend, ovipositing constantly, until she was about a foot beneath the surface and at times hidden among the ribbons of eel-grass. After about fifteen minutes she suddenly released her hold upon the plant and floated with the current to the surface, passing down stream about three feet before reaching it, whereupon the wings were immediately spread and she flew away.

LESTIDAE

3. *Lestes unguiculatus* Hag. A mature and pruinose male was taken in a black-spruce swamp near the camp on July 19, 1929.

4. *Lestes uncatatus* Kirby. A mature male was taken at station 11 on July 17, 1929. This species is decidedly partial to temporary or semi-permanent waters.

5. *Lestes disjunctus* Selys. First observed on July 12, 1929, at station 9, in the same vicinity as the preceding species; several seen also on July 17 at station 11. All of these, except a few observed on the latter date, were teneral. Adults were common on August 7, 9, and 11, 1931, along the banks of Sand Creek, occasional pairs seen in copula. It is a species of still, permanent waters.

6. *Lestes rectangularis* Say. A male was taken on Sand Creek on August 7, 1931.

7. *Lestes vigilax* Hagen. "Brasenia Lake" (station 8), July 12, 1929. Common on the bog myrtle and other

shore vegetation of a marshy bay on this small lake. It was also found, but in smaller numbers, about a typical bog lake in the same vicinity (station 10).

AGRIONIDAE

8. *Argia moesta putrida* (Hagen). Teneral were beginning to be frequent about the rocky islands in the vicinity of Frank's Bay on July 10, 1929. On July 20 mature individuals were found along the shore of Iron Island, settling on the boulders. It was the only common dragonfly here. In August, 1931, adults were abundant about the camp and elsewhere on the rocky islands.

9. *Argia violacea* (Hagen). Station 11, July 17,¹ common along the brook and even about the rocky shores of a small lake of which it is the outlet. They settled most frequently on the rocks but often on the low-growing foliage. All were in full colour and one or two pairs were seen in copula. A single male was taken by Mr. Ide on July 12 on a marshy ditch connecting two small lakes in the same general vicinity.

10. *Chromagrion conditum* (Hagen). A male in full colour was taken at station 9, July 12. It was resting with the wings half spread, like a *Lestes*, a habit which is common in this species. At Sand Creek, on July 13, one was taken near a cold spring on the bank of the stream; at station 11, on July 17, several were seen, including a pair in copula, about the beaver pond.

11. *Nehalennia irene* (Hagen). Common about still waters everywhere; Lake Nipissing, June 21, 1929 (Ricker); Sand Creek, July 9, in the vegetation along the banks; station 3, July 10, 11, on various islands; stations 9 and 10, common in the bogs, many pairs in copula; station 11, July 17, common; station 7, July 20, one specimen in the horsetail and arrowhead marsh, among the myriads of *Enallagma hageni*.

12. *Ichnura verticalis* (Say). Generally distributed and abundant; Frank's Bay, June 15 (Ide); Sand Creek

¹When not otherwise indicated, the dates refer to the season of 1929.

July 9 to 16, abundant along the banks; August 7-10, 1931, abundant everywhere along the creek, the females all pruinose, a pair in copula, August 10; stations 8, 9, and 10, July 12, abundant and in full colour, most females pruinose but some orange ones seen; station 11, July 17, common at the lake and at the beaver pond on the lower part of the stream, but not observed in the intervening rapid part of the stream except as a stray; Sandy Island, July 15, common about a small pond on the beach and abundant at the lagoon, where the specimens were of larger size than usual; station 2, August 10, 1931, abundant.

13. *Enallagma clausum* Morse. Found on all the outlying islands but not observed elsewhere; first seen on July 11, at the Goose Islands on a very limited area of the shore, 2♂ 4♀; Sandy Island, July 15, along the beach; though not common a fair series of both sexes was obtained, many in full colour but some still teneral. They did not appear about the lagoon where *E. hageni*, *E. boreale*, and *I. verticalis* were common but were most numerous near the rush beds, where they were associated with *E. carunculatum*. Since the latter species develops in these beds, it is probable that *E. clausum* breeds here also. This belief is strengthened by the fact of its occurrence at station 6 and other outlying islands where no ponds were present.

These specimens are large, like those from Lake Winnipeg and Lake Dauphin, Manitoba, greatly exceeding in size specimens from Penticton, B.C. Measurements of typical specimens are as follows: length, ♂34-36 mm., ♀35.5-36.0 mm.; abdomen, ♂27.0-29.0 mm., ♀28.0-29.0 mm.; hind wing, ♂20.0-22.0 mm., ♀22.0-23.0 mm.

In its habit of resting on the beach or on rocks along the shore this species resembles an *Argia*.

This is the first record of *E. clausum* from Ontario but there is a male in the National Collection, Ottawa, from Lachine, Quebec, taken by Mr. F. P. Ide. It is apparently a somewhat boreal species.

14. *Enallagma boreale* Selys. Associated with *E. clausum* on some of the outlying islands; Goose Islands, July 11, 1♂;

Sandy Island, July 15, fairly common along the shore, particularly at the lagoon, where pairs in copula were obtained. This was evidently the principal breeding place. The specimens were uniformly smaller and darker coloured than *E. clausum*. They were mostly fully mature. A male was taken on the French River on June 21, 1929, by Mr. Ricker.

15. *Enallagma hageni* (Walsh). The most abundant damselfly of the Lake Nipissing region, occurring almost everywhere: June 29, teneral ♀ (Ide); Sand Creek, June 15, 1930, full-grown nymph (Oughton); Sand Creek, July 9 to 16, very abundant along the banks in the quiet reaches; August 7 to 10, 1931, still very common; Goose Islands, July 11, common, particularly about the "Pirates' Cove", a small, sheltered bay; Sandy Island, July 15, common all along the sandy shore, particularly at the lagoon, where it was abundant, mostly mature but still emerging; some pairs in copula; the individuals were smaller and somewhat lighter blue than *E. boreale*; station 7, exceedingly abundant in the emergent vegetation, perhaps owing to the almost complete absence of competitive species; station 8, abundant at "Brasenia Lake" but not observed at the bog lakes (stations 10 and 11) where *E. ebrium* occurred. It was probably overlooked but was doubtless less common here than elsewhere. It was common in all the marshy bays and coves along the shore of the mainland and neighbouring islands, and was frequently noticed at some distance from the water, e.g., on July 19, in a black spruce camp, where a few were observed.

16. *Enallagma ebrium* (Hagen). Stations 9 and 10, July 12, common in the bogs; station 11, in the boggy margins of the lake, one pair in copula.

The restriction of this species to bogs and its small size are peculiar features not observed elsewhere in our experience. Usually it is similar in size to *E. hageni* and inhabits the same type of environment. The pair in copula, which are typical in size, measure as follows: length, ♂27.0, ♀27.5 mm.; abdomen, ♂21.0, ♀22.0 mm.; hind wing, ♂15.0, ♀16.5 mm.

17. *Enallagma exsulans* (Hagen). Sand Creek, July

13 to 21; quite common along the banks of the stream almost everywhere.

18. *Enallagma carunculatum* Morse. Sandy Island, July 15; found along the beach with *E. clausum*, which it resembles in size and colour, the males being distinguishable, however, by the more extensive black areas of the abdomen and the slightly darker colour. Both mature and teneral individuals were present. The beds of rushes (*Scirpus lacustris*), growing in patches thirty or forty yards from the shore were probably the breeding place of both species.

Unlike *E. clausum* this species also occurs about the mainland and islands nearby. It was not infrequently seen in the open, rocky woods in the vicinity of Frank's Bay, on August 7 to 10, 1931.

19. *Enallagma signatum* (Hagen). Several individuals were seen flying over the water near the mouth of Sand Creek in July, 1929. They were almost impossible to capture from the canoe, but Mr. Ide succeeded in obtaining one specimen, a male.

AESCHNIDAE

20. *Boyeria vinosa* (Say). Station 2, July 13; an exuvia was found on a wooden pile of a bridge near the mouth of Sand Creek. On the banks of the creek farther up the exuviae were very abundant in July. They were found, wherever a slight current was perceptible, upon stubs, logs, grass, or ferns overhanging the water, and all within two feet or so of its surface. No adults were seen this year in spite of the abundance of exuviae, for they had evidently emerged very recently and, at the time of my departure from the camp, had not yet returned to the stream from their first flights abroad. On July 17, 1931, 2♂ were taken on Sand Creek by Mr. Ricker, and on August 7 to 10 of the same year the writer observed both sexes flying here and there along the same parts of the stream where exuviae had been found, but they were much less abundant than had been expected. No exuviae were found and it was evident that they were not nearly so plentiful as in 1929.

As they patrol the banks of the stream near the water, their somewhat jerky, flitting movements are slightly suggestive of Calopteryx and are very different from the swift dash and hovering pause of *Aeschna umbrosa*, which frequents the same haunts.

21. *Boyeria grafiana* Wmsn. On July 16, 1929, I observed a full-grown nymph on the lake bottom, exposed to the sunlight, a few yards from shore and close to the camp wharf. It was placed in an aquarium but died the following day. An exuvia was found on July 10 by Mr. Ide and a teneral adult entered the laboratory through a window on the same day. The season was too early for this species to appear along the water's edge in its characteristic manner and no adults were observed in the field. On August 6, 1931, a specimen was brought to camp by one of the staff, but I did not observe any adults during the few days of my visit this year. There is every reason, however, to believe that it is common here.

22. *Nasiaeschna pentacantha* (Rambur). A fine male was taken on July 12, 1929, at station 9. It was flying in a somewhat circuitous course over the broad expansion of the creek, where it debouches from the lake and is margined by floating bog. Another individual was seen here and a third was observed on the same day in a narrow, rock-margined bay in the vicinity of station 10.

This is the most northerly record for this species.

23. *Basiaeschna janata* (Say). Sand Creek, in swift water, July 4, 1930, nymph, penult. stage (Oughton); in weed-choked waters above the falls, August 27, 1931, nine nymphs (five full grown, four very small) (Dymond); station 3, July 10, 1929, 1 ♂ patrolling the margin of a sheltered cove on one of the islands near Frank's Bay; Sand Creek, July 13, an old female was captured in flight over a quiet part of the stream.

The season for this species was practically over. It is probably abundant in June as it is on Georgian Bay.

24. *Aeschna eremita* Scudd. A female in good condition was found floating upon a quiet part of Sand Creek, July

13. Other large Aeschnas, probably this species, were occasionally seen on July 16, hawking erratically over the creek. A male was taken by Mr. Ricker on September 8, 1931, at Mud Lake, near North Bay, Lake Nipissing.

25. *Aeschna interrupta interrupta* Walk. Goose Islands, July 11, 1 ♀, somewhat teneral (Ide); Sand Creek, July 31, 1930, half-grown nymph (Oughton); island near 200, July 14, 1931, 1 ♂ 1 ♀ (Ricker).

26. *Aeschna canadensis* Walk. Blueberry Island, June 21, 1 ♀ (Ide); station 10, July 12; males were hawking over the open bog and often flying down to the water among the weeds; they were all in full colour; Sand Creek, July 13, 1 ♂ taken and others seen flying irregularly over the water; Sandy Island, July 15, a number were flying in sunny openings among the trees, some hanging up. Three were captured, one not fully mature in colour. They had evidently emerged later on this outlying island than on the mainland; at station 2, on August 10, 1931, a number of males were flying over an open marsh adjoining the bay; only one was captured; Twin Lakes, near North Bay, September 2, 1931, 1 ♂ (Ricker).

This appears to be by far the commonest Aeschna of the open marshes in this region.

27. *Aeschna umbrosa* Walk. Adults of this species were not observed in 1929, although emergence had commenced, as indicated by the finding of an exuvia at station 4 ("Pirates' Cove", an unusual situation for this species), on July 11, and another on Sand Creek on July 13. In 1931, adults were common on Sand Creek, August 7 to 10. The males were patrolling the margins of the stream and occasionally females were observed ovipositing. A very young nymph was taken on August 27, 1931, in weed-choked water above the falls (Dymond); station 3, September 2, 1931, 1 ♀ (Dymond); single exuviae were also collected in 1930 by Mr. Oughton at Frank's Bay near the dock, July 28; Mud Lake, Miners' Bay region, October 11; and from a small stream near the trail from South Bay to Perch Lake, August 4; and by Mr. Tester from a rock pool near Sand Creek, August 17. A number of nymphs of various sizes were also collected at

the last locality and from a small creek flowing into South Bay by Messrs. Tester and Oughton.

28. *Anax junius* (Drury). Two half-grown nymphs were taken in 1930 by Mr. Oughton, one at the mouth of Muskrat Creek, West Bay, on July 17, and the other at the mouth of a sluggish stream, on August 7. An adult, apparently of this species, was seen by Mr. Ide and the writer on July 13, 1921, at station 2, flying over the open marsh.

GOMPHIDAE

29. *Hagenius brevistylus* Selys. Frank's Bay, July 30, 1931, 1 ♂ (Ricker); station 3, July 10, a very large teneral female was captured in a grove on one of the islands; Goose Islands, July 11, many tenerals seen in open places, exuviae frequent both on the rocky shores and on a sandy beach on the largest island, where most of the adults appeared; Sand Creek, July 13 to 21, frequently seen along the stream in all its parts, all fully mature. Exuviae were also found on the banks of the creek and one on Sandy Island, July 15. It was again common on Sand Creek on August 7 to 19, 1931.

This huge gomphine flies with the end of the abdomen strongly decurved and settles upon bushes as well as rocks.

30. *Gomphus spicatus* Hagen. Frank's Bay, June 19, 1 ♀ (Ide); station 8, July 12, a female was taken on a rocky point along the shore of "Brasenia Lake".

This is an early and short-lived species, whose season of flight was practically over on my arrival at camp. Judging from its abundance on Georgian Bay it is probably also common at Lake Nipissing.

31. *Gomphus exilis* Selys. Sand Creek, July 22, 2♂ 1 ♀ (Ricker); July 13 to 16, exuviae very numerous, mostly on the mud banks, two or three feet from the water, which had evidently receded since their emergence. Most of them were slightly imbedded in the mud. They were more generally distributed than the exuviae of *S. scudderi*. Frank's Bay, July 18, 1931 (Ricker); station 3, July 10, a number observed flying over the rocky shore of one of the islands near Frank's Bay; Sandy Island, July 15, fairly common along the beach

and sometimes in open, sunny places among the trees, very active and difficult to approach, the day being fine and warm; exuviae not uncommon on the beach; station 8, July 12, and station 11, July 17, occasionally seen along the rocky shores of the channels and small lakes in this vicinity.

32. *Gomphus lividus* Selys. Frank's Bay, June 19, 1 ♂ (Ide); June 29, 1 ♂ (Ricker); July 10, 2 exuviae (Ide); station 3, June 10, young individuals just beyond the teneral stage were fairly common on the rocky shore of an island near Frank's Bay. They flew in company with the preceding species. Most of them were females but one male was taken. July 15 and 20, 1931, 3 ♀ (Ricker); July 10 and 21, 2 exuviae (Ide); Sand Creek, June 22, 1 ♂ (Ide); July 13, 1 ♂ 1 ♀. The last were old individuals, smaller and duller in colour than those just emerging from the lake. Sandy Island, July 15, one exuvia, no adult seen; small lake near Perch Lake, June 30, 1930, half-grown nymph (Oughton).

33. *Gomphus brevis* Hagen. Sand Creek, June 22, 1 ♂ (Ide); June 29, 1 ♀, teneral (Ricker); July 13, 1 ♀ beside shallow rapid; Goose Islands, June 23, 2 ♀ (Ricker).

The occurrence of this species on the exposed shores of outlying islands as well as in rapid streams was observed also at Go-Home Bay, Georgian Bay.

34. *Stylurus scudderi* (Selys). Sand Creek, July 13 to 16; exuviae found chiefly above the first five miles or so of the stream, sometimes clinging to leaves but more often on mud banks near the water line. They were fresh, the adults having evidently emerged very recently. They were much less numerous than those of *G. exilis* but a considerable number was collected by careful search. No adults appeared at this time nor were they seen on August 7 to 10, 1931.

35. *Stylurus notatus* (Rambur). An exuvia was found by Professor Dymond at Duke's Point on the north shore of the lake on August 22, 1931.

CORDULEGASTERIDAE

36. *Cordulegaster maculatus* Selys. Sand Creek, July 22, 2 ♂ (Ide); July 13, 2 ♂ taken and others seen over

the more rapid part of the stream below the upper falls. They flew very swiftly up and down the stream. A nymph was taken by Mr. Tester in a rapid stream flowing into South Bay, at a depth of three or four feet.

LIBELLULIDAE

CORDULIINAE

37. *Cordulia shurtleffi* Scudd. Lake Nipissing, June 21, 1 ♀ (Ricker).

38. *Dorocordulia libera* (Selys). Frank's Bay, June 29, 1 ♀ (Ricker); Goose Islands, June 23, 1 ♀ (Ricker); Lake Nipissing, July 13, 1 ♀ (Oughton and Tester); Blueberry Island, June 15, 1 ♂ (Ricker); June 21, 3 ♂ 8 ♀ (Ide); station 2, July 9 and 13, six exuviae from the piles of a wooden bridge, several feet above the water; July 10, several seen and 1 ♀ taken in open woods near a black spruce swamp half a mile from camp. They had probably come from the marshes of station 2. Station 9, July 12, one or two seen over the creek and 1 ♂ captured in the open bog; station 10, July 12, common, males patrolling the boggy lake margin; Sandy Island, July 15, a few observed in sunny openings in the red pine woods; station 11, July 17, 1 ♂ and 1 ♀ observed in the bog at end of lake.

This is a common bog species throughout most of Ontario.

39. *Somatochlora minor* Calvert. Sand Creek, August 17, 1930, a full-grown nymph taken from a small pool near the dam (Oughton). No adults were taken but a *Somatochlora* that was almost certainly this species was seen for an instant as it flew up the little brook at station 11, July 17.

40. *Somatochlora elongata* (Scudd.). Sand Creek, August 7, 1931, a female taken while ovipositing close to the bank in a quiet part of the stream. She was striking the water and the bank alternately, the latter about eight inches from the water line. The spot struck was damp and mossy. Two full-grown nymphs were taken by Professor Dymond from the same stream above the falls in "shallow weed-choked water", on August 27, 1931.

41. *Somatochlora williamsoni* Walk. This species had evidently been recently emerging on my arrival in 1929, as indicated by the finding of eleven exuviae on Sand Creek on July 9. They were found in the quiet water about a quarter of a mile below the lower falls in a narrow zone of *Sagittaria*, *Equisetum*, and *Sparganium*. Most of them were floating among the drowned stems of willow and the aquatic plants, but two were clinging to emergent stalks about ten inches above the water. Another exuvia was found under the bridge near the mouth of the creek. No adults were seen on this occasion but many, apparently of this species, appeared on July 13, flying high along the river. On revisiting the same stream on August 7 to 10, 1931, males were not uncommon, patrolling sections of the stream along the margins, and a female was observed ovipositing on the edge of the bank, striking the wet sand with the ovipositor a few inches above the water line. Apparently she did not strike the water as in the case of *S. elongata* and *S. minor*. This individual escaped but I had no doubt as to its identity. The extreme secretiveness of the female of *S. williamsoni* is very remarkable. Goose Islands, July 11, 1 ♂ found floating on the lake near the shore. Another individual, a female, was hawking among a swarm of small mayflies (*Baetis* sp.), devouring them rapidly. Station 9, July 12, 1 ♂ taken over the boggy end of the creek; others seen, mostly flying high, though two or three were patrolling the channel at low levels; station 11, July 17, one flying in a sunny opening at edge of wood and another over the boggy margin of the lake. A nymph of the penultimate stage was found by Mr. Oughton in a small pool on Sand Creek, near the dam, on August 17, 1930. Mud Lake, vicinity of North Bay, September 8, 1931, 1 ♂ (Ricker).

42. *Somatochlora kennedyi* Walk. Blueberry Island, June 15, 1 ♀ (Ide). Two exuviae of penultimate instars and one final exuvia were found floating in two small moss-bottomed pools, occupying depressions in the rocks within a mile of the camp. These pools were only a few square yards in area and, although in open woods, were fairly exposed to the sun. Although so small as to appear to be of a temporary

nature they must have contained some water for three years at least, as it takes that length of time for this species to develop to maturity. These pools and others like them were rich in aquatic insect life, especially corixids. Numerous tadpoles and a few green frogs were observed in some of them.

43. *Somatochlora incurvata* Walk. On my last trip in 1929 to Sand Creek, on August 21, I observed a *Somatochlora* fly over the creek and come to rest on a tree on the edge of a clearing, seven or eight feet from the ground. It proved to be a male of this rare species, hitherto known only from northern Michigan.

In the original account of this species (Walker 1925) I expressed a slight degree of doubt as to whether it was specifically distinct from *S. forcipata* Scudd. This specimen is in every respect like the Michigan ones and I now have no doubt whatever as to its validity as a species. In coloration it is remarkably like *S. williamsoni* though belonging to a very different group.

44. *Helocordulia uhleri* (Selys). French River, June 10, 1♂ (Ricker); station 11, July 17, an exuvia was found on the bank of the running stream, some distance above the water level. Another exuvia was found on a steep rock on the shore of Sand Creek, on August 10, 1931. Both exuviae were found long after the period of emergence of this early species. The period of flight was already over before I reached the camp in 1929.

45. *Tetragoneuria canis* MacLachlan. Sandy Island, July 15, 1♂ (Ide). As this species is abundant in Algonquin Park it is probably commoner here than this single record would indicate.

46. *Tetragoneuria spinigera* Selys. Frank's Bay, June 20, 1♂ 1♀ (Ricker); June 21, 1♀ (Ide); Blueberry Island, June 15, 1929, 2♂ (Ricker); station 10, July 12, 1♂ 1♀, captured in flight over the bog adjoining the lake; Sandy Island, July 15, observed here and there not infrequently, 1♂ captured on the beach, another flying over the lagoon.

The specimens from this region are similar in size to those

of central and southern Ontario but smaller than those taken in the Thunder Bay district (Walker 1924).

Two nymphs belonging to this species or the next were taken by Mr. Oughton in West Bay, mouth of Muskoka Creek, on July 17, 1930, one of them from the stomach of a perch; a third from Mud Lake, Miner's Bay region, on October 11, 1930. The first belongs to the penultimate stage, the other two about a stage later. Two exuviae of this or the next species were found under the bridge near the mouth of Sand Creek, on July 9, 1929.

47. *Tetragoneuria cynosura simulans* (Say) (Mutt.) Station 10, July 12; both Mr. Ide and the writer observed an individual of this species and variety flying high but occasionally descending within reach of the net over the bog adjoining the lake. Although not captured it was easily recognized as *simulans* by the large dark patch at the base of the hind wings. Station 11, July 17; another individual observed in flight too high for capture over the small trees and bushes skirting the bog.

This species shows marked fluctuations in numbers and is probably abundant here during certain years.

48. *Neurocordulia yamaskanensis* (Prov.). A few exuviae of this crepuscular species were found by my son, E. H. Walker, at South Bay, on August 1, 1931. Its season of flight was over when I first visited the camp and I found no evidence of its presence in the vicinity. As it is abundant on Georgian Bay and generally distributed in Pre-Cambrian areas in Ontario south of the height of land, it is probably common here.

49. *Didymops transversa* (Say). Sand Creek, August 9, 1931; an exuvia was found on the bank of the stream. It is doubtless abundant here in the early summer but the season of flight is so short that it was probably over when I arrived in 1929.

50. *Macromia illinoiensis* (Walsh). Woods near Sand Creek, July 20, 1931, 1♂ (Ricker): Sand Creek, July 13; a female flew swiftly past the canoe two or three times in a rather rapid part of the stream. She struck the water

several times, probably ovipositing. Goose Islands, July 11, two observed but not captured; vicinity of North Bay, July 13, 1931, 1 ♀ (Ricker).

LIBELLULINAE

51. *Libellula quadrimaculata* L. Common in marshy places. Frank's Bay, June 29, July 19, 2 ♂ (Ricker); station 8, July 12, observed at "Brasenia Lake"; station 9, July 12, abundant over the ditch-like part of the creek; station 10, July 12, very common, particularly over puddles in the bog; Sand Creek, July 13, occasionally in marshy parts of the stream; station 11, July 17, one seen at mouth of stream.

52. *Libellula exusta julia* (Say) Uhler. Frank's Bay, June 21, 1 ♂ (Ricker); station 8, July 12, common at "Brasenia Lake" in a marshy bay; station 11, July 17, seen in a narrow, weedy bay.

53. *Libellula lydia* Drury. Sand Creek, July 13, a male in full colour was observed just below the upper falls but escaped; Sandy Island, July 15, a male, mature but not pruinose, was seen at the edge of the woods but not captured.

This species is so distinctively marked that it cannot be mistaken for any other. It should be common here under proper conditions.

54. *Sympetrum decisum* (Hagen). Goose Islands, July 11; a number of teneral were observed on one of the islands. The only possible habitat for the nymphs which we discovered was a pool near the shore, but this was choked with moss and apparently contained little or no aquatic insect life. Recently emerged individuals were also met with in the tussock marsh at station 11, on July 17.

55. *Sympetrum obtrusum* (Hagen). Sandy Island, July 15, 1 ♂ teneral (Ide); common in black spruce swamp near camp, July 19; Sand Creek, August 7, 1931, a few fully mature males were flying over a marshy slough at a bend in the stream; vicinity of North Bay, including Thibeault Lake, September 1, 1931, 2 ♂ (Ricker).

56. *Sympetrum costiferum* (Hagen). Frank's Bay, July 14, 1931, 1 ♂ (Ricker); Sand Creek, August 10, 1931, 1 ♂

taken and another observed while flying over a patch of low rushes and horsetails in very shallow water on the edge of a quiet part of the stream; vicinity of North Bay, September 2, 1931, 1 ♂ (Ricker).

57. *Sympetrum vicinum* (Hagen). Sand Creek, August 7 to 10, 1931, teneral occasionally seen along the banks of the stream in quiet reaches; two full-grown nymphs were taken from shallow weedy water above the dam, on July 31, 1930 (Oughton); West Bay, mouth of Muskrat Creek, July 15 to 17, 1930, ten nymphs, nine full-grown and one penult. stage (Oughton); vicinity of North Bay, including Thibeault Lake, September 1 to 2, 1931, 2 ♂ (Ricker).

Doubtless this is an abundant species in late August and September.

58. *Leucorrhinia hudsonica* (Selys). Blueberry Island, July 15, 1 ♀, somewhat teneral (Ricker).

59. *Leucorrhinia proxima* Calvert. Frank's Bay, June 21 to 29, 1 ♂ 5 ♀; July 15, 1931, 1 ♀ (Ricker); Sand Creek, June 24, 1 ♂ (Ricker); July 13, occasional in marshy places; Lake Nipissing, three miles out, July 11, 2 ♂; nine miles from land, 1 ♂ (Fallis); July 13, 1 ♂ (Oughton and Tester); station 9, July 12, a few seen in the bog; station 10, July 12, fairly common in the bog but less so than *L. frigida*; all the individuals pruinose males; station 11, July 17, 1 ♀ on boggy margin of lake.

60. *Leucorrhinia frigida* Hagen. Frank's Bay, in marsh, June 29, three young ♀ (Ide); July 19, 1931, 3 ♂ (Ricker); Bertram River, July 12, 1 ♂ (Ide); station 8, "Brasenia Lake", July 12, common in a marshy bay; station 9, July 12, teneral females were appearing in the bog, also some old individuals; station 10, July 12, abundant; besides old pruinose individuals of both sexes there were many teneral, which had apparently just emerged.

61. *Leucorrhinia intacta* Hagen. Goose Islands, June 30, 1 ♂, mature (Ricker); black spruce swamp about a mile from camp, July 10, 1 ♂; station 10, July 12, a few somewhat teneral individuals in the bog adjoining the lake; station 11, July 17, 1 ♀ from the tussock marsh.

The time of emergence of this species and *L. frigida* appears to be either irregular or somewhat divided. *L. intacta* is much less common at this latitude than farther south, the other species taking its place.

62. *Celithemis elisa* Hagen. Station 10, July 12, 3 ♀; they were flying over the bog and alighting on shrubs; station 11, July 17, a few were scattered over the bog, 2 ♂ 1 ♀ taken.

This is the most northerly record for this species and for the genus *Celithemis*.

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