AN ECOLOGICAL SURVEY OF ISLE ROYALE, LAKE SUPERIOR

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NOTES ON THE VEGETATION OF ISLE ROYALE, MICHIGAN.

W. P. HOLT, CENTRAL HIGH SCHOOL, TOLEDO, OHIO.

I. General Observations on the Plant Societies.

Situated in the northern part of Lake Superior, in sight of the Canada shore, and bisected by the parallel of 43° N., Isle Royale offers a most attractive field for summer work. That its flora is strikingly northern may be inferred from its proximity to the Canadian shore, as well as by the many species of northern plants included in the annotated list of plants.

The island, 45 miles long and containing about 210 square miles, has had almost no permanent population since the "copper days;" and only a few localities along the water's edge are frequented by summer visitors, thus leaving the island largely free from man's occupancy. With the exception of the buildings and mining improvements of the Wendigo Mining Company, at the head of Washington Harbor, little remains on the island to mark the vanished population, except the burnings and clearings, which are easily recognized by their characteristic floras.

Large parts of the island, however, have remained quite free from man's invasion. That the present natural conditions are not likely to remain long undisturbed, and that the past summer's observations and records were made none too soon, is shown by the fact that contemporaneous with the work of the Museum party there were at least three different parties of timber estimators working over large parts of the island looking toward the cutting off of the forests.

The general plan of the summer's work on the biota of the island was to select the most typical and representative parts as general stations, working these through sub-stations as carefully as time would allow, and comparing other similar localities with these.

The principal plant societies of Isle Royale may be considered under four heads, viz.: Bog societies, shore societies, forests, and burnings.

1. Bog Societies. It is doubtful if there could be found anywhere in an area of the same size a more interesting and more complete series of bogs than occurs on Isle Royale. On the geological map of the island, by Lane and Stockly, there are shown over 100 smaller bog areas, exclusive of the extensive bog region in the southwest part of the island, to the west of Siskowit Bay. Add to this the various stages of partly filled lakes, and there is shown almost every conceivable stage in the life history of bogs, from the open tarns, or lakes, to the climatic bog forest.

It is unnecessary to call attention to the very interesting manner in which the bog floras respond to the various stages of physical changes; such responses of vegetation in any physiographic series are too well known to need comment. For any student who desires to work out in detail these stages of successions as carefully and minutely as Cowles has done for the dunes of the Chicago region, Isle Royale presents all that could be desired; and one important advantage here is that most of the bog areas are comparatively small, and all in a reasonably limited aree, thus offering an unusual opportunity for their comparative study.

There is, on the other hand, one difficulty that should be mentioned in connection with any kind of field work on Isle Royale which takes one far back from the shore, and that is the difficulty of penetrating the dense - tangles of the forest. The absence of roads, the limited number even of old blazed trails, the unusually dense underbrush, including a very rank growth of *Taxus minor* (Ground Hemlock) and numerous windfalls, together with the necessity of carrying by pack one's supplies—all render the penetration of many parts of the island a, matter of such difficulty that it has been remarked by all who have attempted it.

In the limited time at our disposal during the summer it was impossible to visit all of the 100 or more bog areas on the island: our attention was therefore confined to a limited number of those which are typical of a certain stage of development, or to those having individual points of special interest.

Three general stages of the lake-bog series will be briefly touched upon, (1) the open lake *without* marginal vegetation, (2) the partly open lake *with* marginal vegetation of varying width, (3) the wholly carpeted bog area; the vegetative carpet in some cases being recent enough to give beneath the feet, in other cases old and solid enough to be more or less forested.

The first, or open stage, includes only a few of the largest lakes of Isle Royale, such as Lake Siskowit and Sargent Lake. Of these Lake Siskowit is by far the largest, being at least a mile and one-half broad in places. The principal reasons for the absence of vegetation in the lakes of the first class seems to be that their size and openings renders the sweep of the wind and the resulting wave action so vigorous that even annuals cannot get a foothold along their shores.

Wave action in a few places is clearly marked by a narrow but well-defined beach, as along the north shore of Lake Siskowit.

Another factor that has to be reckoned with in the larger lakes of the first class, is the work of ice. Ice destroys shore vegetation in two ways, first—by pushing, due to expansion by freezing (and this total expansion in a lake as large as Lake Siskowit is considerable); second —the open expanse allows large ice floes to blow ashore during the spring break-up. The most interesting example of ice pushing noted was along the north shore of Lake Siskowit, where there is an irregular ridge, varying in height up to 15 feet and composed of bowlders and various fraginental materials. Along this ridge there were, in places, even over-turned trees of considerable size, pointing away from the lake, back 20 to 25 feet from the present shore. This ridge seems certainly to be the work of ice as in the case of the so-called "bowlder rim" lakes of the western United States, or the ice floe ridges at Put-in-Bay in Lake Erie.

In drawing a line between the lakes that will long continue to remain free from the encroachment of vegetation and those which are being gradually captured by vegetation, the size and openness seem to be the most important factors, affecting the vigor of wave action as well as the work of ice in one or both of the ways suggested.

In the smaller lakes, especially those nestled in depressions, the surrounding forests protect their surfaces from vigorous wind action so that there are practically no waves at all to check the encroachment of vegetation along the lake margins.

That the slope of the shore, in the case of protected lakes, has much to do with retarding or assisting the encroachments of plants is self evident. The Isle Royale lakes of the protected class show numerous examples where the plant zone is much farther advanced on the gently sloping side than on the opposite one with a more abrupt slope.

A typical example of a lake midway in the process of capture is Simmer Lake. This lake, which is roughly one-half mile long and one-third as wide, with its long axis nearly east and west, has already been captured at its east and west ends. Had its north and south borders been less steep the entire lake would doubtless have been covered ere this. This lake has an outlet into Conglomerate Bay, but at its west end it receives a small creek. The west end is covered by a bog carpet still so young and elastic as to render the crossing of it difficult. Along the more abrupt sides, and connecting the bog carpet at the ends, was a narrow, irregular zone of *Calla palustris* and *Iris versicolor*, with the *Menyanthes* (Buckbean) and *Comarum palustre* (Marsh cinquefoil) mixed in places. Parts of this zone, where the shore is less steep, were closely backed up by willows, *Cornus stolonifera*, and *Alnus incana*, thus giving to the marginal zone the aspect of a swamp rather than of a bog. Growing on the wet bog carpet at the ends were the *Sarracenia purpurea*, *Drosera rotundifolia*, *Drosera intermedia*, *Menyanthes trifoliata*, *Comarum palustre*, *Drosera linearis* (the latter two in wetter places generally than the former), *Oxycoccus oxycoccus*, *Habenaria psycodes*, *Habenaria dilatata*, *Pogonia ophioglossoides*, *Utricularia minor* (wetter parts), *Campanula aparinoides*, *Scutellaria galericula*, *Cicuta bulbifera*, *Triadenum virginicum*, *Parnassia palustris*, *Solidago neglecta*, etc.

A word in passing in regard to the "false bottom" of Sumner Lake, for in no place on the island was this better shown. In paddling around the open part of this lake on a raft it appeared in places that the water was

only 6-10 feet deep. This was a matter of surprise since even a raft's length from the shore we could not touch bottom with our 15 foot pole. Further investigation showed a "false bottom" in various parts of this lake. This was composed of the fine, disintegrated remains of leaves and other light organic material. In places there were great breaks in this "false bottom," doubtless due to the escape of gases which has lifted this fine, ooze-like material from a greater depth; and through these breaks one could look down several feet through the brownish colored water. While this "false bottom" was so tenuous that a pole could be thrust through it almost as easily as through the clear water; it seemed to play an important part in the distribution of patches of *Castalia odorata* (White Pond Lily) so abundant on the surface of the lake, and also served to call attention to the manner in which this material assists in lake filling.

An area illustrating the final stage of bog covering was examined at the end of the cabin trail from our Siskowit Bay camp. In this sphagnum bog (V, 5), containing 80-100 acres, all has been covered except an area of open water about 60 feet long and half as wide surrounded by an exceedingly wet, unstable margin.

A few years hence and even this will be covered. The main part of the bog was covered with sphagnum hummocks, upon which were growing *Ledum groenlandicum*, *Chamaedaphne calyculata* and *Andromeda polifolia* in dense patches. Young Tamaracks and Black Spruces were pushing out from the older parts of the margin, with Balsam Firs close behind.

Along the south margin of this bog, in the tension zone between the bog and the adjacent forest, there was being waged one of the most intense and most interesting struggles for plant supremacy that we have ever seen. Working up the gentle slope from the bog margin the sphagnum invasion (after the manner of a large snowdrift) was pushing out its lobate fingers, over the forest carpet of leaves; and during a single season by its rapid growth had surrounded such plants of the forest as *Aralia nudicaulis*, *Trientalis americana*, *Clintonia borealis*, *Lycopodium lucidulum*, all of which were completely helpless in the path of the sphagnum invasion. Even large, fallen trees were able to check its advance only temporarily, for instances were noted where entire fallen trunks were covered, only the upward projecting branches being out of reach of the Sphagnum. In a dry carpet of forest leaves the clean-cut forward margin of the sphagnum was so wet that water could be wrung from it at a distance of 15-20 feet from the original bog margin, thus showing how readily water is transferred through the sphagnum patches, even up a slope.

While the sphagnum invasion was eminently successful against all the *scattered* plants of the woods there was at least one species of moss (*Polytrichum commune*) growing in dense formations which was successful in holding the sphagnum in check. The moss colonies were so dense that the sphagnum could not penetrate them; on the other hand the moss was actually invading the moist sphagnum and growing over it.

Before leaving the semi-enclosed lake bogs a few questions suggest themselves regarding the trembling bog carpet adjacent to the water's edge. What is the thickness of this elastic, quaking water cover which is, at the same time, strong enough to enable one to walk out to within a single step (in some cases) of the water's edge? Also of what is it composed? In all the measurements taken it was found that this vegetative cover, within two to three feet of the water's edge, had a thickness varying from 22-24 inches. Back from this younger and more unstable margin the bog cover becomes thicker and firmer. In one bog, back about 100 yards from the water's edge, where the surface was firm and unyielding, the boring pole broke through into open water at a depth of 5 feet 6 inches. In another instance, at the west end of Sumner Lake, at a distance of over 100 yards back from the water's edge, I found the bog cover still so thin and trembling that I broke through in one place in attempting to walk across it, and anticipated that the same might happen in several other places. These and other instances all go to show that no definite statement can be made as to the exact distance from the water's edge at which the bog cover becomes thick enough to support one. This may vary with the depth of water underneath, as well as the distance from the original shorem. It is to be regretted that more borings and measurements could not have been taken in the limited time at our disposal. A summer spent with suitable boring tools in making an extended series of borings over various parts of several of the Isle Royale bogs and bog-lake margins would doubtless bring to light some very interesting data.

Now as to what gives strength to the bog cover. Since the sphagnum is so predominant on bog areas, covering large parts of the surface, and often extending out almost to the water's edge, one is apt to think only of the sphagnum surface and fail to consider the important network below that gives such strength to the trembling bog carpet out almost to the very water's edge. It is scarcely necessary to add that the delicate sphagnum alone is riot sufficient to make a *strong* bog cover. The weakness of the individual sphagnum plants to resist strain, the lack of interlacing parts, or of even "felting" properties are clearly shown in that one can reach down a foot or more into the loose, soft sphagnum and pull out a handful of it without seriously disturbing the adjacent plants. Moreover, the sphagnum does not grow along the water's edge *in advance of* its supporting mat—at least we failed to find a single instance of this on Isle Royale—while in many cases it did not extend out to within several feet of the water edge of the supporting mat.

On pulling up large masses of the floating mat at the water's edge it was found to consist of a dense tangle, or network, of tough fibrous roots and rhizomes of sedges, *Menyanthes trifoliata* and *Comarum palustre*, all so tightly interlaced that it was very difficult to separate any

part of the tangle from the rest. Such tough parts are in striking contrast to the delicate sphagnum, as is also the manner of growth; and furnish the platform on which the sphagnum works out toward the lake margin.

In the last, or wholly covered, division of bogs a wet and a drier stage may be recognized; the former may be characterized by the *Sarracenia purpurea*, *Menyanthes trifoliata*, *Comarum palustre*, and one or more species of *Drosera*. Sphagnum hummocks may occur in both of these covered stages, or the surface may be comparatively smooth. These hummocks, of varying size up to 4 feet in height, seem to be due in most cases to the sphagnum growing up around tree trunks, shrubs, or other objects. Instances were noted of where the rapidly growing sphagnum had so nearly covered the *Ledum groenlandicum* that only the ends of the upper branches were to be seen. It is possible, however, that some of the hummocks may be formed in other ways, e. g. one large hummock was noted that was inhabited by ants. This suggested that possibly the sphagnum had overgrown a large ant mound, although it is also possible that the ants may have inhabited the mound only after its formation in some other way.

The pioneer trees to appear in Isle Royale bogs are the *Larix laricina* (Tamarack), and *Picea mariana* (Black Spruce), which appear simultaneously, and seem equally well adapted to bog conditions. Owing to the advance of the bog cover from the margin toward the centre, one naturally expects to find the youngest trees farthest in, and this is strikingly well illustrated in many of the bogs.

By counting the rings of trees cut in the bogs, and comparing with the same species just outside, it was found that the growth of those in the bogs was strikingly slower. The rings of the bog species were in many cases so close together as to render a hand lens desirable for counting them, while the annual rings of the same species in the adjacent forest were widely separated.

2. Shore Vegetation. The work done on shore forms was confined entirely to the south shore, including the group of small islands near the abandoned Light-house at Rock Harbor. The northern shore is steep and cliff-like, the southern shore gently sloping. While the northern shore is strikingly different from the southern, and might have brought to light many interesting things (especially in the way of lichen formations), it seemed best to confine the limited time at our disposal to work on the south shore.

Of the special shore forms, the crevice plants are both interesting and attractive. The crevices in most cases are due to fissuring, although some long, narrow grooves were made by the differential weathering of the softer vein rock. The bed-rock of the shore is often amygdaloidal, and many small depressions in this, due to the more rapid weathering, afford a foothold for the hardy plants of the rock shore. In their narrow rock crevices and confines, with little soil, and on dark-colored rock which in summer becomes highly heated, at all times exposed to the strong lake winds, and in winter often washed by the powerful storm waves of Lake Superior, their struggle for existence is certainly a most strenuous one. On the whole their size and appearance is strikingly alpine, as is also their coloring in many cases.

A partial list of the crevice plants is as follows: *Campanula rotundifolia*, *Potentilla tridentata*, *Potentilla littoralis*, *Saxifraga tricuspidata*, *Saxifraga aizoon*, *Saxifraga nivalis*, *Artemisia canadensis*, *Senecio balsamitae*, *Primula mistassinica*, *Solidago virgaurea* (?), *Sagina saginoides*, *Achillea millefolium*, *Aster ptarmacoides*, *Sisymbrium humile*, *Lobelia kalmii*, *Nabalus racemosa*, etc. The insectivorous *Pinguicula vulgaris* (Butterwort) occurs in rock pools and on wet rocks along the rocky shores.

The most common crevice shrubs were the *Juniperus nana*, *Juniperus procumbens*; *Arctostaphylos uva-ursi* (Bear-berry), *Shepherdia canadensis* (Shepherdia), *Opulaster opulifolius* (Ninebark). On the exposed rocks at Scovill Point and at the eastern end of the island, the *Empetrum nigrum* (Crowberry) was also found, forming a part of the heath mat. Of all these the *J. procumbens* is easily of the greatest importance in preparing the way for other larger forms of plants. Certainly no shrub of Isle Royale precedes it or has better claims for pioneer distinction. Its hardiness, prostrate manner of growth, and its thick, sheltering branches are all of great importance in making it an excellent pioneer.

A study of the small rock islands near the Rock Harbor light-house was very interesting not only on account of the striking differences in the individual flora of each, but also for a comparative study of the plant successions upon them. All stages of successions were noted from an unusually rich mesophytic flora, growing on a humus soil 3-10 inches in depth, down to islands almost bare except for a few crevice plants. In general all the islands showed a less development of the flora on the side exposed to the open lake than on the more protected land side: in some cases the vegetation of the two sides was strikingly different.

The advantages of crevices in enabling vegetation to get a start upon bare islands was well illustrated in the case of one of the small islands of this group. Its smooth, sloping surface was bare except for a few small patches of crustaceous lichens and a single large procumbent juniper. The juniper was growing in a crevice along which it had reached for several feet in either direction, occasionally rooting along the crevice which held it more securely in place. The spaces between its dense sheltering branches were filled with a vigorous growth of moss which doubtless started on the wind-blown material that had lodged there. So solidly had the moss filled the spaces between the branches where it was growing that in breaking off a portion of the juniper everything was stripped off down to the bed-rock. As such a juniper patch spreads, and the humus made by the moss increases, other plants come to grow on the

juniper patch, and an ever-increasing heath mat is formed. Other similar crevices may, in like manner, spread to join this, and in a comparatively short time the entire surface is carpeted with vegetation. On other sniall islands crevice trees and shrubs have contributed shade and partial protection from the wind, and the process has gone on even more rapidly. Had there been no crevices to enable these higher pioneer plants to secure a foothold the process of vegetative capture would have gone on infinitely slower. What the possible steps are in such a case may best be considered in connection with the rock shore-heath-forest series to be referred to presently.

To suggest the severe and varied conditions of the exposed rock shore the following is cited. On a bare, gently sloping (10°-12°) portion of the rock shore near Rock Harbor, there were, in an area approximately 40 feet square, over 100 fresh scars where the thin (1-6 to 1-8 inch) patches of rock had recently been broken off. These patches varied in size from 12 inches in diameter down: some were covered in part by lichens (principally Parmelias), others were entirely bare. The intense daily heating and expansion to which the immediate surface of the dark colored, exposed rocks is subjected, together with the rapid cooling and the resulting contraction at night, doubtless has much to do with weakening the immediate surface, and *starting* the chipping. The freezing of moisture in the rock surface may have been responsible for the final breaking away and lifting.

For a brief survey of the vegetation from the water's edge back through the heath zone to the forest at the top of the gently sloping rock shore area, V 2, (designated as "the heath zone and beach" of Siskowit Bay) will be selected as a typical locality, and supplemented by additional observations on similar places elsewhere along the southern shore. The portion of rock shore to be considered has a rather uniform slope of about 10° and a width of 200-250 feet from the water's edge back to the forest at its summit.

The first zone of no vegetation extends back about 20-25 feet from the water's edge, although the winter waves doubtless reach far beyond this. Back of this occur, in turn, the crustaceous and foliaceous lichen zones, which meet in a somewhat irregular tension zone that can, nevertheless, be distinguished by looking up or down the shore. The lichens of these zones are included in the annotated list, and will not be enumerated here.

Numerous crevice plants (as already listed under shore forms) make their appearance in the crustaceous and foliaceous lichen zones, also *Thuja occidentalis* and *Picea canadensis*, the former being the hardier pioneer of the two. In parts of the upper, or third, lichen zone there are unusually dense and luxuriant formations of Cladonias, often 50-60 feet across. Scattered among the Cladonias were *Juniperus nana*, *J. procumbens*, *Arctostaphylos uva-ursi*, and *Vaccinium pennsylvanicum*. The upper, or back portion, of this zone will be designated as the Cladonia-heath zone, for it is here that the real shore heath begins. The back of the heath zone contains numerous young Balsam Firs and White Birches which have worked in irregularly from the adjacent forest.

A similar sloping rock shore near our Siskowit cabin camp (V, 4) showed some interesting later stages. The shore was here better protected from waves and wind by the flat neighboring wooded islands; and the forest development had gone on more rapidly, having extended irregularly from the higher shore down to the very water's edge suggesting the ultimate condition elsewhere along the less protected rock shore. There were still open places, suggesting the irregular manner in which the trees had pushed out to take possession of the lower shore; but the forest was here far better established (seemingly on account of the better protection) than elsewhere along the beach where exposed directly to the lake winds and waves.

As the trees increase in number, and afford better conditions of shade and moisture, vigorous mosses and wood plants begin to invade the Cladonia patches still occupying the more open places. A series of photographs was taken showing various stages of this invasion of under-growth wood plants, from a pure formation of Cladonias to a climax of a dense society of wood plants with not a vestige of Cladonias remaining. These later back shore formations were equally well shown along the heath-forest tension zone at Rock Harbor.

If carefully worked out the rock shore series, from the water's edge back to the neighboring forest, might be made to rival in interest the lake-bog-forest series, so deserving of more careful study on Isle Royale.

3. Forests. The forests of Isle Royale include about 21 species of trees, 13 of which are deciduous, the remainder evergreen conifers. The paucity of species has been more than offset by a generous distribution and abundance, for the island as a whole is heavily forested. The largest and dominant trees of the present forest are *Abies balsamea* (Balsam Fir), *Betula papyrifera* (White, or Canoe Birch), and *Picea canadensis* (White Spruce), with the exception of the western end of Greenstone ridge where *Acer saccharum* (Hard Maple), *Betula lutea* (Yellow Birch), and *Betula lenta* (Black, or Cherry Birch) are dominant.

Between the end of Washington Harbor and Lake Desor there are places where almost pure stands of Hard Maple and birches obtain. The scarcity of *Abies balsamea* here, which is so abundant over almost all other parts of the island, is an interesting matter of speculation. Young Balsam Firs were noted growing in the shade and shelter of the maple groves, and they appeared to be vigorous and thriving, yet scarcely a large fir could be found associated with the maples in this part of the Greenstone ridge. An examination of the soil here showed that it is only 4-6 inches deep. This, together with the laterally limited root system exhibited by the larger overturned firs, seemed to suggest that, after attaining a certain height and rigidity, they became

sufficiently exposed to be overturned by the powerful winds that sweep that exposed part of the Greenstone ridge.

The forested bog areas are characterized by the dominance of Tamarack, Black Spruce and White Cedar. As a rule, where the Tamarack is more abundant the White Cedar is less abundant, and the opposite. Where the White Cedar is dominant (as it is in many bog areas, the largest trees being 2-31/2 feet in diameter), the few Tamaracks present are large and appear as pioneer relicts. The White Cedar, moreover, does not appear with the Black Spruce and the Tamarack in the earliest, wetter stages; but seems to come in only when a drier condition has been reached.

It may also be added that none of these characteristic bog trees are here so closely confined to their bog habitats as to the south of here; but they have a much more general distribution. The Black Spruce, for example, one of the earliest pioneers of the bogs; occurs sparingly distributed in the original forests along with the White Cedar and Balsam Fir; and I have also noted it growing on dry exposed rocks where very little soil was present. The Tamaracks also get out of the bogs and occur sparingly distributed in the upland forests—sometimes in most unexpected places.

Of all the island conifers the *Abies balsamea*, is easily the most common, and seems to be superseding the spruces and tamaracks. The young seedlings of it grow in dense shade, as well as in more open places. Seedlings of the Balsam Fir come up abundantly under the White Spruces in place of the seedlings of that species which do not seem to be able to endure the shade of the dense forest. It will doubtless form an important part of the *climatic* forest of the island.

The *Picea canadensis* is fairly common along the margins of forests, and in the more open parts—even in the deeper parts of the forest—when it has come in as a pioneer with firs and other conifers of the present generation; but the White Spruces do not seem likely to succeed themselves and become a considerable part of the dominant forest, on account of the inability of their seedlings to withstand deep shade.

4. Burnings. The burnings and old clearings are everywhere characterized by an abundance of *Populus tremuloides* and *Betula papyrifera*, while the undergrowth consists largely of *Diervilla diervilla*, *Aster macrophylla*, *Chamaenerion angustifolium*, *Rubus parviflorum*, *Cornus canadensis*, and in places an abundance of *Taxus minor*. Burnings of *different periods* were suggested by uniform stands of Quaking Aspens and White Birches which were of different heights.

The Pennsylvania Cherry (*Prunus pennsylvanicus*) occurs in burned areas and elsewhere where there is little soil, sometimes growing out of the crevices of exposed rocks where the conditions of growth were strikingly unfavorable. Perhaps no other tree on Isle Royale can withstand more xerophytic inland conditions, with the possible exception of the Jack Pine (*Pinus divaricata*) which was occasionally found associated with it on high exposed ledges. In one locality where the two were growing in close company—a high rocky ledge near Conglomerate Bay (III, 5)—there was an almost total absence of soil, due to its removal to lower altitudes by wind and rain; there was a striking range of 50°-70° F. in the daily temperature, and a complete exposure to the powerful Lake Superior winds which overturn so many trees when they had developed enough heart wood to become rigid and resisting. There might be added to the unfavorable conditions of growth on such exposed ridges the work of Hares, for the Northern Varying Hare often resorts to the exposed heights—as in the case just noted—for its winter feeding ground, since there is probably less snow left there by the sweeping winter winds than at lesser elevations, and the Hares can get about more easily. The principal damage done to the trees by Hares consists of the cutting off of the young branches, and gnawing the bark, and this in some cases amounts to considerable.

Scattered individuals of White Pine (*Pinus strobus*) occur along the ridges and on the north side of Siskowit Lake, but it is nowhere abundant. Only a few Norway Pines (*Pinus resinosa*) were noted—these occurring principally on ridges and in exposed places, as on the ridge north of Sumner Lake (III, 5).

The Green, or Mountain Alder (*Alnus alnobetula*) was widely distributed on higher ground, and can seemingly stand as much shade as any broad leaved tree on the island. The Speckled Alder (*Alnus incana*) was common near the* water's edge and on low ground; and in places had worked back some distance from the water.

The *Sorbus americana*, found on many parts of the island, was in most cases solitary in its distribution and nowhere abundant. It appears to be most abundant along the water's edge.

The successions of the burnings and clearings due to the attempts of the early copper prospectors to clear the land, as well as the results of later forest fires, present an interesting problem; also the peculiar distribution of the Hard Maple and White Pine on the island. Students of fleshy fungi may also find a most fascinating field for later summer work at the west end of the island, especially along the forest road from the Washington Club grounds to Lake Desor. Never have we seen a more inviting, field for mycologists; and in a region as yet untouched as to its fungi.

In conclusion, we beg to call attention to the fact that, owing to time limitations, no attempt was made to work out in detail any of the large and interesting problems that presented themselves; our object being rather to make a general reconnaisance of the plant life on as many different parts of the island as possible. It is to be regretted that time did not permit the party to investigate several habitats on the north side of the island in addition to the work done on the south side, for the physiographic conditions there are different from those on the south shore, and a comparison of the

environmental conditions of the two localities would doubtless throw additional light upon the series of shore societies.

To give a more detailed account of the plants noted and collected on the island than could be attempted in this resume of conditions the following annotated list is herewith presented.

The writer is indebted to Dr. C. A. Davis of the Michigan Biological Survey for the determination of the sedges and certain flowering plants; to Prof. Bruce Fink of Miami College, Oxford, Ohio, for the determination of the lichens; for the determination of the mosses to Prof. J. M. Holzinger of Winona Normal School, Winona, Minn., and Dr. J. Roll, Germany. The nomenclature is that of Britton and Brown's Illustrated Flora of the Northern States and Canada, 1898. The report of the expedition for 1904 followed the nomenclature of Britton's Manual of the Flora of Northern United States and Canada, 1901.

II. Annotated List of Plants.

Lichens.

By lichen zone No. 1 is meant to include the *crustaceous lichens*; these forming small patches on the rocks as in *Placodium elegans*, in which the thallus is principally imbedded in the rock so closely that the rock must be broken away to secure them. Zone No. 2 (Foliose zone) includes the flat thallus species which are attached by rhizoids, as *Parmelia*. These can be scraped or pulled off. Zone No. 3 (Fruiticose zone) includes the upright lichens like *Cladonia*.

1. *Ramalina calicaris farinacea* (C) Fr. Vertical rock cliffs at water's elge. Principal branching lichen on vertical cliffs. Common Sta. I, Sub. 1.

2. *Cetraria lacunosa* Ach. On nearly bare surface of rocks Siskowit Bay, (V, 2). Occasional.

3. *Evernia prunastris* (C) Arch. A light green, branching form growing in Cladonia zone (I, 1).

4. *Usnea barbata cerotina* (Ach.) Schaer. Hanging from trees along Siskowit cabin trail (V, 4), also on trees at Rock Harbor (I, 3). Common.

5. *Usnea longissima* Ach. A pendulous form 12-15 inches or more in length. Occurs on conifers. Less common than preceding species.

6. *Parmelia perlata* (Jacq.) Ach. Top of cliff at Rock Harbor (I, 2). Not widely distributed.

7. *Parmelia saxitalis sulcata* Tayl. A gray foliose form growing on very thin black humus on sloping tops of cliffs. Noted to be abundant top of rock cliff at Rock Harbor (I, 1).

8. *Parmelia caperata* (C) Ach. On rocks of foliose lichen zone at Rock Harbor, I, 1; V, 2.

9. *Parmelia conspersa* Ehr. One of the most common lichens on the island, and the principal form in the second (foliose) lichen zone of the sloping rock shore. Also fairly abundant on rock surfaces back from the shore. I, 1; V, 2; V, 3; I, 2.

10. *Physcia pulverulenta* (Scrieb.) Nyl. Natural openings on bed rock, growing on very thin hard humus. V, 3.

11. *Gyrophora hyperborea* Ach. On almost bare rock in the foliose lichen zone (No. 2). Scarce. V, 2.

12. *Gyrophora* (*Umbilicaria*) *vellea* (C) Ach. Occurs in patches on vertical rock faces. I, 1. Fairly common.

13. *Sticta pulmonaria* (C) Schaer. Common along Siskowit -cabin trail, on trunks of fallen trees. Fairly common in similar places elsewhere in forest. V, 4; II.

14. *Peltidea* (*Peltigera*) *aphthosa* (L) Ach. In forest along cabin trail to bog at Siskowit Bay. Fairly abundant (V, 4).

15. *Peltigera canina* (C) Hoffm. On moist moss patches in woods, and in shady places. Common. V, 4.

16. *Placodium elegans* (Link) DC. On exposed rock surfaces along shore. Very abundant. Also on conglomerate. Gives a striking dark orange color to the cliffs along the main shore and on surfaces of small rock reefs and islands. I, 1; V, 2. The most striking lichen of the crustaceous lichen zone.

17. *Lecanora rubina* (Vill.) Ach. In foliose lichen zone. Not common. V, 2.

18. *Lecanora muralis* Schrieb. In low rocky reefs scarcely above-the action of summer waves. I, 1. Not abundant.

19. *Lecanora frustulosa* (Dichs.) Ach. Rocky shores and cliff faces, also in patches among parmelias. I, 1; V, 2.

20. *Lecanora subfusca allophana* Ach. Rocky shores and exposed rocks. Fairly common, I, 1; V, 2.

21. *Lecanora cinerea gibbosa* (Ach.) Nyl. Back 20-25 feet froms water's edge in second or foliose lichen zone, in lower edge of same. V, 2.

22. *Stereocaulon coralloides* Fr. In foliose lichen zone. V, 2.

23. *Stereocaulon paschale* (C) Ach. Rocky openings near Siskowit cabin. V, 3. Not abundant.

24. *Cladonia rangiferina* (C) Web. Very common in cladonia, zone on all parts of shore where cladonias occur. Probably most abundant of all cladonias noted.

25. *Cladonia sylvatica* (C) Hoffm. Very common in cladonia zones. Lighter and smaller than preceding. Common in V, 2; I, 1.

26. *Cladonia alpestris* (L). One of the principal forms in cladonia zone in the shore-heath series. Common. I, 1; V, 2.

27. *Cladonia coccifera* (C) Willd. Thin earth on exposed rocks. Fairly common. II, 3; V, 7 (in burned area).

28. *Cladonia deformis* (C) Hoffm. On partly decayed bark and wood of fallen trees. Not common. V, 4.

29. *Cladonia cristatella* Tuck. On old wood. V, 4.

30. *Cladonia crispata* (Ach.) Fib. Forest trail Siskowit. Also found growing into moss patches in woods. V, 4.

31. *Cladonia amoaurocraea* (Flk.) Schaer. A cladonia in heath-cladonia zone at Rock Harbor, I, 1. Patches of this are being invadecl by moss.

32. *Cladonia furcata pinnata* Flk. Growing along cabin trail oife debris, and on fallen conifers. V, 4. Not abundant.

33. *Cladonia turgida* (Ehrh.) Hoffm. Growing on thin humus accumulation on open rocky places. V, 4. Also along portage to Siskowit Lake (V, 9).

34. *Cladonia gracilis dilatata* (Hoffm.) Wain. On thin humus covering of bed rock. Natural forest "openings." V, 4, 3.

35. *Cladonia verticillata* Hoffm. Woods and rock clearing at Siskowit Bay station, V, 4, 5.

36. *Cladonia pyxidata* (C) Hoffm. Rock shore in foliose and fruiticose lichen zones. V, 2. Not abundant.

37. *Cladonia fimbriata simplex* (Weis) Wainio. On decaying bark of fallen trees in forest. Forest trail from Washington Harbor to Lake Desor.

38. *Cladonia fimbriata coniocraea* (Flk.) Wainio. Bark of fallent trees in forest along Siskowit cabin trail. V, 4. Not abundant.

39. *Lecidea lactea* (Flk.). In rather small patches on exposed sloping and vertical rocky cliffs. Common on the water side of crustaceous or lower lichen zone. A white lichen with black dots. I, 1; V, 2.

40. *Endocarpon miniatum* (C) Ach. Rock surfaces writh little soil, along Siskowit cabin trail, V, 4. Also in lower crustaceous lichen zone. V, 2; I, 1. Not abundant.

41. *Endocarpon miniatum saauaticum*. In lower crustaceous lichen -zone within reach of winter waves. Not abundant. I, 1; V, 2.

42. *Ichmodophila aeruginosa*. On decaying bark of fallen trees along Siskowit cabin trail. Scarce. V, 4.

43. *Rhizocarpon* (*Buellia*) *geographicum* (C) DC. A small green lichen occurring in small patches on rocky shores in crustaceous lichen zone, often near the water. Can only be removed by chipping away the rock on which it grows. Fairly common. I, 2; V, 1.

Mosses.

44. *Sphagnum teres* Aug., var. *tenellum* Rl., *bicolor*.

45. *Sphagnum robustum* Rl., var. *gracile* Rl., *palleus*.

46. *Sphagnum girgensohnii* Russ., var. *molle* Crey., *palleus*.

47. *Sphagnum platyphyllum* Sull., var. *subsimplex* Cdbg., *glaucum*.

The above sphagna were abundant in all the bog areas of the island, and were of occasional occurrence on the low ground along creeks and elsewhere on low wret ground. I, 4; I, 6; II, 2; II, 5; III, 5; IV, 10; V, 5; V, 8; V, 11.

48. *Georgia pellucida* (*Tetraphis pellucida*). Woods along Siskowit cabin trail. V, 4.

49. *Polytrichum commune* C. A most vigorous moss growing in dense colonies; in places along the forest-bog tension zone successfully invading the sphagnum masses. The only plant of the woods that could hold its own against the invasion of the Sphagnum into the forest. Confined to moist or wret places. V, 4.

50. *Polytrichum strictum* Banks. Rather bare exposed places along Greenstone Ridge, also "natural openings" along the Siskowit cabin trail. V, 2; V, 4.

51. *Dicranum schreberi*. Near sphagnum bog at end of cabin trail. V, 5.

52. *Dicranum fuscescens* Turn. Occurs in small heads or clumps on dead wood. In woods. V, 4.

53. *Dicranum longifolium* Hedw. Woods along Siskowit cabin trail. V, 4.

54. *Dicranum scoparium* (C) Hedw. Woods along Siskowit cabin trail. V, 4.

55. *Dicranum undulatum* Voit. Woods along Siskowit cabin trail. V, 4.

56. *Grimmia unicolor* Hook. Confined entirely to small crevices and cavities in the bed rock of the gently sloping shore. It occurs nearer to the water's edge than any other form of vegetation observed on the island. No other mosses approach it in nearness to the water's edge, and it surpasses even the hardiest lichens of the crustaceous zone in this respect. Yery hardy, and at times highly xerophytic. I, 1; V, 2. It is of a very dark greenish brown color.

57. *Leucobryum glaucum* (L) Schimp. Grows in heads of varying size, principally in woods. I, 3; V, 4.

58. *Tortella tortuosa* (L) Limpr. Rock ridges, and other rocky places. Grows in dense rounded tufts. II, 3.

59. *Ulota americana* (Beauv.) Lindb. Growing on gently sloping rock shore sometimes covering crustaceous and foliose lichen patches. I, 1; V, 2.

60. *Bartramia pom iformis* (L) Hedw. Shady, moist niches and crevices in rock cliffs. A beautiful moss having the appearance of green wool. I, 1; V, 4.

61. *Bryum palleus* Swartz. On dead wood, and on thinly covered rock surfaces in woods, V, 4.

62. *Aulocomium palustre* (L) Schwaegr. Near bog at end of cabin trail Siskowit Bay. V, 5.

63. *Mnium punctatum* Hedw. Moist woods along Benson Brook; also in moist places along Siskowit cabin trail through woods. II, 1; V, 4.

64. *Leskea nervosa* (Schwaeg.). Myr. Closely associated with *Ulota americana* on the sloping rock shore where it sometimes covers patches of crustaceous and foliose lichens. I, 1; V, 2.

65. *Thuidium abietinum* (L) B. & S. Growing on fine material that has accumulated among the close branches of the low Procumbent Juniper. It was noted on one of the small rock islands in Rock Harbor which had little if any vegetation besides the crevices plants. It here plays an important part in the early formation of a humus soil by solidly filling in the spaces between the Juniper branches. I, 1.

66. *Hypnum crista-castrensis* L. On decayed wood in cool moist woods near peat bog. V, 4, 5.

67. *Hypnum schreberi* Willd. Rich, moist woods along forest road Washington Harbor; also noted growing in Cladonia patches in woods along Siskowit cabin trail. It seems to be replacing and succeeding the Cladonias in places. V, 4; I, 3.

68. *Hypnum scorpoides* L. Bog margin of Forbes Lake. II, 5.

69. *Hypnmn vernicosum* Lindb. Bog beyond Malone's fishing camp. Back from V, 2.

70. *Hypnum polare* Lindb. Protected rock crevices, Rock Harbor. I, 1.

71. *Hypnum fluitans* L. Rock pools Scovill Point. IV, 1.

72. *Hypnum stramineum* Dicks. Bog bevond Malone's fishing camp. Back from V, 2.

73. *Hypnum aduncum* Sch. Bog at end of Siskowit Bay cabin trail. V, 5.

74. *Hypnum aduncum intermedium* Sch. Growing in water in margin of a brook emptying into Forbes Lake, II, 5.

75. *Hypnum uncinatum* Hedw. *formaplumosa* Sch. Moist woods along trail to Monument Rock. IV, 4.

76. *Hylocomium triquetum* (L) B. & S. Woods along Siskowit cabin trail. V, 4. Fairly common.

77. *Hylocomium splendens*. Woods along forest road from Washington Harbor to Lake Desor, III, '04.

78. *Distichium capillaceum*. From a partly protected vertical rock crevice 6-8 feet above water, Rock Harbor. I, 1.

79. *Neckera oligocarpa* B. & S. Forest road, Washington Harbor: woods.

80. *Dickelyma uncinatum* Mitl. (?) Growing in a pool on small island at upper end of Rock Harbor. Unusually large. Ill, 1.

81. *Palndella squarrosa* (L) Brid. Bog margin of Forbes Lake. II, 5.

Pteridophytes.

Ophioglossaceae—Adder's Tongue Family.

82. *Botrychium lunaria*, (L) Sw. Moonwort. Rare. Partially shaded rocky ground near Rock Harbor light-house, I, 1.

83. *Botrychium virginicum* (L) Sw. Virginia Grape Fern. Sparingly distributed in rich woods. I, 3; III, 4; V, 4.

Osmundaceae.

84. *Osmunda regalis* L. Royal Fern. One locality. Rich low ground near small creek emptying into Forbes Lake, II, 5.

85. *Osmunda cinnamomea* L. Cinnamon Fern. Moist thickets and low ground. II, 5.

86. *Osmunda claytoniana* L. Interrupted Fern. Mesophytic woods. Not common.

Polypodiaceae—Fern Family.

87. *Onoclea sensibilis* L. Sensitive Fern. Fairly abundant.

88. *Onoclea struthiopteris* (L) Hoffm. Ostrich fern. Few localities: not abundant.

89. *Woodsia ilvensis* (L) R. Br. Rusty Woodsia. Several small, dense patches on rock surfaces, and along rock crevices. Island upper end of Rock Harbor and I, 1; V, 2.

90. *Cystopteris bulbifera* (L) Bernh. Bulblet Cystopteris. Thinly scattered on moist, shaded cliff faces. Cliff near Rock Harbor lighthouse.

91. *Cystopteris fragilis* (C) Bernh. Brittle Fern. Shaded, moist places. Not abundant.

92. *Dryopteris thelypteris* (L) A. Gray. Marsh Fern. Wet margins of bogs, and other low, wet places. Common in such places. II, 5; III, 5.

93. *Dryopteris fragrans* (L) Schott. Fragrant Shield Fern. Common in patches on cliffs and rocks along shore, I, 1.

94. *Dryopteris filix-mas* (L) Schott. Male Fern. Fairly abundant in rich, moist woods. Especially abundant near Benson Brook. II, 1.

95. *Dryopteris spinulosa* (Retz.) Kuntze. Spinulose Fern. Rich, moist woods. Fairly common. Unusually large and vigorous on Malone's Island in Siskowit Bay. Ill, 4; V, 4.

96. *Phegopteris phegopteris* (L) Underw. Long Beech Fern. Moist woods (IV, 4). Less common than *P. dryopteris.*

97. *Phegopteris dryopteris* (L) Fee. Oak Fern. Rich, moist woods. Fairly common. IV, 4; III, 4.

98. *Asplenium trichomanes* L. Maiden-hair Spleenwort. On thinly soil-covered rocks. Rare. Rock cliff along Siskowit cabin trail. V, 4.

99. *Adiantum pedatum* L. Maiden-hair Fern. Sparingly distri buted in the mesophytic forest. Ill, 4, and at Washington Club (forest).

100. *Pteris aquilina* L. Brake. Abundant in open, drier places, especially in burned areas.

101. *Cryptogramma acrostichoides* R. Br. American Rock Brake. In dense patches on exposed bed-rock where thinly soil-covered. Upper end of Rock Harbor and I, 1.

102. *Polypodium vulgare* L. Common Polypody. Tops and exposed edges of cliffs. Common. I, 1.

Equisetaceae—Horsetail Family.

103. *Equisetum arvense* L. Between forest and bog margin, Forbes Lake, II, 5.

104. *Equisetum sylvaticum* L. Wood Horse-tail. Moist woods. II, 1. Noted in one locality only.

105. *Equisetum palustre* L. Marsh Horse-tail. Wet, back-margin of bog.

106. *Equisetum fluviatile* L. Swamp Horse-tail. I n water upper end of Rock Harbor. Ill, 3.

107. *Equisetum scirpoides* Michx. Depression in Arbor-vitæ swamp along Siskowit Lake portage, (V, 9).

Lycopodiaceae—Club-Moss Family.

108. *Lycopodium selago* L. Fir Club Moss. Rare. Exposed rocks at Scovill Point, IV, 1.

109. *Lycopodium lucidulum* Michx. Shining Club Moss. Edge of rock pools Scovill Point, IV, 1, and in moist woods, III, 4.

110. *Lycopodium inundatum* L. Bog Club Moss. Wet bog margin, Sumner Lake. Ill, 5.

111. *Lycopodium obscurum* L. Ground Pine. Sparingly distributed in moist woods. I, 3.

112. *Lycopodium clavatum* L. Running Pine. Common in dry to moist woods. Ill, 4; V, 4; I, 3.

113. *Lycopodium complanatum* L. Fairly common in woods and shady places. V, 4; III, 4.

114. *Lycopodium annotinum* L. Stiff Club Moss. Cool, dry woods. V, 4.

Selaginellaceae—Selaginella Family.

115. *Selaginella rupestris* (L) Spring. On thinly soil-covered rocks along Siskowit Lake portage (V, 9). Sparingly distributed.

Isoetaceae—Quillwort Family.

116. *Isoetes* sp? In shallow water at upper end of Rock Harbor, III, 3.

Spermatophytes. (Seed Plants).

Naiadaceae—Pondweed Family.

117. *Potamogeton natans* L. Fairly common on margin of Sumner Lake. Ill, 5.

118. *Potamogeton perfoliatus* L. Clasping leaved Pond-weed. Margin of Sumner Lake.

119. *Potamogeton heterophyllus*. Schreb. Washington Creek.

120. *Potamogeton hillii* (?) Hill's Potamogeton. Margin of Sumner Lake.

121. *Potamogeton pectinatus* L. Margin of Sumner Lake.

122. *Naias flexilis* Willd. Slender Naias. Shallow water at head of Rock Harbor.

Scheuchzeriaceae—Arrow-Grass Family.

123. *Triglochin maritima* L. Bog margin of Sumner Lake. Not abundant. Ill, 5.

Vallisneriaceae—Tape-Grass Family.

124. *Vallisneria spiralis* L. Tape-Grass, Eel-Grass. Shallow water at head of Rock Harbor.

Graminae—Grass Family.

125. *Panicum xanthophysum* A. Gray. Dry rocky ridges, and rocks with little soil.

126. *Agrostis hyemalis* (Walt.) B. S. P. Rather dry ground.

127. *Calamagrostis canadensis* (Michx.) Beauv. Rock pool margins, Scovill Point, IV, 1. Creek margin upper end of Rock Harbor, III, 3. Wet places generally.

128. *Trisetum subspicatum* (L) Beauv. Common in rock crevices and dry places. Rock shore where little soil is present, where it occurs as the pioneer grass. I, 1; V, 2.

129. *Phragmites phragmites* (L) Karst. Washington Creek.

130. *Poa pratensis* L. A dry ground form. Island in Rock Harbor, III, 1.

131. *Panicularia canadensis* (Michx.) Kuntze. Upper end of bog at end of Siskowit cabin trail. V, 5.

132. *Panicularia elongata* (Torr.) Kuntze. Margin of Siskowit cabin trail bog. V, 5.

133. *Fescuta ovina* L. Rock crevices and on thinly soil-covered rocks. I, 2;'V, 2.

Cyperaceae—Sedge Family.

134. *Eleocharis palustris* (L) R. & S. In shallow water at upper end of Siskowit cabin trail. V, 5.

135. *Eleocharis palustris glaucescens* (Willd.) A. Gray. (?) Wet part of island in Tobin Harbor.

136. *Scirpus caespitosus* L. Margin of Forbes Lake, II, 5. Rock pools, Scovill Point. IV, 1.

137. *Scirpus cyperinus* (L) Kunth. Low ground along "Island mine" road, head of Siskowit Bay.

138. *Eriophorum alpinum* L. Alpine Cotton-Grass. Most common “cotton-grass" on the island. Common in all the bogs. II, 2; III, 5.

139. *Eriophorum vaginatum* L. Sheathed Cotton-Grass. Sphagnum bogs. V, 11; III, 4; V, 5.

140. *Eriophorum gracile* L. Bog margin of Sumner Lake, II, 5.

141. *Rynchospora alba* (L) Tahl. White Beaked Rush. Common in wet bog margins. V, 11; II, 5.

142. *Carex pauciflora* Lightf. Few-flowered Sedge. Margin of Siskowit cabin trail bog. V, 5.

143. *Carex folliculota* L. Long Sedge. Associated with preceding species.

144. *Carex monile* Tuckerm. Necklace Sedge. Wet creek margin of bog near Malone's fishing camp, (V, 11)

145. *Carex tuckermani* Dewey. Along Washington Creek.

146. *Carex retrorsa Schwein*. Retrorse Sedge. Along Washington Creek.

147. *Carex riparia* Curtis. River-bank Sedge. Creek margin head of Rock Harbor, III, 3.

148. *Carex filiformis* L. Slender Sedge. Common in bog margins. II, 5; III, 5.

149. *Carex stricta* Lam. Tussock Sedge. Bog margins. V. 11; II, 5.

150. *Carex aquatilis* Wahl. Water Sedge. Bog margins. V, 11; III, 5.

151. *Carex limosa* L. Mud Sedge. Rock pools, Scovill Point, IV, I. Siskowit cabin trail bog. V, 5.

152. *Carex crinita* Lam. Along road to "Island Mine" head of Siskowit Bay.

153. *Carex arctata* Boott. Drooping Wood Sedge. Dry woods, Washington Harbor.

154. *Carex viridula* Michx. Edge of rock pools, and on moister parts of rock beach. I, 1; V, 1, 2.

155. *Carex chordorhiza* L. Creeping Sedge. Bog margins. V, 11; III, 5; II. 5.

156. *Carex tenella* Schk. Soft-leaved Sedge. Arbor-vitæ depression, Siskowit Lake portage, (V, 9).

157. *Carex sterilis* Willd. Rock pools, Scovill Point, IV, 1, and Siskowit cabin trail bog. V, 4.

158. *Carex brunnescens* (Pers.) Poir. Rock pools, Scovill Point. IV, 1.

159. *Carex trisperma* Dewey. Three-fruited Sedge. Bog margins. II, 5; III, 5.

160. *Carex scoparia* Schk. Pointed Broom Sedge. Washington Club Grounds. I, ‘04.

161. *Carex festucacea* Willd. Fescue Sedge. Dry rocky places; rock ridges. II, 3; V, 3.

NOTE.—For more convenient reference the principal trees of the island will be grouped together instead of being placed under their respective orders and genera.

Pinaceae—Pine Family.

162. *Pinus strobus* L. White Pine. Large, isolated individuals occur along the Greenstone Ridge, and on other ridges; but is nowhere abundant. It is confined almost entirely to higher ground, and to open, sunny places. Large, charred trunks 3-4 feet in diameter are still fairly abundant along the Greenstone and other ridges. Very few young trees of this species were noted; and there are no indications, at present, to suggest that it will again become abundant on the island. I, 3; II, 3; III, ‘04; VII, '04.

163. *Pinus resinosa* Ait. Red, or Norway Pine. Not abundant; noted in two localities only. Occurs on high, exposed ground. III, 4.

164. *Pinus divaricata* (Ait.) Sudw. Labrador, or Gray Pine. Fairly common on exposed, dry rock ridges, and on a few of the rock islands. Several in heath-forest tension zone near Rock Harbor lighthouse. Able to withstand highly xerophytic conditions.

165. *Larix laricina* (DuRoi) Koch. Tamarack, or American Larch. Principally in recently filled bogs or working in along margins of partly filled ones. The tamaracks and Black Spruces are the pioneer trees of the bogs. In the older bogs the few large tamaracks present are relicts, and few young ones appear to be coming on. Scattered individuals occur throughout the upland forests but are nowhere abundant outside the bogs. Largest individuals noted (V, 8) were over 3 feet in diameter, I, 4; I, 6; II, 2; II, 4; II, 5; III, 5; IV, 4; IV, 8; V, 5; V, 7; V, 8; V, 11; V, '04.

166. *Abies balsamea* (L) Mill. Balsam Fir. The most characteristic and abundant evergreen of the upland forest. Abundant on all parts of the island except the Greenstone Ridge, and in the more recently filled bogs. Along the forest road from Washington Club to Lake Desor the absence of the larger firs was probably due to the shallowness of soil, exposure to the powerful winter gales (as soon as they overtop the maples and other trees among which they start to grow), and the reduced root system in proportion to the size of the tree. It reproduces readily in dense shade as well as more open places, and is not only succeeding itself but other forest trees, as the White Spruce. It will certainly occupy a large and important place in the climatic forest. Up to 2 feet in diameter. I, 3; I, 4; III, 4; IV, 4; IV, 8; IV, 9; V, 4; V, 7; III, '04.

167. *Picea canadensis* (Mill.) B. S. P. White Spruce. Older trees are fairly common where they have come in with *Abies* as pioneers. It does not appear to be succeeding itself except along the edge of clearings and in, more open parts of the forest. Since the Fir seedlings are common under the older trees instead of those from the present spruces it appears that the White Spruce will be replaced by the Fir in the climatic forest, the Fir seedlings being able to endure much deeper shade. I, 2; I, 3; III, 1.

168. *Picea mariana* (Mill.) B. S. P. (Possibly *Picea brevifolia* Peck). Black Spruce. Confined principally to sphagnum bogs where it comes in with the tamarack as a pioneer. The largest trees noted were 21/2 feet in diameter. Also sparingly distributed outside of bogs. In a few instances it was found growing on the exposed tops of cliffs (as at Rock Harbor) where there is only a thin covering of soil. I, 6.

169. *Thuya occidentalis* L. White Cedar or Arbor vitæ. Occurs in all bog areas except those most recently carpeted over. It does not appear to come in as a pioneer but follows closely *Picea mariana* and *Larix laricina*. Largest, specimens in old bog areas, V, 8, were 40 inches in diameter. Occasional in upland forest, in fact, fairly abundant in places; also one of the trees to occur in crevices on the small rock islands and along the rock shore, in which cases they have a decidedly stunted appearance, and are often broader than high. I, 4; I, 6; II, 2; IV, 4; IV, 8; V, 6; V, 7; V, 8; V, 11; II, '04; V, 704.

170. *Juniperus nana* Willd. Low evergreen shrub common on the back heath zone and along the rock shore. It appears to follow rather than to precede *Juniperus* (*procumbens*) *sabina* with which it is so commonly associated. A common form on the rock islands and in the rock shore crevices. Also in the natural rock openings back from the shore. I, 1; I, 2; I, 5; III, 1.

171. *Juniperus* (*procumbens*} *sabina* L. Procumbent Juniper. A very important pioneer on the rock islands and on the sloping rock shore, starting as a crevice plant and sending out its dense prostrate branches 6-10 feet. It offers a favorable place for wind blown material which there accumulates, and this is of great importance for the pioneer mosses which contribute so largely to the first humus soil. Some most interesting examples of these pioneer stages were noted on one of the low, nearly bare rock islands near the Rock Harbor lighthouse, I, 1, and at V, 2, it was very abundant.

Taxaceae—Yew Family.

172. *Taxus canadensis* Marsh. Ground Hemlock, American Yew. Everywhere abundant in the upland forests of the island. On account of its low, spreading growth it forms one of the greatest impediments in penetrating the island forests. The rankest growth was noted in the lower forest region around Washington Harbor, where it attains a height of four to five feet. I, 6; IV, 4; IV, 8; IV, 9; V, 4; V, 5; V, 7; V, '04.

Salicaceae—Willow Family.

173. *Populus grandidentata* Michx. Large-toothed Aspen. Principally along the Greenstone Ridge; not at all common as compared with *P. tremuloides*.

174. *Populus tremuloides* Michx. American Aspen. Very common on almost all parts of the islands where burnings and clearings have occurred. This and the *Betula papyrifera*, are the pioneer deciduous trees in burned and cleared areas, where the two seem about equally abundant, colonies of both being intimately associated. Younger and older stands of this as noted along the Greenstone Ridge near Rock Harbor, suggest the younger and older burnings by the copper prospectors. I, 1; I, 2; I, 3; I, 5; I, 6; I, 7; II, 1; II, 3; III, 4; IV, 5; IV, 9; V, 8; V, 9; V, 3; V, 1; V, 5; V, 7; I, '04; III, '04.

75. *Populus balsamifera* L. Balsam Poplar. One locality only; head of Siskowit Bay.

Betulaceae—Birch Family.

176. *Corylus rostrata* Ait. Beaked Hazel. Rocky slopes and summits of ridges. In thickets along the Greenstone.

177. *Betula papyrifora*, Marsh. Paper, or Canoe Birch. Common everywhere in forested portions as well as burnings and clearings. This and the Balsam Fir seem to be the climax trees of the upland forest. I, 2; I, 3; I, 7; II, 1; III, 4; IV, 8; IV, 9; V, 3; V, 4; V, 7; I, '04; III, '04.

178. *Betula lutea* Michx. F. Yellow Birch. Noted only along the forest road from Washington Harbor to Lake Desor, where it was very common along the Greenstone Eidge. Specimens 86 inches in diameter were noted. III, '04.

179. *Betula lenta* L. Black or Cherry Birch. Associated with *B. lutea* as mentioned above. Also attaining great size. III, '04.

180. *Alnus alnobetula*, (Ehrh.) Koch. Green, or Mountain Alder. Fairly common in upland forest at Rock Harbor. Common shrub along with birches and aspens.

181. *Alnus incana* (L) Willd. Speckled Alder. Low ground, borders of streams and margins of lakes. Along water's edge at Rock Harbor, and sparingly associated with *Alnus alnobetula*, in the forest back from water.

Note.—Thru an over-sight the 3 species of *Salix* observed were omitted in preparing this list for the press.

Fagaceae—Beech Family.

182. *Quercus rubra* L. Red Oak. A single specimen was noted along the forest road between Washington Club and Lake Desor, (III, '04). The *only oak noted on the island.*

Pomaceae—Apple Family.

188. *Sorbus americana* Marsh. American Mountain Ash. Fairly common along the forested margins of the principal inlets, as Rock Harbor, and sparingly

distributed through the inland forest. Always more or less isolated, never in colonies.

184. *Aronia nigra* (Wiild.) Britton. A single specimen noted on north side of Rock Harbor.

185. *Amelanchier alnifolia* Nutt. Northwestern June-berry. A shrub 6 feet or less in height. Rock openings also rock ridge near Conglomerate Bay (I, 5).

186. *Amelanchier oligocarpa* (Michx.) Roen. Oblong-fruited June-berry. A shrub about the size of preceding, but occurring on lower ground.

Drupaceae—Plum Family.

187. *Prunus pennsylvanica* L. Wild Red Cherry, Pennsylvania Cherry. Characteristic of xerophytie places as rock openings, talus slopes, and burnings; and able to thrive in exposed rocky positions where subject to great temperature extremes, and where there is very little soil. I, 5.

188. *Prunus virginiana* L. Choke Cherry. Woods: not common.

Aceraceae—Maple Family.

189. *Acer saccharum* Marsh. Sugar or Hard Maple. One part of the island, on the summit of the Greenstone Ridge along the forest road from Washington Harbor to Lake Desor, it is very abundant. Reported to occur sparingly along other parts of the Greenstone, but seems to be confined entirely to the higher parts of the summit ridge. Along this "forest road" it forms almost pure stands, in other places there is *B. lenta* and *B. lutea* mixed with it. Some of the trees are 2-3 feet in diameter. (III, '04.)

190. *Acer spicatum* Lam. Mountain Maple. Generally distributed in the forest, but nowhere very abundant. Largest trees over 30 feet high. One of the lower growth forms to invade the forest roads. Often in rocky places. V, 7; III, '04.

191. *Acer pennsylvanicum*, Striped Maple, Moosewood. Rare on island.

Cornaceae—Dogwood Family.

192. *Cornus stolonifera* Michx. Common in low ground and back margins of bogs. A prominent member of the shrub zone surrounding small lakes.

193. *Cornus circinata* L'Her. Round-leaved Cornel. Sparingly distributed in rich woods.

Araceae—Arum Family.

194. *Calla palustris* L. Water Arum. Lake margins, especially abundant at Sumner Lake. III, 5.

195. *Spathyema foetida* (L) Raf. Skunk Cabbage. Common in low grounds in woods, and near logs. III, 5; II, 1, 2; II, 5; IV, 4.

Juncaceae—Rush Family.

196. *Juncus effusus* L. Along old road to "Island mine," and in shallow water at upper end of Rock Harbor. III, 3.

Melanthaceae—Bunch-Flower Family.

197. *Tofieldia palustris* Huds. Asphodel. Rocks at Scovill Point, IV, 1.

189. *Uvularia perfoliata* L. Perfoliate Bellwort. Rich, moist woods. Scattered.

Liliaceae—Lily Family.

199. *Lilium philadelphicum* L. Red, or Wood Lily. Common in drier parts of woods; even occurs as a rock crevice plant on the small islands in Rock Harbor.

Convallariaceae—Lily-of-the-Valley Family.

200. *Clintonia borealis* (Ait.) Raf. Yellow Clintonia. Common everywhere in moist, rich woods; very abundant in places. I, 3; IV, 4; V, 4; V, 5.

201. *Vagnera trifolia* (L) Morong. Three-leaved Solomon's Seal.Frequent in forest margins of bogs, and in cool, moist woods. I, 4; II, 2; V, 5.

202. *Unifolium canadense* (Desf.) Greene. False Lily-of-Valley, Two-leaved Solomon's Seal. Rather open patches in rich, moist woods. I, 4; II, 2.

203. *Streptopus amplexicaulis* (L) DC. Clasping-leaved Twisted-stalk. Woods along portage to Siskowit Lake (V, 9).

204. *Trillium grandiflorum* (Michx.) Salisb. Showy, White Trillium. Flood plain of Washington Creek.

Iridaceae—Iris Family.

205. *Iris versicolor* L. Larger Blue Flag. Common in low wet places, as lake and bog margins. V, 5; III, 5; II, 5.

Orchidaceae—Orchid Family.

206. *Cypripedium reginae* Walt. Showy Ladies-Slipper. Wet places in woods: not abundant. II, 1; near II, 5.

207. *Cypripedium hirsutum* Mill. Larger Yellow Ladies-Slipper. In drier parts of woods than preceding. IV, 4.

208. *Orchis rotundifolia* Pursh. Small Round-leaved Orchild. Rare: tamarack forest.

209. *Habenaria orbiculata* (Pursh) Torr. Large Round-leaved Orchid. Rich woods near IV, 2; few localities.

210. *Habenaria obtusata* (Pursh) Richards. Small Northern Bog Orchid. Fairly common in forested bog margins, and bog forests. I, 4; II, 2; V, 5.

211. *Habenaria hyperborea* (L) R. Br. Tall Leafy Green Orchid. Bogs and wet woods: margin of Sumner Lake, II, 5.

212. *Habenaria dilatata* (Pursh) Hook. Tall White Bog Orchid. Trembling bog margins of Forbes and Sumner Lakes, very abundant in latter place. II, 5; III, 5.

213. *Habenaria psycodes* (L) Gray. Smaller Purple-fringed Orchid. Associated with *H. dilatata* as given above, and also abundant. III, 5; II, 5.

214. *Pogonia ophioglossoides* (L) Ker. Rose Pogonia. Common along wet bog margins. III, 5; II, 5.

215. *Arethusa bulbosa* L. Arethusa. Wet bog margins. Not so common as preceding species.

216. *Gyrostachys romanzoffiana* (Cham.) MacM. Wet margins of Sumner Lake and Forbes Lake.

217. *Listera cordata* (L) R. Br. Heart-leaved Twayblade. Moist woods and ravines.

218. *Peramium repens* (L) Salisb. Lesser Rattle-snake Plantain. Cabin trail woods, V, 4, Siskowit.

219. *Peramium pubescens* (Willd.) MacM. Downy Rattle-snake Plantain. Rather dry woods. V, 4, III, 4.

220. *Peramium menziesii* (Lindl.) Morong. Menzies' Rattle-snake Plantain. Rich woods. V, 4; III, 4.

221. *Acroanthes monophylla* (L) Greene. (?) Sumner Lake margin. III, 5.

222. *Leptorchis liliifolia* (L) Kuntze. Large Twayblade. Moist woods and along bog margins. Woods of I.

223. *Leptorchis loeselii* (L) MacM. Loesel's Twayblade. Wet thickets and spring banks.

224. *Calypso bulbosa* (L) Oakes. Calypso. Wet, cool woods and ravines.

225. *Corallorhiza corallorhiza* (L) Karst. Early Coral-root. Rich, moist woods. Woods at upper end of Rock Harbor.

226. *Corallorhiza multiflora* Nutt. Large Coral-root. Fairly common in rich woods. I, 4; III, 4.

Santalaceae—Sandalwood Family.

227. *Comandra livida* Richards. Northern Comandra. Thin soil on rocks, and in open, xerophytic places. Pine ridge near Sunnier Lake, III, 4. Fairly common.

Aristolochiaceae—Birthwort Family.

228. *Asarum canadense* L. Wild Ginger. Flood plain, Washington Creek. Only locality where noted.

Myricaceae—Bayberry Family.

229. *Myrica gale* L. Sweet Gale. Margin of bayou off Tobin's Harbor; wet rocks at Scovill Point. Also V. 6.

Caryophyllaceae—Pink Family.

230. *Sagina saginoides* (L) Britton. Arctic Pearl-wort. A hardy r low, rock crevice plant. I, 1.

231. *Alsine longifolia* (Muhl.) Britton. Long-leaved Stitch-wort. Scattered ruderal. II, 1.

232. *Silene antirrhina* L. Sleepy Catch-Fly. Side of Greenstone Ridge, and exposed xerophytic places. Not abundant. II, 3.

Nymphaeaceae—Water-Lily Family.

233. *Brasenia purpurea* (Michx) Casp. Water Shield. Open water in a few bogs; not abundant. Bog near Malone's fishing camp, V, II.

234. *Nymphaea advena* Soland. Large Yellow Pond-Lily. Margins and shallower water in a few bogs. III, 5.

235. *Castalia odorata* (Dryand.) W. & W. Sweet-scented White Pond-Lily. Abundant in Sunnier Lake, III, 5, where it seems to grow in part on the uplifted "false bottom."

Ranunculaceae—Crowfoot Family.

236. *Caltha palustris* L. Marsh Marigold, Cowslip. Wet places in woods. Low woods at head of Rock Harbor, II, 1, 2; III, 5.

237. *Coptis trifolia* (L) Salisb. Gold-thread. Hummocks in wet woods and filled bogs, and in wet bog margins. Common.

238. *Actaea rubra* (Ait.) Willd. Red Baneberry. Sparingly distributed in woods. V, 4, 9; IV, 4.

239. *Aquilegia canadensis* L. Wild Red Columbine. Rocks near light-house at Rock Harbor. Not abundant.

240. *Anemone multifida* Poir. Red Wind-Flower. Rare. Rock shore of one island in Rock Harbor.

241. *Hepatica hepatica* (L) Karst. Round-lobed Hepatica. Woods: not abundant.

242. *Ranunculus abortivus* L. Kidney-leaved Crowfoot. Scattered as a ruderal. II, 1, and on Washington Club grounds.

243. *Ranunculus ovalis* Raf. Thin soil on rock islands. Upper end of Rock Harbor, III, 1; also near Siskowit cabin (V, 1).

244. *Ranunculus macounii* Britton. Macoun's Buttercup. Rare, one locality, near Siskowit cabin (V, 1).

245. *Thalictrum purpurascens* L. Tall Purple Rue. Moist, rich woods near Benson Brook (II, 1), and along Washington Creek.

Papaveraceae—Poppy Family.

246. *Capnoides sempervirens* (L) Borck. Pink Corydalis. Rocky, exposed places along the Greenstone. II, 3.

Cruciferae—Mustard Family.

247. *Thlaspi arvense* L. Field Penny Cress. Washington Club grounds. Only locality. Ruderal.

248. *Sisymbrium altissium* L. Tall Sisymbrium. Washington Club grounds: waste places. I, '04. Ruderal.

249. *Arabis brachycarpa* (T. & G.) Britton. Purple Rock Cress. Exposed rocks. Greenstone Ridge along the McCargo Cove trail. II, 3.

Sarraceniaceae—Pitcher Plant Family.

250. *Sarracenia purpurea* L. Pitcher Plant. Common in bog areas everywhere on island. I, 6; II, 2; II, 5; V, 5; V, 11.

Droseraceae—Sundew Family.

251. *Drosera rotundifolia* L. Round-leaved Drosera. Common along wet bog margins, especially III, 5.

252. *Drosera intermedia* Hayne. Spatulate-leaved Sundew. Bog margins, but generally in wetter parts than the preceding; often elevated on a short stem extension. III, 5.

253. *Drosera linearis* Goldie. Slender-leaved Drosera. Bog margins; fairly abundant. III, 5.

Saxifragaceae—Saxifrage Family.

254. *Saxifraga tricuspidata* Retz. Three-toothed Saxifrage. Fairly common as a crevice plant along the low rock shore. L, 1.

255. *Saxifraga aizoon* Jacq. Livelong Saxifrage. A rock shore crevice plant. Rare. V, 2.

256. *Saxifraga nivalis* L. Clustered Alpine Saxifrage. Exposed rock shores, growing on scanty soil. I, 1; V. 2.

257. *Mitella nuda* L. Naked, or Low Mitrewort. Very common in moist woods. I, 3. Woods at end of Rock Harbor and on forested islands.

258. *Parnassia palustris* L. Northern Grass of Parnassus. Bog margin of Sunnier Lake. Sparingly distributed.

Grossulariaceae—Gooseberry Family.

259. *Ribes setosum* Lindl. Bristly Gooseberry. Shore of Siskowit Lake. Rare.

260. *Ribes prostratum* L'Her. Fetid Currant. Rich, moist woods; also one of rock islands at Rock Harbor. Fairly abundant.

261. *Ribes rubrum* L. Red Currant. Growing wild in abundance in vicinity of Siskowit Lake portage. V, 9.

Rosaceae—Rose Family.

262. *Opulaster opulifolius* (L) Kuntz. Ninebark. Occurs principally along the shores, often as a crevice plant on the rock islands, as well as on rocky shore of main land. I, 1; III, 1; V. 6.

263. *Rubus parviflorus* Nutt. White-flowering Raspberry. A very common and characteristic plant of clearings and burnings; also occurs in thickets and open parts of woods. VIII, '04.

264. *Rubus arcticus* L. Arctic Raspberry, or Bramble. Sparingly distributed in moist woods and filled bog areas.

265. *Rubus strigosus* Michx. Wild Red Raspberry. Found most abundant in the burned areas at head of Siskowit Bay.

266. *Rubus americanus* (Pers.) Britton Dwarf Raspberry. Occasional in woods; rather common in bog forests.

267. *Fragaria vesca* L. Sparingly distributed. I, 1.

268. *Potentilla arguta* Pursh. Tall White Cinque foil. Common around light-house clearing at Rock Harbor as a ruderal. I.

269. *Potentilla monspeliensis* L. Rough Cinquefoil. Exposed rocks having scanty soil.

270. *Potentilla littoralis* Rydberg. Coast Cinquefoil. Fairly common as a rock crevice plant along main shore, and on small rock islands. I, 1.

271. *Potentilla tridentata* Soland. Three-toothed Cinquefoil. Very common as a rock crevice plant along shores and on small rock islands. I, 1; V, 2.

272. *Potentilla fruticosa* L. Shrubby Cinquefoil. Rocks at Scovill Point, IV, 1. Occasional shore crevice plant. I, 1.

273. *Comarum palustre* L. Purple Marsh Cinquefoil. One of the most common and most characteristic plants of all bog-lake margins, and contributing an important part toward the vegetative bog carpet.

274. *Waldsteinia fragariodes* (Michx.) Tratt. Barren or Dry Strawberry. Large patches on the side of the Greenstone range along McCargo trail. II, 3.

275. *Rosa acicularis* Lindl. Prickly Rose. Only species of rose found on island. Fairly common around light-house clearing and in open places.

Geraniaceae—Geranium Family.

276. *Geranium bicknellii* Britton. Bicknell's Cranebill. Rock crevice plant: also on rocks with thin soil covering. Few localities only. I, 1.

Polygalaceae—Milkwort Family.

277. *Polygala paucifolia* Willd. Fringed Polygala. Fairly common in rich, moist woods. I, 3; III, 4.

Empetraceae—Crowberry Family.

278. *Empetrum nigrum* L. Crowberry, Heath-berry. On exposed, nearly bare rocks at Scovill Point. IV, 1.

Anacardiaceae—Sumac Family.

279. *Rhus hirta* (L) Sudw. Staghorn Sumac. Sparingly distributed on higher parts of Greenstone. II, 3.

Hypericaceae—St. John's-wort Family.

280. *Triadenum virginicum* (L) Raf. Marsh St. John's-wort. Bog margin of Sumner Lake (III, 5); also margin of Forbes Lake (II, 5). Common.

Violaceae—Violet Family.

281. *Viola rotundifolia* Michx. Round-leaved Violet. Fairly common in rich, moist woods, especially near I, 6.

282. *Viola labradorica* Schrank. American Dog Violet. Few Specimens in low moist ground near shore at Siskowit Bay cabin, V, 1.

283. *Viola arenaria* DC. Sand Violet. Rocky shore near Siskowit cabin V, 1.

Onagraceae—Evening Primrose Family.

284. *Chamaenerion angustifolium* (L) Scop. Fireweed. Very abundant everywhere in burnings and clearings.

285. *Epilobium lineare* Muhl. Narrow-leaved Willow-Herb. Bog margin Sumner Lake, III, 5.

286. *Epilobium adenocaulon* Haussk. Northern Bog Willow-Herb. Wet soil near shore of Siskowit cabin, V, 1.

287. *Circaea Alpina*, L. Smaller Enchanter's Nightshade. Cool moist woods at head of Rock Harbor. Not common.

Pyrolaceae—Wintergreen Family.

288. *Pyrola chlorantha* Sw. Greenish-flowered Wintergreen. Rich, moist woods.

289. *Pyrola asarifolia* Michx. Liver-leaf Pyrola. Most common of the island pyrolas. Woods.

290. *Pyrola secunda* L. One-sided Wintergreen. Rich, moist woods. Not common.

291. *Pyrola minor* L. Lesser Pyrola. Woods. Scarce.

292. *Moneses uniflora* (L) A. Gray. One-flowered Wintergreen. Rather widely distributed in rich, moist woods, although nowhere abundant. I, 3, 4; III, 4; IV, 4.

293. *Chimaphila umbellata* (L) Nutt. Pipsissewa. Dry woods and exposed sunny places, as the pine ridge near Sumner Lake.

Monotropaceae—Indian Pipe Family.

294. *Monotropa uniflora* L. Indian Pipe. Quite abundant in rich, dark, moist woods. Unusually large, vigorous specimens in wet margin of woods beyond Cabin bog at Siskowit (V, 5).

295. *Hypopitys hypopitys* (L) Small. Woods at Siskowit Bay, V, 4. Rare.

Haloragidaceae—Water Milfoil Family.

296. *Hippuris vulgaris* L. Mare's Tail. Head of Rock Harbor in shallow water. Ill, 2.

Araliaceae—Ginseng Family.

297. *Aralia nudicaulis* L. Wild Sarsaparilla. Abundant everywhere in rich moist woods, where it is one of the characteristic plants of the mesophytic forest. V, 4.

298. *Aralia hispida* Vent. Bristly Sarsaparilla. One single colony on a burned-over island in Rock Harbor. I, 1.

Umbelliferae—Carrot, or Umbel Family.

299. *Heracleum lanatum* Michx. Cow Parsnip. Light-house clearing at Rock Harbor; also an old mine clearing along Rock Harbor. Ruderal. I, 7; V, 3.'

300. *Cicuta bulbifera* L. Bulb-bearing Water Hemlock. Occasional in bog margins, as II, 5; III, 5.

301. *Pastinaca sativa* L. Wild Parsnip. Clearing at beginning of McCargo's trail.

Cornaceae—Dogwood Family.

302. *Cornus canadensis* L. Low, or Dwarf Cornel. Bunchberry. Very abundant in filled bog areas and in moist woods. Also occurring abundantly in open places. One of most common herbaceous plants on the island.

Cornus stolonifera (See tree and shrub list.)

Cornus circinata (See tree and shrub list).

Ericaceae—Heath Family.

303. *Ledum groenlandicum* OEder. Labrador Tea. One of the most characteristic bog shrubs. Common in bogs everywhere. I, 6; II, 2; II, 5; V, 5; V, 11.

304. *Kalmia glauca* Ait. Swamp Laurel. Fairly common in bogs, but nowhere so abundant as the preceding.

305. *Andromeda polifolia* L. Wild Rosemary. Abundant in nearly all the recently filled bogs.

306. *Chamaedaphne catyculata* (L) Moench. Dwarf Cassandra. A very characteristic and common shrub of nearly all the bogs.

307. *Arctostaphylos uva-ursi* (L) Spreng. Bearberry. Very abundant as a heath plant along the rock shore, and on the thinly-covered "rock openings." I, 1, 5 and V, 2.

Vacciniaceae—Huckleberry Family.

308. *Vaccinium uliginosum* L. Great Bilberry. Rocks at Scovill Point. IV, 1.

309. *Vactinium pennsylvanicum* Lam. Low, or Pennsylvania Huckleberry. Abundant as a heath plant along shores, and on nearly bare mountain sides. V, 2; II, 3; IV, 8, and on some of the small islands at Rock Harbor.

310. *Chiogenes hispidula* (L) T. & G. Creeping Snowberry. Edge of bogs, and on sphagnum hummocks. I, 6; V, 5; II, 2.

311. *Oxycoccus oxycoccus* (L) MacM. Low Cranberry. Confined to wet, unforested bogs: only fairly abundant. I, 6; II, 2; V, 5, and bog near Malone's fishing camp, V, 11.

Primulaceae—Primrose Family.

312. *Primula mistassinica* Michx. Dwarf Canadian Primrose. A crevice plant along the rock shore. Not abundant. I, 1; IV, 1; V, 2.

313. *Lysimachia terrestris* (L) B. S. P. Bulb-bearing Loosestrife. Thinly soil-covered rock shore near Siskowit cabin, V, 1.

314. *Naumbergia thyrsifolia* (L) Duby. Tufted Loosestrife. Margin of Siskowit Lake near head of Trout Creek, V, 6.

315. *Trientalis americana* Pursh. American Star-Flower. Moist, rich woods. Sparingly distributed. I, 4; IV, 4; V, 4.

Gentianaceae—Gentian Family.

316. *Gentiana andrewsii* Griseb. Closed, or Bottled Gentian. A few specimens from the Siskowit cabin trail bog, V, 5. Bare.

317. *Tetragonanthus deflexus* (J. E. Smith) Kuntze. Spurred Gentian. Moist woods, head of Rock Harbor. Few localities only.

Menyanthaceae—Buck-bean Family.

318. *Menyanthes trifoliata* L. Buckbean. Abundant in wetter parts of bogs: very important contribution in the formation of the "bog carpet." II, 5, III, 5, and bog near V, 2.

Apocynaceae—Dogbane Family.

319. *Apocynum androsaemifolium* L. Spreading Dogbane. Washington Club grounds.

Convolvulaceae—Morning-glory Family.

320. *Convolvulus repens*, var. *pubescens*. Pubescent Bindweed. Nearly bare sides of the Greenstone along the McCargo Cove trail, II, 3.

Hydrophyllaceae—Water-leaf Family.

321. *Phacelia franklinii* (R. Br) A. Gray. Franklin's Phacelia. Few specimens taken on a thinly soil-covered rock elevation near Rock Harbor lighthouse.

Labiatae—Mint Family.

322. *Scutellaria laterifolia* L. Mad-Dog Skullcap. Along flood plain of Washington Creek.

323. *Scutellaria galericulata* L. Marsh Skull-Cap. Wet bog margins, as of Sumner (III, 5) and Forbes (II, 5) lakes.

324. *Prunella vulgaris* L. Self-heal. Clearings: occurs as a ruderal, Washington Club grounds, II, 1, etc.

325. *Clinopodium vulgare* L. Wild Basil. Woods on Greenstone along McCargo trail. Not abundant.

326. *Lycopus americanus* Muhl. Cut-leaved Water Hoar-hound. Wet bog margin of Sumner Lake. Ill, 5.

327. *Mentha canadensis* L. American Wild Mint. Near water's edge at Siskowit cabin, V, 1. Also on Washington Club grounds.

Scrophulariaceae—Figwort Family.

328. *Scrophularia leporella* Bicknell. Hare Firwort. Along Washington Creek.

329. *Veronica americana* Schwein. American Brooklime. Along Washington Creek on low ground.

330. *Castilleja acuminata* (Pursh) Spreng. Lance-leaved Painted-Cup. Common around light-house at Rock Harbor. Fairly abundant in open, moist places.

331. *Melampyrum lineare* Lam. Narrow-leaved Cow-wheat. Fairly common on dry, open, to partly shaded places. Exposed Norway Pine ridge near Sumner Lake; also occasional in open woods.

Lentibulariaceae—Bladderwort Family.

332. *Utricularia minor* L. (?) Lesser Bladderwort. In shallow water on bog marginal carpet at Sumner Lake (III, 5); also occurs at Forbes Lake (II, 5).

333. *Pinguicula vulgaris* L. Butterwort, Bog Violet. Rock pools or moist rocks near water's edge; fairly common. IV, 1; I, 1; V, 2.

Rubiaceae—Madder Family.

334. *Galium spurium* L. Lesser Cleavers. Low ground along Washington Creek.

335. *Galium triflorun* Michx. Sweet-scented Bed-straw. Woods along McCargo trail.

336. *Galium trifidum* L. Small Marsh Bed-straw. Wet bog margins of Sumner (III, 5) and Forbes (II, 5) lakes.

Caprifoliaceae—Honey-suckle Family.

337. *Sambucus pubens* Michx. Red-Berried Elder. Along Siskowit portage. Fairly common.

338. *Sambucus canadensis* L. American Elder, Light-house clearing at Rock Harbor.

339. *Viburnum acerifolium* L. Fairly common in woods. I, 3; III, 4.

340. *Viburnum paucifolium* Pyl. Few-flowered Cranberry. Moist woods: abundant. I, 3,

341. *Linnaea borealis* L. Twin-flower. Very common in woods and partial clearings. Even occurs at I, 1, as a rock crevice plant. Widely distributed.

342. *Lonicera dioica* L. Glaucous Honey-suckle. Occasional in woods. I, 3.

343. *Lonicera ciliata* Muhl. American Fly Honey-suckle. Fairly common in woods. I, 3; III, 4; IV, 4, 8; V, 4.

344. *Lonicera hirsuta* Eaton. Hairy Honey-suckle. Rare: in woods.

345. *Lonicera involucrata* (Richards) Banks. Involucred Honeysuckle. Border of lighthouse clearing, and in open parts of woods. Fairly common. I, 3.

346. *Diervilla diervilla* L. Bush Honey-suckle. A very abundant and characteristic shrub of burnings, clearings, and natural openings in woods. 1, 2 (and on rock islands in Rock Harbor), II, 1, 3; III, 4; IV, 4;V, 2, 3.

Campanulaceae—Bell-Flower Family.

347. *Campanula rotundifolia* L. Blue Hare-bell. Common rock crevice plant on rock shore and small rock island. Also growing on thin soil along the shore. I, 1; V, 2.

348. *Campanula aparinoides* Pursh. Marsh Bell-flower. Common in wet bog margins of Sumner (III, 5) and Forbes (II, 5) lakes.

349. *Lobelia kalmii* L. Brook, or Kalm's Lobelia. A rock crevice plant, and on moist rocks near water's edge. Common. I, 1; IV, 1; V, 2.

Chicoriaceae—Chicory Family.

350. *Lactuca pulchella* (Pursh) DC. Large-flowered Blue Lettuce. Noted in one locality only, rock clearing on side of Greenstone along the McCargo trail. II, 3.

351. *Hieracium umbellatum* L. Narrow-leaved Hawkweed. On rocks or in rock crevices. V, 2.

352. *Nabalus albus* (L) Hook. White Rattle-snake Root. Woods: not abundant. Forest along Siskowit portage. V. 9.

353. *Nabalus racemosus* (Michx.) DC. Glaucous White Lettuce. Rocks and rock crevices along shore. IV, 1; V, 2.

Compositae—Composite Family.

354. *Eupatorium pupureum* L. Joe-Pye Weed, or Purple Boneset. In moist land near creek, upper end of Rock Harbor, III, 3.

355. *Solidago virgaurea* L. var. (?) European Golden-rod. Rock crevices, and thin soil on rocks and rock islands. I, 1.

356. *Solidago neglecta* T. & G. Swamp Golden-rod. Fairly common in most of the wet bogs. I, 6; III, 5; V, 5.

357. *Solidago juncea* Ait. On thinly soil-covered rock surfaces. Rock Harbor, I, 5.

358. *Solidago uliginosa* Nutt. Siskowit cabin trail bog. V, 5.

359. *Aster macrophyilus* L. Large-leaved Aster. Very abundant and characteristic in nearly all clearings, and in natural rock openings in woods. Often forms large colonies.

300. *Aster ptarmacoides* (Nees) T. & G. Upland White Aster. Fairly common on small rock island, and as a rock shore crevice plant, the only crevice aster. I, 1; IV, 1; V, 2.

361. *Aster hirsuticaulis* Lindl. Hairy-stemmed Aster. Woods along Washington Creek; one locality only.

362. *Anaphalis margaritacea* (L) B. & H. Large Pearly Everlasting. Dry soil, and rock clearings along Greenstone (McCargo trail). II, 3, .and on Washington Club grounds.

363. *Artemisia canadensis* Michx. Canada Wormwood. Crevice plant along rock shore, and on small islands in Rock Harbor. I, 1; V, 2.

364. *Senecio balsamitae* Muhl. Balsam Groundsel. Common rock crevice plant on Rock Harbor islands, and elsewhere along the rock shore. I, 1; III, 1; IV, 1; V, 2.

SUMMARY.

Species of lichens	43
Species of mosses	38
Species of Pteridophytes	35
Species of Spermatophytes	248
Total	364

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1901. Notes on Some Plants of Isle Royale. Minn. Bot. Studies, 2, pp. 619-620.

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1906. Notes on the Plants of the Porcupine Mountains and Isle Royale, Michigan. Rep. Mich. Geol. Survey for 1905, pp. 86-92.

ANNOTATIONS ON CERTAIN ISLE ROYALE INVERTEBRATES.

DR. CHAS. C. ADAMS.

The following annotated list of Isle Royale invertebrates includes the groups which have not been made the basis for separate papers by specialists. For the determination of these I am indebted to the following persons: Prof. N. A. Harvey, the Sponge; Dr. T. H. Montgomery, Hair-worms; Prof. Frank Smith, Earthworms; Dr. J. Percy Moore, Leeches; Miss Ada Weckel, Amphipods; Dr. Harriet Richardson, Sow-bug; Mr. Nathan Banks and Mr. J. H.Emerton, Spiders; Dr. J. W. Folsom, Spring-tail; Mr. E. B. Williamson, Dragonflies; Prof. Herbert Osborn and Mr. J. B. de la Torre Bueno, Hemiptera; and to Prof. A. J. Snyder and Dr. James Fletcher, Lepidoptera.

In general, in addition to the field notes which include those made by Dr. H. A. Gleason and myself, the geographic range has been outlined and a selected series of references is given for the convenience of the student of the Michigan fauna. The insects were largely collected by Dr. Gleason, the writer, and B. F. Savery who collected insects about the camps, but all members of the party aided in the collection of the specimens. The field numbers are indicated in parentheses, preceded by G in the case of Dr. Gleason's numbers and A in my own.

An examination of these lists will reveal their incomplete character, as an effort was made to make representative rather than complete collections of the groups. On account of the small amount of zoological information which we possess from Isle Royale it has been thought

desirable to make the determinations of the collections as complete as circumstances would allow.

PORIFERA.

Spongillidae.

Spongilla lacustris (Linn.). Fresh Water Sponge. A small colony of this sponge was found on July 26 in shallow water near the head of Rock Harbor (III, 3) by Gleason. Prof. N. A. Harvey examined the specimen and makes the following comments: "Small encrusting sponge, with a tendency to branch. One branch cylindrical, full of gemmules. Skeleton spicules smooth, pointed, slightly curved, numerous. Dermal spicules, few, half as long as skeleton spicules, densely spined, spines short, more numerous towards the ends, slightly curved. Gemmules with very thin membrane, destitute of spicules, foramen oval.

"This sponge is evidently a weak form of *Spongilla lacustris* (Linn.). It is very close to the *paupercula* of Bowerbank. There can be no question about the identity of this sponge, although it is somewhat unusual to find gemmules so well developed in July. It developes its gemmules ordinarily very late in the fall. The spicules on the gemmule appear to be wholly wanting, and the dermal spicules are not numerous. The specimen is too small to show the peculiar branching habit very distinctly."

A large quantity of this sponge was also secured during 1904 in the Porcupine Mountains, Ontonagon county, Mich., by N. F. Macduff. The specimens came from Carp Creek (Sta. VI) in August. Concerning these specimens Prof. Harvey also remarks: "Skeleton spicules smooth, slightly curved, pointed at both ends. Dermal spicules half the length of skeleton spicules, or shorter, spinous spines numerous but short, Gemmules not well developed. The branches containing few or none. The encrusting portion of the sponge manifesting some. Gemmule spicules wanting. The geinmule crust very thin, or altogether wanting. Its branching character is well marked, and the small size of the branches indicate the weak form which seldom shows many gemmules or in which the geinmule spicules are seldom well developed. In consequence of the size and striking branched habit of this sponge it is the one that is usually first found by collectors. I am surprised to find any gemmules matured in these sponges at the season when these were collected."

NEMATODA.

Gordiidae.

Gordius aquaticus robustus (Leidy) Montg. Hair Worm. This species of hair worm was fairly abundant: specimens were taken at the head of Tobin Harbor (IV, 7) among *Potamogeton perfoliatum* on July 20: among sedges at the head of a small island in the Harbor (IV, 6), and on the beach at our camp on Siskowit Bay (V, 1) August 3 and 6. Both sexes are represented in our series, cf. Montgomery, '98, pp. 30-31.

Geographic Range. Bay of Fundy; Maine; Massachusetts; Maryland; District of Columbia; New York; Pennsylvania; Montana; Michigan; Kansas. The typical form occurs in Europe.

During August, 1903, Mr. A. G. Ruthven secured specimens of *Gordius lineatus* Leidy, in a spring in the Porcupine Mountains (Station VI), Ontonagon county, Mich. cf. Montgomery, '98, p. 32. This species seems to frequent springs. It is recorded from New York, Pennsylvania and Maryland.

REFERENCES.

1898. Montgomery, Jr., T. H. The Gordiacea of Certain American Collections with Particular Reference to the North American Fauna. Bull. Mus. Comp. Zool., 32, pp. 23-59.

1899. Gordiacea (Hair worms). Amer. Nat., 33, pp. 647-652.

HIRUDINEA.

Glossiphonidae.

Glossiphonia complanata (Linn.). One specimen of this leech was taken in a tamarack swamp (V, 5) on August 12. Moore ('01, p. 493) states that it abounds under stones in running water and "feeds chiefly on small snails and annelids."

Geographic Range. Connecticut; Lake Ontario; Lake Erie; Ontario; Ohio; Michigan; Illinois; also found in Europe.

Hirudinidae.

Macrobdella decora (Say) Verrill. This species was quite abundant at a marshy margin of Simmer Lake (III, 5), where many specimens were taken during July. This is a large species and easily recognized by its dark brown dorsal surface and reddish colored ventral surface. They are very graceful and conspicuous objects when seen swimming. One specimen was taken upon a frog. Moore (1901, p. 511) reports this: species as a true blood-sucker and that it is frequently found gorged.

Geographic Range. Maine; New York; Connecticut; Virginia; Michigan; Minnesota; Illinois; Kansas; Nebraska.

Haemopsis grandis Verrill. One specimen was taken, July 5, on the south shore of Siskowit Lake (V, 6). This is a mud leech and at times leaves the water in search of earthworms (Moore, '01, p. 527). Also taken in 1904 by Ruthven at Lake Desor (VII, '04), Ruthven, '06, p. 51.

Geographic Range. Connecticut; Lake Huron; Michigan; Lake Superior (Verrill, '74, p. 672); Yellowstone Park; Kansas; Alaska (*H. marmoratis* Moore, '98, p. 560); Michigan; Illinois; Nebraska.

Herpobdellidae.

Herpobdella lateralis (Verrill) Moore. On the south shore of Siskowit Lake (V, 6) one specimen was taken August 5, and another specimen was taken July 14, in shallow water, at the head of Rock Harbor (III, 3).

The type of this species came from near the northern shore of Lake Superior.

Geographic Range. Maine; Connecticut; Lake Huron; Lake Superior; Colorado, (Verrill, '74, p. 675).

Nephalopsis obscura Verrill. Egg capsules of these leeches were taken July 27 at Sumner Lake (III, 5), on a yellow water lily leaf (*Nymphaea advena*) and apparently young were associated with them; and similar capsules were also found on *Potamogeton* leaves. A capsule was also found in Rock Harbor at Neutson's Besort (IV, 5) also in a swampy bayou off Tobin's Harbor (IV, 3) on July 21. Specimens of the leeches themselves were taken in Siskowit Bay on the beach at our camp (V, 1), in Siskowit Lake at a small island on the south shore (V, 6) and at the swamp margin of a pond in the yellow water-lily and *Potamogeton zone* (V, 11). Also taken in 1904 by Ruthven at Lake Desor (VII, '04), Ruthven, '06, p. 61.

Geographic Range. Wisconsin; Colorado (Verrill, '74, p. 674); Michigan.

REFERENCES.

1874. Verrill, A. E. Synopsis of the North American Fresh-water Leeches. Report U. S. Fish Comm. Pt. II, 1872-73, pp. 666-689.

1898. Moore, J. P. The Leeches of the U. S. National Museum. Proc. U. S. Nat. Mus. Vol. 21, No. 1160, pp. 543-563.

1901. Moore, J. P. The Hirundinea of Illinois. Bull. Ill. State Lab. Nat. His. Vol. 5, pp. 479-547.

1906. Hirudinea and Oligochaeta Collected in the Great Lakes Region. Bull. U. S. Bureau of Fisheries, 25, pp. 153-171.

1906. Ruthven, A. G. An Ecological Survey in the Porcupine Mountains and Isle Royale, Michigan. Ann. Rep. 1905; Mich. Geol. Surrey, pp. 1755.

1902. Ward, H. B. Notes on the Leeches of Nebraska. Report Neb. State Board of Agriculture for 1901. pp. 229-242.

OLIGOCHAETA.

Lumbricidae.

Helodrilus (*Allolobophora*) *caliginosus* (Savigny), nearer to typicits than to H. (*A.*) *C. trapezoides* (Ant. Dug.). these earthworms were taken along the beach near the light-house at Rock Harbor (I, 1) July 9, and in a "rock clearing" (I, 2) on July 13, and also at the outlet of Siskowit Lake (V, 9) on August 15. An undetermined species was taken in the shallow humus on the rock beach under *Cladonia* (V, 2).

Geographic Range. Northern Europe and North America. (Michaelsen, '00, p. 483).

Lumbricus terrestris Müll. A large specimen was taken from the mouth of a Garter Snake (*Thamnophis sirtalis*) found in a clearing which was formerly the location of the Ransom settlement (II, 1). The snakes were very abundant near the shore in the grass. It is not improbable that these earthworms were introduced at this locality. Other specimens, doubtfully referred to this species came from the balsam-spruce forest (I, 3), where there was also found an Enchytraid. (G. 140).

Geographic Range. Europe; New England; Illinois; Mexico. (Michaelsen, '00, p. 512, '03, p. 144).

REFERENCES.

1900. Michaelsen, W. Oligochaeta. Das Tierreich. 10 Lieferung.

1903. Michaelsen, W. Die geographische Verbreitung der Oligochaeten. Berlin.

AMPHIPODA.

Gammaridae.

Eucrangonyx gracilis (Smith). Among the dark colored vegetable debris on the north shore of Sumner Lake (III, 5) this species was found. July 29; also in a small stream flowing from a tamarack-spruce swamp (V, 5) on August 8, in the *Potamogeton* and *Nymphaea advena* zone of a small pond, and also back from the pond in small footprint-like pools of water in the buck-bean (*Menyanthes trifoliata*) and sedge zone. (A. 126, 128, 77, 97).

Hyalella knickerbockeri (Bate). Taken at the west end of Rock Harbor in the bulrushes about the mouth of a small stream (III, 3) on July 26, (G. 159). Other specimens were taken in 1904 at Lake Desor ('04, VII) on August 30; and on water plants in Washington river ('04, II) on August 18.

Gammarus limnaeus Smith. Found in the same conditions as the above species (III, 3) and in abundance.

REFERENCES.

1874. Smith, S. I. The Crustacea of the Fresh Waters of the United States. Report U. S. Fish Comm. 1872-73. Pt. II, pp. 637-665.

1907. Weckel, A. L. The Fresh-water Amphipoda of North America. Pro. U. S. Nat. Mus., 32, pp. 25-58.

ISOPODA.

Oniscidae.

Cylisticus convexus (DeG.). One specimen of this sow-bug was taken at camp at the Light-house (I, 7) on July 15. (G. 09). Another specimen was taken July 2, at Mackinaw Island, Straits of Mackinac, Michigan, cf. Richardson, '05, p. 609.

Geographic Range. Massachusetts; New York; Washington, D. C.; Ohio; Michigan; Illinois; New Mexico; also Norway; Sweden; Denmark; British Isles; Germany; Bohemia; Holland; Belgium; France; Turkey. This species may have been carried to Isle Royale by man.

REFERENCE.

1905. Richardson, H. A Monograph of the Isopods of North America. Bull. No. 54, U. S. Nat. Museum.

ACARINA.

Rhyncolophidae

Rhyncolophus simplex Bks. This mite was found in the thin soil and debris beneath the mats of bearberry in a dry rock clearing (I, 2). Banks, '04, p. 30.

Hydrachnidae.

Limnochares extendens Say. This water mite was taken from the water in the sedge zone near the open water at Sunnier Lake (III, 5).

Geographic Range. "It occurs in northern states, from Maine to Michigan, perhaps farther west." (Banks, in letter).

ARACHNIDA.

Phalangiidae.

Lacinius ohioensis Weed. Only three specimens of this Harvest Spider were taken, one was found under stones on a shallow soil among the Jack Pines (I, 5) in a-very hot and dry locality; the second from the margin of the sedge zone about a pond (V, 11), and the third from under Cladonia on a rocky beach with a very shallow soil (V, 2).

Geographic Range. Ohio, Illinois, Weed, '93, p. 559; Michigan.

Dictynidae.

Amaurobius bennetti Blk. A few specimens were taken under dry bark in the hardwoods on a ridge north of the Club House at Washington Harbor (V, '04); also from under the bark of decayed log in the maples on the Desor Trail (III, '04). In the moist vegetable mold in the balsam-spruce forest (I, 3) and under the bark of dead trees near the rock clearing at the camp on Siskowit Bay (V, 3). One was found in the month of a Winter Wren shot by MeCreary (II, 1). In the clearing at Benson Brook (II, 1), and in the "rock clearing" at camp on Siskowit Bay (V, 3).

Geographic Range. Canada, Marx, '90, p. 510; Porcupine Mountains, Michigan.

Drassidae.

Drassus neglectus Keys.=*D. saccatus*, Emerton, '02, p. 6. One specimen was taken from under a stone, upon the jack pine ridge where the soil was very shallow and the heat intense during the middle of the day (I, 5). It was enclosed in a rather compact close fitting web. Also taken from the margin of a pond among the vegetation (V, 11). One collected on the rock ridge north of the light-house (I, 2) was in a small pocket-like web about 2 by 2.5 cm. in a cavity under a flat stone, surrounded by moist soil, at a depth of about 6 cm. (Gleason).

Geographic Range. New Hampshire, Slosson, '98, p. 247; Michigan; Dist. Columbia, Marx, '96a, p. 154.

Gnaphosa brumalis Th. The only specimen (G. 22) was taken in a small *Cladonia* clearing on the north side of Conglomerate Bay (I, 2) near the beach.

Geographic Range. Labrador; Anticosti Island, Quebec; White Mts., above tree limit, N. H.; Ithaca, N. Y.; Massachusetts; Colorado; Laggan, Alberta, cf. Emerton, '94, p. 413; Banks, '95, pp. 417, 421; Marx, 790, p. 508. It is not unlikely that the New York and Massachusets localities are from "boreal islands"—swamps or cool ravines, and are thus outliers from the principal range of this form to the northward. Alaska, Marx, '96a, p. 189.'

Agriopidae.

Linyphia phrygiana Koch. One specimen was taken at our camp at the Light-house (1, 7). Emerton, '02, p. 141.

Geographic Range. Gaspe, Quebec; Mt. Washington, N. H.; Maine; Mass.; New York; Connecticut; Colorado; Rocky Mts. of Canada; Calif.; probably all over the United States and Northern Europe. Emerton, '94, p. 409, and '82, p. 63; Banks, '95, p. 425.

Tetragnatha extensa Linn. One specimen was taken on the window sill at the Light-house (I, 7). Emerton, '02, 201, 203.

Geographic Range. Labrador; Mass.; New York, Marx, '90, p. 552; Anticosti Island, Quebec; Saskatchewan River; White Mts., N. H.; Adirondack Mts., N. Y.; Connecticut; Dist. Columbia; Alaska; Siberia; Lapland; Europe, Emerton, '04, p. 406; Beaver Island, Mich., Pettit, '01, p, 39; Calif., Collidge, Can. Ent. 39, p. 376. Marx. '96a, p. 196.

Epeira patagiata Clerck. Taken in the cassandra zone of a tamarack swamp (V, 5). Emerton, '02, p. 160. Comstock, '03, p. 38.

Geographic Range. Lapland; Labrador; New Foundland; New Hampshire; New York; Pennsylvania; Maryland; District of Columbia; Virginia; Illinois; Montreal, Anticosti Island, Quebec; Lake of the Woods; Saskatchewan River; Colorado; British Columbia; Washington; Oregon; Sitka, Alaska; Europe, Emerton, '04, p. 404, and '84, p. 305; Slosson, '98, p. 248; Banks, '95, pp. 417, 425. Marx. '96a, p. 194. It seems probable that the most

southern localities of this species are confined to some restricted habitat.

Thomisidae.

Ebo latithorax Keys. One specimen was taken on the beach near the Light-house (I, 1). Emerton, '02, p. 38.

Geographic Range. Mass.; New York, Emerton, '92, p. 378; Virginia; District of Columbia; Maryland; Utah. Marx, '90, p. 558.

Clubionidae.

Clubiona riparia Koch. One specimen was taken in the vicinity of Tobin Harbor (IV).

Geographic Range. Maryland, Marx. '90, p. 512; New Hampshire, Slosson, '98, p. 247; Colorado, Banks, '95, p. 422. Dist. Columbia, Marx. '96, p. 155.

Agelenidae.

Tegenaria derhami (Scop.). Found in the hardwood forest on the ridge east of the tamarack swamp (V, '04) back of the Club House at Washington Harbor. Emerton, '02, p. 96, and Marx, '90, p. 516.

Geographic Range. Labrador; Gaspe, Quebec; "A common house spider in North America and Europe," Emerton, '94, p. 411; New Hampshire, Slosson, '98, p. 247; Colorado, Banks, '95, p. 422; Calif., Collidge, Can. Ent, 39, p. 375. Marx. '96a, p. 190. Dist. Columbia, Marx. '96, p. 155. Indiana, Fox, '93, p. 268. Probably introduced (Emerton).

Coelotes sp. A specimen, too young for specific identification, was taken in a rock clearing (I, 2) near the Light-house. It spins a pocket just about large enough for its body beneath loose rocks.

Cicurina arcuata Keys. Where the soil was very thin on the jack pine ridge (I, 5) one specimen was taken under a stone and a female was found with a white disk-like cocoon containing a large number of young white spiders. A specimen belonging to this genus was found along the trail through the balsam forest in leaf mold at Siskowit Bay (V, 4), but it is too young for specific determination. It spins a small pocket-like web beneath flat stones. Frequents the dead leaves of forests (Emerton).

Geographic Range. Labrador; New Hampshire; Penn.; District of Columbia; Virginia; Lake Superior; Minnesota; Illinois; Colorado, Marx, '90, p. 516; '96^ p, 190, '92 ,p. 155.

Pisauridae.

Dolomedes idoneus Montg. This large spider was taken at the log cabin of the Washington Club at Lake Desor (VII, '04) (A. 139).

Geographic Range. Lake Champlain; Conn. (Emerton); Penn.; Michigan.

Lycosidae.

Lycosa frondicola Emer. One specimen was taken about camp at the Light-house (I, 7).

Geographic Range. Conn., Marx, '90, p. 561; New Hampshire; Slosson, '98, p. 248; Penn., Stone, '90, p. 426; Michigan; Dist. Columbia, Marx, '96, p. 160. Indiana, Fox, '93, p. 269.

Lycosa pratensis Emer. On a gravelly beach near the Light-house (I, 1) dragging an egg-case with it, in the rock clearing (I, 2) and on the dry Jack Pine Ridge (I, 5) were the situations in which this species was taken. Emerton, '02, p. 69.

Geographic Range. Anticosti, Quebec; White Mts., N. H.; Mass.; Conn.; Porcupine Mountains, Mich.; Lake of the Woods; Laggan, Alberta. Marx, '90, p. 563 and Emerton, '94, p. 422.

Lycosa kochi Keys. This was an abundant species, found upon the beach near the Light-house (I, 1); in a rock clearing adjoining the beach (I, 2) (G, 71), and about the camp on Siskowit Bay (V, 3) where one had been captured by a wasp. One with an egg-case attached was buried under half an inch of soil on a rock ridge (I, 2). Emerton, '02, p. 74.

Geographic Range. Mass.; Conn.; Penn.; New Jersey; Dist. Columbia; Michigan. Emerton, '85, p. 486; Stone, '90, p. 426; Marx, '96. p. 160'.

Pardosa glacialis Thor. Found quite abundantly running about over the wet sphagnum on the north shore of Porbes Lake (II, 5); many were carrying cocoons. Others were secured among the open cassandra, tamarack and spruce zone about a pond (V, 11). Several other specimens were taken running about with cocoons in the *Cladonia-Jumper* procumbens and bearberry belt on a sloping rock beach (V, 2). Emerton, '02, p. 80.

Geographic Range. Greenland; Labrador; White Mts., N. H.; Massachusetts (Emerton); Conn.; Laggan, Alberta; Emerton, '94, p. 425; New Mexico, Psyche, 9, p. 123, Ma,rx, 96a, p. 197. Found near Ann Arbor, Mich. in a tamarack swamp (Miss Jean Dawson), thus clearly indicating the boreal island character of such a habitat.

Pardosa groenlandica Thor. This was apparently the most common species of spider collected. Many were found running about over the rocky, gravelly or sandy beaches (I, 1) with cocoons (G. 16, 38, 39, 30, 46). A specimen was also taken on the open heath beach on the south shore near Siskowit Bay (V, 2). Emerton, '02, p. 79.

Geographic Range. Greenland; Labrador; Anticosti Island, Quebec; White Mts., above the tree limit among stones (Emerton), N. H.; Lake of the Woods; Laggan, Alberta; Idaho; Colorado; Washington; Oregon: Alaska. Emerton, '94, pp. 400, 423; Banks, '98, p. 16, '95, p. 430; Marx, 96a, p. 197.

Pardosa sternalis Th.=*luteola* Em. All the specimens of this species were taken in open areas in a small Cladonia clearing near the beach on the north side of Conglomerate Bay (I, 2), and crawling about over the nests of the ant *Formica fusca* (V, 3); the heath beach near Siskowit Bay (V, 2) (A. 107) and in the open area about our camp on Siskowit Bay (V, 3) (G. 225). Most of the females carried cocoons.

Geographic Range. Colorado, Banks, '95, p. 429. Mt. Washington, N. H. On mosses and lichens (Emerton).

Pardosa lapidicina Emer. This was also a beach spider (I, 1) (G. 25, 38 (2)). The cocoons are very large in proportion to the size of the female and are flattened. Emerton, '02, p. 78. Lives among stones (Emerton).

Geographic Range. Gaspe. Quebec; Massachusetts; Connecticut; Pennsylvania. Emerton, '02, p. 79, states that this species "lives among stones in the hottest and dryest places from Connecticut to Labrador." Marx, '90, p. 565; Stone', '90, p. 431.

Pardosa tachypoda Thor. Found running over the bare rocks on the top of the jack pine ridge (I, 5), and carrying cocoons (A. 21). Emerton, '02, p. 81.

Geographic Range. Labrador; Mt. Washington, N. H.; Adirondack Mts., N. Y.; Manitou, Colo. Emerton, '85, p. 493, and '94, p. 401.

Salticidae—Attidae.

Phiddippus borealis Bks. One specimen of this jumping spider was found under loose stones on moist earth on the jack pine ridge (I, 5).

Geographic Range. New Hampshire, Banks, '95, p. 96, Slosson, '98, p. 249; Maine; New York, Banks (in letter).

Habitat Preferences. Reviewing the preceding list of mites and spiders the following habitat preferences appear to be indicated:

I. Beach, rocky, bouldery or sandy.
   Lycosa pratensis (also dry openings).
   Lycosa kochi.
   Pardosa groenlandica.
   Pardosa sternalis (also dry openings).
   Pardosa lapidicina.
   Pardosa glacialis (also in sphagnum bogs).

II. Dry openings, rock or shallow soil, heath-juniper—Cladonia plant society represented by I, 5; V, 2.
   Rhyncolophus simplex.
   Lacmius ohioensis (in swamp also).
   Gnaphosa brumalis.
   Drassus neglectus (in swamp also).
   Coeletes sp.
   Cicurina arcuata.
   Lycosa pratensis.
   Lycosa kochi (also beach).
   Pardosa sternalis (on beach also).
   Pardosa tachypoda.
   Pardosa glacialis.
   Phidippus borealis.

III. Wet places—as sphagnum swamps.
   Epeira patagiata (cassandra zone).
   Pardosa glacialis (also dry openings).
   Drassus neglectus (also dry openings).
   Lucinus ohioensis (also dry openings).

IV. Mesophytic forest—balsam-spruce or hardwoods.
   Amarobius bennetti.
   Tegenaria derhami.

V. About Camps.
   Linyphia phrygiana.
   Dolomedes idoneus.

From the above tabulation it is evident that, if the collections are representative, most of the spiders prefer the open places, the beach, rock openings or open parts of swamps, the most marked preference being for dry openings. It thus appears that as the forests encroach upon these areas the spider habitats become more restricted. The genus *Pardosa* seems quite characteristic of the open places. The general *Arachnid* successions are thus suggested in outline as follows: from beach types and rock openings to the forest; inland from the aquatic types and swamp forms to the forest. Particular attention is directed to the following habitats which deserve special attention for their bearing on succession; these are the birch-aspen border and clearing society, and glades or openings in the forest and the forested swamps. An examination of the literature clearly shows that the habitats of spiders have received but little attention. This is an excellent field for study and one certain to give interesting and valuable results.

Geographic Notes. The following nine species of Isle Royale spiders have been recorded from Labrador: *Gnaphosa brumalis*, *Tetragnatha extensa*, *Tegenaria derhami, Cicurina arcuata*, *Epeira patagiata*, *Pardosa glacialis* (also Greenland), *Pardosa groenlandica* (also Greenland), *Pardosa lapidicina* and *Pardosa tachypoda*.

The following fourteen species have been reported from New Hampshire: *Drassus neglectus*, *Gnaphosa brumalis*, *Linyphia phrygiana*, *Tetragnatha extensa*, *Epeira patagiata*, *Clubiona riparia*, *Tegenaria derhami*, *Dolomedes idoneus*, *Lycosa frondicola*, *Lycosa pratensis*, *Pardosa glacialis*, *Pardosa groenlandica*, *Pardosa tachypoda* and *Phidippus borealis*.

The following species are found in the mountains, of Colorado: *Gnaphosa brumalis*, *Epeira patagiata* and *Pardosa groenlandica*, (Banks, '95). They also occur in New Hampshire, Labrador, and frequent open places.

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1894. On the Lycosidae of Colorado. Jour. N. Y. Ent. Soc., 2, pp. 49-52.
1895. The Arachnida of Colorado. Ann. N. Y. Acad. of Sciences, 8, pp. 417-434.
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INSECTA.

Entomobryidae.

Tomocerus niger Beurl. Specimens of this spring-tail (G. 140) were taken July 24, in the balsam-spruce forest (I, 3).

This species has an extensive range; through Europe, Siberia, Alaska, California, Minnesota, Isle Royale, Michigan, cf. Folsom, 1902, Proc, Wash. Acad. Sciences, IV, p. "97; Guthrie, 1903, The Collembola of Minnesota, p. 81.

HEMIPTERA.

Corisidae.

Corixa sp. Nymphs were taken in the rock pools on the beach (I, 1) (G. 73, 74, 75); in Summer Lake (III, 5), (G. 175); and in the pond in a tamarack-spruce swamps (V, 11) (126. A).

Belostomatidae.

Belostoma sp. Nymphs, but no adults, were secured at Simmer Lake (III, 5) (77 A.); and in the pond in the tamarack-spruce swamp (V, 11) (126 A) on August 16.

Saldidae.

Salda ligata Say. On August 10 these shore bugs were running about in numbers on the bare rock beach, just beyond the reach of the waves, on the south shore near the mouth of Siskowit Bay (V, 2) (106 A). "Common over eastern United States. These specimens are darker than most in my collection but seem to agree very perfectly with descriptions of Say and Uhler." H. Osborn.

Hydrobatidae.

Gerris remigis Say. This member of the surface film fauna was found on July 14 on the bulrush zone and delta near the head of Rock Harbor (III, 3); in rock pools at Scovill Point on July 19 (33 A), where it was very abundant and represented by unwinged adults and nymphs; in rock pools on the south shore near Siskowit Bay (V, 2) on August 9 and 14 by adults and nymphs (103 A, 117 A); and on Lake Desor (VII. '04) on August 20 (139 A) by both young and adults.

Gerris rufoscutellatus Latr. This species of water strider, in company with *G. remigis*, was taken from rock pools at Scovill Point (IV, 1) on July 19 (33 A). The specimens areawringed. Also from the rock beach pools on the south shore (V, 2) on August 14 (117, A), and from a pond surrounded by a tamarack-spruce bog (V, 11) on August 10 (126 A).

Gerris marginatus Say. This third species of strider wras found only at Simmer Lake (III, 5) on July 28 (G. 175), and was represented by nymphs and adults.

Gerris sp? Nymphs were taken in a rock pool at Tobin Harbor (IV, 2) on July 19 (30 A), and on a small stream at the head of a bog (V, 5) near Siskowit Lake (95 A).

Aradidae.

Aradus abbas Berg. One specimen was taken on August 7 about camp on Siskowit Bay (V, 3).

Lygaeidae.

Lygus pratensis L. Taken about camp at the Light-house (I, 7) July 11. "One of the dark colored varieties. The species has a wide distribution in both Europe and North America" H. Osborn.

Pamera sp. Also taken about camp at the Light-house (I, 7) on July 28. "Apparently an undescribed species." H. Osborn. (136 A).

Cicadidae.

Tibicem rimosa Say. var. This cicada was abundant upon the hot jack pine ridge (I, 5) and among the birches at its base. Adult specimens and a nymph skin were taken on July 8 (G. 28), 10 (G. 44) and 17 (G. 108); at Neutson's resort (IV, 5) on July 21 (44. A); in the rock clearings (I, 2) on July 13 (G. 68); on the rock ridges on the McGargoe trail (II, 3) on July 25 (G. 147); in the clearing about the Light-house (I, 7) on July 8; and near the head of Rock Harbor (III, 6) on July 17 (G. 111). The species thus showed a decided preference for the open dry situations. Prof. H. Osborn writes concerning the specimens sent to him for determination: "These specimens agree closely with a variety of *rimosa* occurring at Ft. Bridger, Wyoming."

Concerning the habits of this species Osborn ('96, p. 196) states that in northwestern Iowa it occurs "on prairie land remote from timber, thus indicating a habit quite different from the other members of the genus." The occurrence of this species in the more or less open place upon Isle Royale is thus in harmony with its prairie habits and shows that these rock openings may contain not only forms of northern faunal affinities but also those from the western plains. The occurrence of these western species in open places in the northern forest region is analogous to the southern prairie species found in dry or sandy places in the south-eastern forests.

Jassideae.

Bathoscopus pruni Prov. This leaf hopper was taken from a rock pool upon a small island in Tobin Harbor (IV, 2) on July 19.

Coccidae.

Orthesia sp. This bark louse was taken July 19, at Scovill Point (IV, 1). "Undescribed so far as I can discover." H. Osborn.

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NEUROPTERA.

Myrmeleonidae.

Myrmeleon immaculatus DeG. Ant-lion. An apparently full grown ant-lion was taken on one of the bare burned over ridges on the McCargoe Trail (II, 3), on July 25. None of the adult insects were seen and this was the only specimen and funnel observed.

Geographic Range. Maine; Keene, N. H.; Isle Royale, Mich.; Illinois; Washington, D. C.; North Carolina; Texas; Colo.; Oregon; Calif, cf. Psyche, 9, p. 95.

ODONATA—DRAGONFLIES.

The Dragonfly collection secured by the party is an interesting one in several respects as will be seen by reference to the geographic distribution of the various species. Most of the specimens were collected by H. A. Gleason; the writer and other members of tlie party also secured some. We are indebted to Mr. E. B. Williamson of Bluffton, Indiana, for the determination of the series.

Agrionidae.

Lestes unguiculatus Hag. A single female, apparently of thts species was found in the clearing at Neutson's resort (IV, 5) July 21.

Geographic Range. Nova Scotia; Quebec; Maine; Mass.; Rhode Island; New York; Penn.; New Jersey; Ohio; Indiana; Tenn.; Illinois; Iowa; Missouri; Wyoming; Montana; California; Corunna, Ann Arbor, Porcupine Mts., Mich.

Nehalennia irene Hag. Two males of this species were found in or near a tamarack-spruce-sphagnum swamp (I, 6) on July 10. This is a swamp-land species which usually dies slowly among the low vegetation.

Geographic Range. Ontario; Maine; New Hampshire; Mass.; New Jersey; Florida; New York; Penn.; Ohio; Indiana; Illinois; Iowa; Wisconsin; South Dakota; Ann Arbor (Kavanaugh Lake, VII, 3, '03), Porcupine Mts., Mich.

Enallagma exsulans Hag. One male was taken living over the water near the boat landing at Lake Desor (VII, '04) on August 20.

Geographic Range. Ontario; Maine; New York; Penn.; Maryland; District of Columbia; Virginia; Ohio; Indiana; Illinois; Missouri; Texas; Corunna, Huron River, near Portage Lake, Aug. 31, '03, Washtenaw Co., Kavanaugh Lake, July 10, '03, Chelsea, Mich.

Enallagma hageni Walsh. This species was quite abundant about the sedge margin of Sumner Lake (III, 5) where eight males were taken between July 24 and 29. Three other males were taken on August 16 in the cassandra and sedge zone about a pond near Siskowit Bay (V, 11).

Geographic Range. Newfoundland; Quebec; Ontario; Maine; New Hampshire; Mass.; New York; Delaware; Maryland; Ohio; Indiana; Illinois; Iowa; Missouri; Wisconsin; South Dakota; (July 10, '03, Kavanaugh Lake) Chelsea, Porcupine Mts., Mich.

Gomphidae.

Ophiogomphus colubrinus Selys. One female was taken, August 7, dying low, at the outlet of Siskowit Lake (V, 9). This stream falls rapidly providing a rapid water habitat which furnishes favorable conditions for most Gomphids. The streams on the island are small and flow through much swamp land so that there is but a slight development of the rapid water habitat.

Geographic Range. Hudson Bay; Quebec; Maine; New Hampshire.

Aeschnidae.

Anax junius Drury. Nymphs only were taken. Cf. Needham report.

Geographic Range. Central America northward to Newfoundland and Alaska; Bermudas; West Indies; Hawaiian Islands; Tahati; China; Kamtschatka. This is a very extensive range, quite exceptional among Dragonflies, and perhaps only surpassed by the cosmopolitan *Pantala flavescens*.

Aeschna sitchensis Hag. One female was taken along the road through the hardwoods on the Desor trail (III, '04) on August 21. (Psyche, 1890, p. 353).

Geographic Range. Sitka, Alaska; Saskatchewan; Newfoundland; (Williamson, '06, p. 135); Pequaming, Michigan, Calvert, Ent. News. 15, p. 288.

Aeschna species? The remaining Aeschnids cannot be satisfactorily determined at present. A male was taken in the sedge and cassandra zone bordering a pond (V, 11) on August 16. A male, which had been patrolling a small stream flowing from a tamarack swamp (V, 5), was taken on August 8. A teneral female was taken July 13 on a rock ridge (I, 2) and in the clearing about the camp on Siskowit Bay (V, 3) (231); one male was taken August 15, and a female on August 12. Eight males were taken at Sumner Lake (III, 5) between July 26 and 29. A female was taken in a rock clearing near the light-house (I, 2) on July 13 (69).

Three nymphs skins were found at the margin of the sedge zone of Jumper Lake (III, 5). Compare Walker, '08, who has examined the Isle Royale specimens.

Cordulidae.

Tetragoneuria spinigera Selys. One specimen was captured in a low rock opening at the shore, near the head of Rock Harbor (near III, 2) on July 14; and a female was taken floating upon the water in the west cove at the head of the Harbor (III, 6). The third specimen, a female, was secured from a rock ridge near the head of the Harbor near III, 2, July 21. (132.)

Geographic Range. Maine; New Hampshire; Mass.; Georgia; Detroit, Mich.; Vancouver Island.

Cordulia shurtleffi Scudd=*aenea* L. Three specimens, two males and one female, were taken at the edge of the water in the sedge zone on the north side of Sumner Lake (III, 5) on July 29. (184, 78A.)

Geographic Range. Nova Scotia; Newfoundland; Ontario; Maine; New Hampshire; Penn.; Saskatchewan; Fort Resolution; Mackenzie; British Columbia; Alaska; Northern Asia; Europe; Algeria.

Somatochlora elongate minor Calvert. Only one male of this interest-mg species was found, it was flying about

the mouth of a small stream at the head of Rock Harbor (III, 3) (165) on July 26. Cf. Calvert, Ent. News 1898, 9, p. 87.

Geographic Range. Quebec; Maine; New Hampshire; Michigan; Wyoming.

Libellulidae.

Celithemis eponina Hagen. Nymphs only taken. Cf. Needham report.

Geographic Range. United States east of the Rocky Mountains and southern Canada (Ontario).

Leucorhinia hudsonica. Three females were taken in the sedge zone of a tamarack swamp (V, 5) on August 8. (96A). *Sympetrum obtrusum* occurred abundantly in the same locality.

Geographic Range. Quebec; Nova Scotia; New Brunswick; Newfoundland; Maine; New Hampshire; Mass.; Lake Winnipeg; Saskatchewan River; Fort Resolution, Mackenzie; Alberta; British Columbia; Alaska.

Leucorhinia proxima Calvert. About the margins of Sumner Lake (III, 5) these dragonflies were very abundant on July 18, 24, and 29, and 19 males and 5 females were taken in the sedge zone. About the lake this zone was quite extensive, as shown by the photographs. Most of our collecting of insects was done at the northeast end where, with the aid of boots, an excellent swamp collecting ground was found. The ground was very wet, and spongy, and treacherous in places, on account of these soft spots. This species also occurred abundantly about the margins of a similar pond near Siskowit Bay (V, 11), where it was associated with *Enallagma hageni*, *Aeschna* and *Sympetrum rubicundulum obtrusum*. There is an interesting correlation between the geographic range of this genus and of its close ally *Sympetrum* (both are primarily boreal, throughout both hemispheres) and the geographic development of those habitat conditions which they prefer.

Geographic Range. Nova Scotia; Ontario; Maine; New Hampshire; Mass.; Quebec; Vancouver Island; Kalso, British Columbia; Washington.

Lucorhinia intacta Hagen. Nymphs only taken. Cf. Needham report.

Geographic Range. Nova Scotia; Maine; New Hampshire; Massachusetts; New York; New Jersey; Perm.; Ohio; Michigan; Ontario-Indiana; Illinois; Wisconsin; Iowa; South Dakota; Nevada; Washington.

Sympetrum rubicundulum obtrusum (Hag.). In the open area about the camp on Siskowit Bay (V, 3) this species was very abundant. Eight males and eight females were collected on August 11 and 12. A male was also taken near the head of Siskowit Bay (VIII, '04) on August 13; and 3 males and 1 female were taken in the sedge zone of a tamarack swamp (V, 5) on August 8. The number of specimens taken is not a fair index of the abundance of this species as an effort was made only to secure representative forms. The open areas where the heath and jiiniper-cladonla plant society were the representative types of vegetation, seemed to afford feeding grounds for this species and they were very abundant in such places. It is in just such situations that the small forms of insect life are most abundantly seen on the wing.

Geographic Range. Nova Scotia; Ontario; Maine; New Hampshire; Mass.; Penn.; New Jersey; North Carolina; New York; Ohio; Indiana; Illinois; Wisconsin; Colorado; British Columbia; Washington; Corunna, Ann Arbor, Porcupine Mts., Isle Royale, Mich.

Libellula quadrimaculata L. A single male specimen represents this species. It was collected about the Light-house clearing (I, 7) on July 25. (153).

Geographic Range. Newfoundland; Nova Scotia; Ontario; Maine; New Hampshire; Mass.; New York; Quejvec; New Jersey; Penn.; Ohio; Indiana ; Illinois; Wisconsin; Wyoming; Montana; Idaho; Utah; Washington; British Columbia; Alaska; Northern and Central Asia; Northern Europe; Asia Minor; Corunna, Isle Royale, Mich.

Geographic Notes. Attention is called to the geographic range of the following species:

1. *Ophiogomphus colubrinus*. Hudson Bay; Quebec; Maine and New Hampshire.

2. *Aeschna sitchensis*. Sitka, Alaska; Saskatchewan; Michigan; Newfoundland.

3. *Somat. e. minor*. Maine; Quebec; New Hampshire; Wyoming.

4. *Cordulia schurtleffi* (—*aenea* L.) Newfoundland; Nova Scotia; New Hampshire; Mackenzie; British Columbia and Alaska; Northern Asia; Europe; Algeria.

5. *Tetra. spinigera.* Maine; Georgia; Mich.; Vancouver Island.

6. *Leucor. hudsonica*. Newfoundland; Nova Scotia; west to Winnipeg, the Mackenzie basin and British Columbia.

7. *Libel. quadrimaculata*. Newfoundland and Alaska; New Jersey; northwestward to Wyoming; Washington; British Columbia; Northern Europe; Asia.

From the above it is seen that seven of the Isle Royale dragonflies are decidedly representative of the region from Labrador to Alaska (and more especially of the eastern part of this area), largely north of the U. S. boundary. There is also a marked transcontinental tendency. As these forms do not now occur abundantly even in the mountain regions of the west, it is likely that many have spread northwest in post-Glacial times with the Northeastern Biota, rather than from the regions south of the western glaciated area with its relatively arid climate.

Of these seven species the following four: *Cordulia aenea* (*C. schurtleffi*), *Leucorhinia hudsonica* and *Libellula quadrimaculata*, are Asiatic (Northern) and European—thus circumpolar. As to the geographic origin of these forms very little can be said, as the taxonomic relations of the Odonata, from a geographic and ecologic standpoint, has never been attempted. Attention, however, should be called to the fact that so far as known, these are all forms that frequent quiet waters.

There is an interesting correlation between the geographic range of the genera *Leucorhinia* and *Sympetrum* and the geographic development of the habitat conditions which they frequent. Both are circumpolar in the subarctic region. This same area (especially in America) also furnishes the greatest almost continuous tract of lake, pond and swamp conditions found upon the earth. In North America at least, the base leveling of the region, its imperfect drainage due to glaciation, and its cool climate are the important or dominant factors in, the production of this extensive area of favorable habitats for these genera. It is very probable that many animals, dependent upon such conditions, will show a similar correlation.

The powerful flight of the larger species suggests that the present distribution of the above listed circumpolar species may have taken place under conditions similar to those which exist today. Thus the habitat preferences and the present geographic distribution of the species all suggest a faunal interchange via Alaska and Siberia. Such a change might have occurred during Glacial, inter-Glacial or post-Glacial times, but at present we have no criteria or evidence by which to determine such relations.

The migratory habits of certain species of dragonflies also has a direct bearing upon the extensive range of certain species. One Isle Royale species, *Libellula quadrimaculata*, has long been known to migrate (cf. Dragon Flies and Mosquitoes, 1890, p. 161).

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LEPIDOPTERA.

Check List.

1. *Carneades bostoniensis* Grt.
2. *Hemaris definis* Bdv.
3. *Hemaris thysbe* Fabr.
4. *Papilio glaucus turnus* L.
5. *Colias philodice* Godt.
6. *Argynnis cypris* Edw.
7. *Argynnis atlantis* Edw.
8. *Brenthis myrina* Cramer.
9. *Brenthis bellona* Fabr.
10. *Phyciodes tharos* Dru.
11. *Eugonia j-album* Bd.—Lee.
12. *Euvanessa antiopa* L.
13. *Aglais milberti* Godt.
14. *Vanessa atalanta* L.
15. *Vanessa hunteri* Fabr.

16. *Vanessa cardui* L.

17. *Basilarchia arthemis* Dru.

18. *Anosia plexippus* L.

19. *Epidemia dorcus* Kby.

20. *Epidemia epixanthe* Bd.—Lec.

21. *Cupido saepiolus* Bd.

22. *Amblyscirtes vialis* Edw.

Noctuidae.

Carneades bostoniensis Grt. A moth of this species was taken about camp on Siskowit Bay (V, 3) on August 9 (G. 222).

Geographic Range. "Middle, Eastern and Northern States", Massachusetts; New York; Michigan; Canada.

Sphingidae.

Hemaris definis Bdv. One specimen taken in the clearing about the camp (I, 7) on July 8 (G. 36).

Geographic Range. "Canada, Hudson Bay Territory, Maine to Georgia, westward to Missouri, Iowa" (Smith). Michigan.

Hemaris thysbe Fabr. One specimen in the open about the camp on Siskowit Bay (V, 3) on August 3 (G. 195). Food plant Viburnum.

Geographic Range. "Labrador, Canada; southward to Florida; westward to the Mississippi" (Smith); Michigan.

Papilionidae.

Papilio glaucus turnus L. Turnus Butterfly. Nine specimens were taken along the beaches (I, 1) on July 9, one in the clearing about the Light-house (I, 7) on July 8, and another on July 14, in a rock clearing near the head of Rock Harbor (near III, 3). The Isle Royale specimens of this species, when compared with specimens from Ann Arbor, are much dwarfed; the right fore wing of three specimens measuring 41, 42 and 47 *mm*. respectively. Most of the specimens secured were old worn males. This species is known to become dwarfed both in the far north (Alaska) and upon mountains (White Mountains, N. H.). A number of animals show this dwarfing tendency to the northward when they are of southern origin. Scudder, '99, p. 158.

Geographic Range. Newfoundland into Florida; U. S. generally; California into Alaska except in southern British Columbia. This is a species of southern origin; its relatives are South American.

Pieridae.

Colias philodice Godt. Clouded Sulphur Butterfly. This species was not taken in 1905 but is recorded by Euthven ('06, p. 103) from the south end of the island.

Geographic Range. Anticosti, Quebec; Ontario; Newfoundland; Maine; New Hampshire; Mass.; New York; Penn.; West Virginia; New Jersey; Florida ; Ohio; Illinois; Indiana; Kansas; Nebraska; Texas; Dakota; Iowa; Colorado. Scudder, '99, p. 24.

Nymphalidae.

Argynnis cypris Edw. One specimen was taken on the burned over ridges (II, 3) on July 25 (G. 147); another August 14 on *Solidago*, in an open area near the beach (Y, 2), (A. 115). Determined by Dr. J. Fletcher and Dr. Wm. Barnes.

Geographic Range. A western Rocky Mountain species. Argynnis atlantis Edw. Atlantis Butterfly. One specimen was taken on the rock ridge near the head of Rock Harbor (III) on July 21 (G. 132); two in the clearing at Neutson's resort (V, 5) on July 21 (G. 121); one from the burned over rock ridges on the McCargoe trail (III, 3) on July 25 (G. 146, 147); and five from the clearing about the camp on Siskowit Bay (V, 3) on August 4, 9, 10 and 16.

Scudder says: "The favorite resorts of this butterfly are grassy fields skirting the mountain streams, and it differs slightly from other species of the genus, preferring sunny woodland nooks to open country." Scudder, '99, p. 213.

Geographic Range. Labrador; Newfoundland; Nova Scotia; Rupert House, Quebec; Ontario; White Mts., N. H.; Catskill and Adirondack Mts., N. Y.; Indiana; Michigan; Iowa; Wisconsin; Lake Winnipeg; Colorado; Mackenzie and Hudson Bay.

Brenthis myrina Cram. Myrina Butterfly. One specimen was taken at Sumner Lake (III, 5) on July 18 (G. 120); a second one upon a *Solidago* flower near a small stream flowing from the tamarack swamps, (V, 5) on August 8 (G. 97). Scudder remarks that this species "frequents low, moist meadows and roadsides in their vicinity." Scudder, '99, p. 317.

Geographic Range. Nova Scotia and New England; south on the Mountains to Maryland, Virginia and North Carolina; Indiana; northern Illinois; Wisconsin; Iowa; Colorado; Utah; Montana; Alberta; British Columbia; Sitka, Alaska; Saskatchewan; Nipigon, Ontario; Hudson Bay. Has a near relative in Asia, *B. amphisaphe*.

Brenthis bellona Fabr. Bellona Butterfly. One specimen, no data. Scudder, '99, p. 311.

Geographic Range. Quebec; New England; Ontario; Penn.; New Jersey; Virginia; northern Ohio; Indiana; Alberta; Colorado; Great Slave Lake; Lake Winnipeg and Hudson Bay.

Phyciodes tharos Dm. Tharos Butterfly. One specimen was takeji on the beach (I, 1) on July 10 (G. 209). Scudder, '99, p. 121.

Geographic Range. Southern Labrador into Florida; west to Texas, Mexico and the Sierra Nevada; British

Columbia; Alberta; Saskatchewan; Mackenzie River and Hudson Bay.

Eugonia J-album Bd.—Lec. White J. Butterfly. Two specimens were taken August 23 and 24 in the clearing at Washington Harbor (I, '04) and at the Siskowit Camp (V, 3) on August 16. Scudder, '99, p. 7. This butterfly, according to Scudder, frequents "high open woodland, and on hilly roadsides in the vicinity of woods." Perhaps migrates. The butterfly hibernates, cf. Scudder, '97, pp. 139-144.

Geographic Range. No. Labrador; Nova Scotia; Ontario; mountains of Penn.; Indiana; Wisconsin; British Columbia; Alaska. Closely related to the European *E. van-album*. Probably of Asiatic origin.

Euvanessa antiopa L. Antiopa Butterfly. Not secured in 1905 but recorded by Ruthven ('06, p. 103) from the south end of the island. This is a wide ranging species from Gautamala and Mexico northward over most of the United States and southern Canada; Alberta; British Columbia; Alaska; northern Asia and Europe. Scudder, '99, p. 1. This species is probably of Asiatic origin. The butterfly hibernates.

Aglais milberti Godt. Milbert's Butterfly. One specimen was taken in the clearing at the Light-house on Rock Harbor (I, 7), (G. 36). Scudder, '99, p. 330. Butterfly hibernates.

Geographic Range. Labrador; Newfoundland; New Brunswick; Ontario; Nova Scotia; New Hampshire; New York; northern Ohio; Indiana; Montana; Colorado; Arizona and New Mexico, on the mountains; Alberta; British Columbia south to central California; Great Slave Lake; Mackenzie; Lake Athabasca; Hudson Bay. A distinctly northern and mountain species.

Vanessa atalanta L. Red Admiral. Two specimens were taken in the light-house clearing (I, 7), (G. 45). This butterfly hibernates. Scudder, '99, p. 79.

Geographic Range. Southern Labrador; Newfoundland; Hudson Bay; Alberta; British Columbia; of general distribution over United States and extending southward on the mountains into Guatamala; Europe; Northern Asia and Africa. The extensive southward distribution on the mountains is worthy of note. This species probably originated in Asia.

Vanessa hunteri Fabr. Hunter's Butterfly. A much worn specimen was taken July 19, on the beach (I, 1), (G. 29), and on July 21 in the clearing at Neutson's resort (IV, 5), (G. 121). Scudder, '99, p. 114. "Butterfly hibernates. Larva feeds on the Pearly Everlasting, *Anophalis, margaritacea* B. & H. (Dr. J. Fletcher), but the plant was not found upon Isle Royale.

Geographic Range. Nova Scotia; Quebec; Ontario; Minn.; British Columbia; United States generally; Mexico; Central America, and along the Andes perhaps even to Patagonia; Antilles; Canary Isles. This species, like the preceding, has an extensive southern distribution along the mountains. Of North American origin.

Vanessa cardui L. Thistle Butterfly. Four specimens were taken July 21, in the clearing about Neutson's resort (IV, 5), (G. 121); two more upon the beach (I, 1) on July 10; a wing was found among the drift on the beach (I, 1); several from the clearing at the Light-house (I, 7) on July 7, 10 and 22 (G. 26, 45, 104, 133); one in the clearing about the camp on Siskowit Bay (V, 3) on August 7 (G. 212) and in the cassandra and sedge zone about a pond on Siskowit Bay (V, 11) on August 16. Scudder, '99, p. 106. This butterfly hibernates. This species, with *Argynnis atlantis* and *Basilachia arthemis*, were the most abundant butterflies upon the island.

Geographic Range.—This butterfly has the most extensive range of any known species. "With the exception of the Arctic regions and South America, it is distributed over the entire extent of every continent." (Scudder). This species is very abundant in Southern Europe; continually invades northern Europe but cannot establish itself. It swarms in immense numbers both in Europe and in America (Calif.). Fletcher, '02, p. 56; Farnham, '95, p. 1.50; Scudder, '76. This species is probably of North American origin. Its inability to withstand, even in the adult stage, the winters of northern Europe and northern North America, and its powers of flight suggests that this species, which is probably of southeastern North American origin, reached the old world not only by way of the north but also across the Atlantic Ocean. Specimens have been taken at sea 200 miles from the Cape Verde Islands in the Atlantic.

Basilarchia arthemis Dru. Arthemis Butterfly. This butterfly was very abundant along the beaches, where they were frequently taken on Conglomerate Bay (near I, 5) and where two specimens were taken on July 10; five other specimens were taken along the beaches on July 19 (G. 29) and one on July 11 and 17 respectively (G. 47, 107); also one specimen in the Light-house clearing (I, 7) on July 8, 10, 24, 26, and two on July 17. A single specimen was taken along the path at the outlet of Siskowit Lake (V, 9) on August 7 (G. 215). This was a burned over area and was relatively open and especially so on the rock exposures. Three specimens were taken in the clearing about the camp on Siskowit Bay (V, 3) on August 9 (G. 222). It was also abundant in rock clearings near the head of Rock Harbor (near III, 3) on July 14 (G. 97).

This purple black butterfly with its oblique white band is a conspicuous form along the beach, on the rock openings, and in the clearings and burnings. Scudder, 799, p. 225.

Geographic Range. Newfoundland; Nova Scotia; Quebec; Ontario; northern New England; New Hampshire; northern and western Mass.; Catskill and Adirondack Mts., N. Y.; mountains of Penn.; southern Mich.; southern Wisconsin; northern Indiana; Minnesota; Alberta; British Columbia; Fort Simpson, Mackenzie. Of North American origin, cf. Field, '04, p. 1.

Anosia plexippus L. Milkweed Butterfly. Two dead specimens and one yet alive were found upon the beach

at the head of a small cove south of the Light-house (I, 1) on July 6 (G. 19). On the following day about a half dozen dead specimens were also found under similar conditions. This drift must have been cast up several days previously, as was indicated by its stage of decay. A single bright colored fresh looking specimen was taken near the head of Siskowit Bay (VIII, '04) on August 13, and is in striking contrast to the faded Specimens preserved from the shore drift. Scudder, '99, p. 95.

The food plant of the caterpillar is milkweed, one species of which, *Asclepias incarnata* L., was found along Washington River (II, '04).

This species is not, in all probability, a permanent resident of the island, as it cannot endure the winters of eastern Canada. Scudder ('93, p. 52) has expressed the opinion that this species cannot survive the winter north of the Gulf States and that those individuals found further north reach there each year as migrants from the south, or the immediate descendants of such migrants. It is well known that these butterflies congregate in vast flocks in the fall and migrate, some think to the south (like birds), others that they wander about aimlessly until killed by the approaching winter (Tutt, '02, p. 127). This wandering tendency, however, would tend to scatter them as they died off slowly by exhaustion. While it seems incredible to think of a southerly migratory instinct, yet the meteorological conditions developing in the far north might give a southerly direction to the wandering movements.

The occurrence of specimens in the shore drift is of interest in connection with the wandering habit of this butterfly. Specimens hove been picked up on the beaches of Lake Michigan (Needham, '00, p. 6); Lake Erie (Moffat, '01, p. 48); and Lake Ontario (Bowles, Can. Ent. Vol. 12, p. 134; and they have been observed flying over Lake Erie. Such facts as above cited suggest that this member of the Isle Royale fauna is restocked each year by migrants, which are probably more likely to come from the southern rather than the northern shore of Lake Superior. If Scudder's opinion is correct, an annual extension of range from the Gulf States to Isle Royale—over 1,200 miles—certainly shows remarkable powers of dispersal.

Geographic Range.—This species has a very extensive range in this hemisphere from northern Patagonia in South America, northwiard through the tropics, West Indies, over most of the United States and southern Canada to British Columbia, Hudson Bay and Lake Athabaska. Through man's influence this species has become almost world-wide in its range. It has been recorded from the south Pacific 500 miles from land (Tutt, '01, p. 40). Originally it was of American origin.

Lycaenidae.

Epidemia dorcas Kby. A single specimen of this was taken on August 16 in the Cassandra and sedge zone of an open bog (V, 11), (A. 136). Determined by Dr. James Fletcher.

Geographic Range.—Michigan (Isle Royale); Nipigon, Ontario; Manitoba; Saskatchewan; Athabasca; Alaska.

Epidemia epixanthe Bd.—Lee. Exipanthe Butterfly. Four specimens were taken on the sedge zone on the north shore of Simmer Lake (III, 5) on July 29.

This is a swamp species about which Fiske ('01, p. 50) writes: "It confines itself closely in its journeyings to the swamp or bog in which its early stages are passed, and rarely indeed ventures upon higher ground. It loves best of all an open, mossy morass, such as are found scattered throughout New England, usually surrounding some small pond caught in a hollow between the hills, and formed by the moss and subaquatic plants which, constantly encroaching upon the water, are bound in time to cover it over."

Geographic Range. Newfoundland; Quebec; Ontario; Maine; New Hampshire; northern Indiana; Iowa; Kansas and Nebraska.

Cupido saepiolus Bd. Greenish Blue Butterfly. In all seven specimens of this interesting western species were taken; one about the camp at the Light-house (I, 7) on July 7, (G. 26); a second in the clearing on Benson Brook (II, 1) on July 25 (G. 148) and five specimens in the clearing about Neutson's Resort (IV, 5) on July 21 (G. 121).

Geographic Range.—Michigan (Isle Royale only); Great Slave Lake; Mackenzie Basin; British Columbia; Montana; Colorado; Nevada; California. Cf. Elrod, 706, p. 136; Carey, '06, p. 451. Isle Royale is also the most eastern record for this species.

Hesperidae.

Amblyscirtes vialis Edw. Vialis Skipper. Three specimens of this skipper were taken on July 11 (G. 49), 22 (G. 133), and 28 (G. 179) in the clearing about the Light-house (I, 7).

Geographic Range. Quebec; Maine; New Hampshire to Florida and westward to Texas; Nevada; Alberta; Manitoba (Fletcher), and British Columbia.

Geographic Notes. After the preceeding geographic records had been secured, the following notes on the distribution of butterflies in Canada were received from Dr. James Fletcher, of Ottawa, Canada. His letter contains so many interesting features that I have thought it desirable, with Dr. Fletcher's consent, to publish it in full, supplementary to the data already given, rather than to scatter the records.

"In just running through your letter I see that I can answer it without turning up any records. The geographical range in Canada of the following butterflies is as follows: *Papilio glaucus turnus*—from the Atlantic to the prairie region, common; across the prairies into British Columbia, rather scarce, and not to my knowledge crossing the interior elevated plateau which is a semi-arid region. North of this in the mountains it reaches right to the Pacific Coast. South of the north

part of Vancouver Island its place is taken by *Pap. eurymedon* and *P. rutulus arizonensis* as named by Mr. W. H. Edwards.

"*Colias philodice*—very abundant from the Atlantic to the Lake Superior region, where its place is taken by *C. eurytheme*, of which one form, the variety *eriphyle* resembles *philodice* very closely and although it is claimed that it is a form of *eurytheme* it resembles *philodice* so closely that it cannot always be separated unless the locality is known.

"*Argynnis atlantis*—this occurs in what we consider the typical form from the Atlantic coast to the Great Lakes. West of that the black markings are rather lighter and the color is brighter. In the Rocky Mountains I believe what we have been calling *electa* is merely a form of *atlantis*. That at any rate extends to the main chain of the Rockies, but I have never seen it further west than the Arrow Lakes.

"*Brenthis myrina* and *bellona*—from Atlantic Coast to the interior plateau of British Columbia.

"*P. tharos*—from the Atlantic Coast to British Columbia, running north to the coast, probably with the main chain of the Rockies. In Vancouver Island and the Fraser River Valley its place is taken by *P. pratensis* and the same areas are inhabited by *Brenthis epithore* in place of *bellona*. *Pratensis* however extends west into Manitoba.

"*Eugonia j-album*, *E. antiopa*, *A. milberti*, *V. atalanta* and *V. cardui*. occur over the whole of our country from Atlantic to Pacific and from the southern border to the arctic regions.

"*V. hunteri* also occurs right to the coast but is very much rarer west of the Great Lakes than the other species mentioned. I have it from Nova Scotia and also took it on Vancouver Island.

"*Basilarchia arthemis* extends from the Atlantic coast to the Kootenai Lakes, when its place is taken by *B. lorquinii*. *Anosia plexippus* a migrant and may turn up at any place where *Asclepias* grows, but is much rarer in British Columbia.

"*Epidemia epixanthe*.—This is the only species I have some doubts about. There is no doubt that some of the records of *epixanthe* should be of the rare and little understood species *dorcas* which occurs in the Lake Superior region and into Manitoba. It is easily distinguished from epiccanthe by its slightly larger size and the brilliant orange wash on the under surface. *Epixanthe* I have only actually taken myself in Ontario. *Dorcas* I have from Nepigon on Lake Superior the Bruce peninsula and from Manitoba. West of that the form, for it is hardly a variety, *florus* which is really only a dimorphic form of *helloides* occurs, and has I think, sometimes been recorded as *epixanthe*. The reference of *florus* to *dorcus* instead of *helloides* as a variety, which was done by Dr. Dyar, has in my opinion no reason in it at all.

"*Amblyscirtes vialis*.—This is nowhere very common but extends from Atlantic to the Pacific coast. I have specimens from Halifax, Nova Scotia and have taken it in Vancouver Island. It is more abundant perhaps in the Lake Superior region than any other where I have collected."

The butterfly fauna of Isle Royale may well be compared to that of the White Mountains of New Hampshire on account of the large number of species common to both localities (cf. Scudder, '97, pp. 71-87). Much the same resemblance holds for northern New England in general. So far as United States is concerned Isle Royale is the western outlier of the distinctly northeastern or Canadian biotic type. Perhaps the Black Hills will show similar affinities, but farther west a marked Rocky Mountain influence becomes apparent. It is of interest to note that six of the eighteen species hibernate as butterflies and another spreads each season into the region. This number includes the species which are of the most northern range and one (*V. cardui*) which is cosmopolitan. Four of the species, *E. j-album*, *P. cardui*., *B. arthemis* and *A. plexippus* are known to flock, or migrate. There can be but little doubt but that these characteristics are important factors in an understanding of their geographic range, and are probably adaptations which permit these species to maintain themselves in the region. Such adaptations may have originated in response to the environment or the possession of them have allowed the species to enter the region already adapted to it.

When the above listed species are grouped geographically they fall into the following classes:

1. Of general geographic range from Labrador, Newfoundland, northern New England, southward on the Adirondacks, Catskills and Appalachians, westward through northern Ohio, Indiana, Wisconsin to Alberta, and southward on the Rocky Mountains, British Columbia to Alaska.
    1. *Argynnis atlantis.*
    2. *Brenthis myrina.*
    3. *Brenthis bellona*.
    4. *Eugonia j-album.*
    5. *Vanessa milberti*.
    6. *Basilarchia arthemis*.

These forms may well be called members of the Canadian biota for they only extend a short distance southward on the lowlands of the United States, but reach much farther south at higher altitudes.

2. Much the same northern limit as group 1, but reaching much farther south of the above southern lowland limit.
    1. *Papilio glaucus turnus*.
    2. *Colias philodice*.
    3. *Phyciodes tharos*.
    4. *Euvanessa antiopa* (Asiatic).
    5. *Vanessa atalanta* (Asiatic).
    6. *Vanessa hunteri*.
    7. *Vanessa cardui* (cosmopolitan).

8. *Anosia plexippus* (Nearly cosmopolitan).
9. *Epidemia epixanthe*.
10. *Amblyscirtes vialis*.

3. Species of distinctly Rocky Mountain or Rocky Mountain and Pacific coast distribution, and reaching their eastern limit in the Lake Superior region.
   1. *Epidemia dorcas*.
   2. *Cupido saepiolus*.
   3. *Argynnis cypris*.

4. Of very extensive geographic range, Asiatic or Cosmopolitan.
   1. *Pyrameis cardui*.
   2. *Anosia plexippus*.
   3. *Vanessa atalanta*.
   4. *Euvanessa antiopa*.

Probable geographic origin:

1. *Papillo glaucus turnus*, S. American.
2. *Colias philodice*, American.
3. *Argynnis atlanta*, Asiatic.
4. *Brenthis myrina*, Asiatic.
5. *Brenthis bellona*, Asiatic.
6. *Phyciodes tharos*, American.
7. *Eugonia j-album*, Asiatic.
8. *Euvanessa antiopa*, Asiatic.
9. *Vanessa milberti*, American.
10. *Vanessa atalanta*, Asiatic.
11. *Vanessa hunteri*, American.
12. *Vanessa cardui*, Amercian.
13. *Basilarchia arthemis*, American.
14. *Anosia plexippus*, So. American.
15. *Cupido saepiolus*, West No. Amer.
16. *Epidemia epixanthe*, Eastern U. S.
17. *Epidemia dorcas*, W. No. Amer.
18. *Amblyscirtes vialis*, No. Amer.

In discussing the geographic origin of the butterflies common to the old and new worlds, Scudder seldom attempts more than a hemispherical location. In discussing the origin of American faunae that are both boreal and Asiatic, it is well to recall that geologically speak-ing the American boreal and arctic are *largely of recent origin in the northern regions*. It is therefore not unlikely that many of these forms which it has been customary to consider boreal are in reality not so, but from high altitudes—from the North American Cordilleras or from the Himalayas, where high altitude and low temperature existed long before the Ice Age. With the development of an Ice Age, there was a great increase of this low temperature, lowland habitat and when once the glacial climate declined a vast area was open for invasion—an area of such great extent that we have become thoroughly accustomed to think the fauna has originated there. It has thus become customary to speak of them as of northern origin, in spite of the fact that we know that they are almost entirely post-Glacial migrants from the south,

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ANNOTATED LIST OF THE MOLLUSCA OF ISLE ROYALE, MICHIGAN.

BY BRYANT WALKER.

1. Introduction.

This list contains all the species of molluscs collected on Isle Royale, both in 1904 and 1905, and so represents the complete fauna so far as known. For the details as to the localities represented by the collection made in 1904, reference should be made to the Report of that expedition (pp. 96-99).

The collection made in 1905 was much larger than that of the preceding year, both in species and individuals. While eleven of the species collected in 1904 were not found in 1905, no less than forty-two additional species were obtained, making the total number of species now known from the island seventy-two. The species added in 1905 are indicated by an * on the list. In compiling the completed list, it has been deemed of sufficient interest to add both the general range of each species and its distribution so far as known in the state of Michigan.

2. Faunal Affinities.

The molluscan fauna of Isle Royale becomes of additional interest when considered in conection with Dr. W. H. Dall's recent work on the "Land and Fresh Water Mollusks of Alaska and Adjoining Regions," (Harriman Alaska Expedition, Vol. XIII, 1905), which is a complete digest of our present knowledge of the land and fresh water mollusca of North America north of latitude 49° North, and practically of our entire boreal fauna. So far as available, the general range of the species given in that work has been followed in this list as being the most "up-to-date" attainable.

Of the seventy-two, species recognized from Isle Royale, forty-nine are included by Dr. Ball in his list of boreal species.

The remaining twenty-three species not cited by him are:

Strobilops virgo (Pils.)

Vertigo tridentata Wolf.

Euconulus chersinus polygyratus Pils.

Zonitoides exigua (Stimp.)

Agriolimax campestris (Say).

Pallifera hemphilli (W. G. Binn.).

Pallifera dorsalis (Binn.).

Lymnæa pilsbryana Walker.

Physa sayii Tapp.

Physa aplectoides Sterki.

Ancylus sp?

Amnicola lustrica Say.

Musculium securis Prime.

Pisidium affine Sterki.

Pisidium sargenti Sterki.

Pisidium roperi Sterki.

Pisidium subrotundum Sterki

Pisidium splendidulum Sterki.

Pisidium pauperculum Sterki.

Pisidium medianum Sterki.

Pisidium punctatum simplex Sterki.

Of these *Lymnæa pilsbryana* is, so far as yet known, peculiar to Isle Royale. The remainder have, as a rule, a general distribution all over the state. *Strobilops virgo* and *Zonitoides exigua*, however, are characteristic boreal species and are apparently rarely found south of the Saginaw-Grand Valley. While, of course, it is possible that Isle Royale marks the northern limit of the range of these species, in view of the fact that nearly all of them are known to range through the Upper Peninsula and that practically nothing is known of the fauna of the north shore of Lake Superior, the probability is that most of them range further north and should be included in the boreal fauna of North America. While the Isle Royale fauna is thus to be considered purely boreal in its character, it must be understood that it is not in any material respect different from that of the Upper Peninsula, and of the northern part of the Lower. The occurrence of such species as Vallonia costata, *Vertigo tridentata* and *Physa aplectoides* must be considered rather as evidence that these forms have been overlooked in the region immediately south rather than that they are restricted to Isle Royale. And the existence of *Lymnæa pilsbryana* and the peculiar forms of *Lymnæa stagnalis*, *Planorbis bicarinatus* and *P. campanulatus*, if ultimately found to be confined to the island, should rather be ascribed to long isolation under peculiar local conditions than as indicating any essential difference from the fauna of the surrounding region.

Considering the fauna of the Upper Peninsula and Isle Royale as a whole, it will be found to include two elements. The first and larger one consists of species having a general range through the northern United States and southern portion of Canada. Just how far to the north most of them range is as yet undetermined. These species, although found in the boreal region, cannot be properly said to be distinctly boreal species. Accompanying these species of general distribution, is a smaller element of purely boreal species, which are characteristic of the northern region and whose range to the south is as a rule quite restricted. This purely boreal element is represented on Isle Royale by the following species:

1. *Acanthinula harpa* (Say).
2. *Vitrina limpida* Gould.

3. *Vitrea binneyana* (Mse.).

4. *Zonitoides exigua* (Stimp.).

5. *Pyramidula asteriscus* (Mse.).

6. *Lymnæa megasoma* Say.

7. *Lymnæa emarginata* Say.

8. *Lymnæa pilsbryana* Walker.

So far as the land species of Isle Royale are concerned, there are but few of special interest, most of them being of general distribution in the Upper Peninsula. The occurrence of *Polygyra albolabris* (which was not found in 1904) in abundance causes a feeling of surprise that *Polygra fraterna* (*monodon* auct.) was not found. In Michigan, its range is coincident with that of *albolabris* and, according to Ball, it is found as far north as James Bay, Hudson Bay.

All the specimens collected of *Pyramidula cronkhitei* were of the *anthonyi* form as in 1904.

Among the fluviatile species, however, several forms either previously undiscovered or new to the fauna of the state were found and some interesting facts in regard to their distribution were developed. The division of *Lymnæa stagnalis* into three very distinct forms coincident with the character of their habitat is very striking and specially noteworthy.

The fact that all the larger species of *Lymnæidae* from Siskowit Lake: *Lymnæa stagnalis*, *Planorbis bicarinatus* and *Planorbis campanulatus*, are well marked varieties peculiar to that lake, is very significant and points to some specially favorable environmental conditions, which apparently are not present to affect the facies of these species on other parts of the island. What these are, if not already determined, would be an interesting subject for future investigation.

The acquisition of the additional material, which has enabled the specific distinctness of *Lymnæa pilsbryana* to be determined, is a matter of congratulation.

The occurrence of the beautiful little *Physa aplectoides* adds a new species to the fauna of the state and affords another instance of apparently anomalous distribution, which so frequently puzzles the student. Originally described from Ohio, it has hitherto escaped attention in southern Michigan, and its discovery on Isle Royale was wholly unexpected. The remarkable form of *Planorbis bicarinatus* from Siskowit Lake was one of the most interesting novelties discovered by the expedition and is a noteworthy addition to the fauna of the state.

"All the *Pisidia*, except *Pisidium idahoense* and *Pisidium sargenti*, are represented by small, and, as it seems, characteristically northern forms, slight and generally of light or pale color. Some are not very characteristic and apparently .little different from each, other and were rather difficult to work up." (Sterki.)

The writer again acknowledges his indebtedness to Dr. Y. Sterki for the identification of the *Sphæria* and *Pisidia* and to Dr. H. A. Pilsbry for the determination of the slugs. Dr. H. A. Gleason, who collected most of the specimens, and Mr. Chas. C. Adams hare kindly interpolated the details as regards the local habitats and distribution of the different species. The field numbers by Mr. C. C. Adams are indicated by the letter A; all others are Dr. Gleason's, except a few lots collected by Mr. N. A. Wood. Detroit, April 1, 1909.

3. Annotated List,

1.* *Polygyra albolabri*s (Say).

Range: "Eastern United States, from Georgia and Arkansas to the Saskatchewan." (Call).

Michigan: Generally distributed.

Distribution on Isle Royale: Station I, Sub. 1, Lake and Bay Beaches, Numbers 19, 32, 50; I, 5, Jack Pine Eidges, Nos. 19 A, 23, 337 81, 187; I, 7, Light-house Clearing, Nos. 34, 42; II, 1, Ransom Clearing, No. 150; II, 2, Tamarack Swamp, No. 113; II, 3, Eock Ridge Clearing, Nos. 51, 145; III, 4, Trail to' Simmer Lake, Nos. 88, 93, 138, 174; III, 5, Simmer Lake, No. 120; III, 6, Southwest Coves, Rock Harbor, No. 91; IV, 5, Neutson's Resort, No. 121; IV, 8, Trail to Greenstone Range, No. 128; V, 2, Heath Zone and Beach, Nos. 101 A, 107 A; V, 3, Rock Clearing at Camp, No. 233; VIII, '04, Upper End of Siskowit Bay, No. 232.

A "dead" shell was found in driftwood cast upon the beach at the head of Tonkin Bay (No. 19) and (No. 32) in a small creek at the head of Conglomerate Bay. The animal was dead but the body was still within the shell. In both of these numbers the shells were beyond their normal habitat.

Live examples (No. 50) were seldom seen but the abundance of the dead ones upon the rock ridges and open *Cladonia* clearings make it apparent that they are abundant here. Numbers, 23, 33, 81, 187, 51, 145, 88, 93, 138, 174, 128, 101 A, 107 A, 232 and 233 were all taken from that association. Thence they wander in small numbers to the moister places, such as the light-house clearing (Nos. 34 and 42), Ransom Clearing (No. 150), or even in the tamarack swamps (No. 113).

Although not found at all in 1904, this species was collected in 1905 in considerable numbers, which show a wide variation both in size and in the thickness of the shells. The 124 mature specimens collected varied in height from 14 to 21.5 mmv and in width from 21.75 to 30.75 *mm*. The average being 17 by 25.86 *mm*. The accompanying diagrams, 61-62, show the variation in height and greater diameter.

A series of 42 from all parts of the Upper Peninsula vary in height from 14 to 20 *mm*., and in width from 22, 75 to 30 *mm*., with an average of 17.20 by 26.28 *mm*. While a series of 183 from all parts of the Lower-Peninsula vary in height from 12 to 24.25 *mm*., and in width from 18.75 to 34.25 *mm*., with an average of 18.10 by 27.11 *mm*.

It would appear from these series that the average Isle Royale shell is slightly smaller than the average specimen from the Upper Peninsula, and considerably smaller than the average Lower Peninsula example. The range of variation in the Isle Royale series is somewhat greater than in the Upper Peninsula series, but much less than in that from the Lower Peninsula.

2. *Acanthinula harpa* (Say).

Range: "Northwestern Scandinavia, Northeastern America, British America near Hudson Bay, Southeastern Alaska and the easternmost margin of Siberia." (Dall.)

Michigan: Petoskey and Charlevoix in the Lower Peninsula, and Ontonagon County and Isle Royale in the Upper.

Isle Royale: I, 5, Jack Pine Eidges, No. 19 A; II, 1, Ransom Clearing, No. 150; V, 2, Heath Zone and Beach near Siskowit Bay, Nos. 118 A, 129 A, 130 A; V, 4, Trail through Balsam-Birch Forest, No. 236.

Number 150 was collected under logs resting on the ground in an open clearing near the lake; No. 236 was in leaf mold in the dense shade of the balsam forest; No. 15 A was taken from under a stone; and No. 118 A, 129 A, 130 A from under mats of *Cladonia*.

3.* *Strobilops virgo* (Pils.).

Range: "Canada to Northern Alabama, and west to Minnesota and Kansas." (Pilsbry).

Michigan: Upper Peninsula and northern counties of the Lower.

Isle Royale: I, 5, Jack Pine Ridge, No. 81; V, 2, Heath Zone and Beach near Siskowit Bay, Nos. 129 A, 130 A; III, '04, Desor Trail, No. 142 A.

In damp soil (No. 81) under loose rocks at a depth of 2-6 inches; No. 129 A and No. 130 A from under Cladonia; and No. 142 A from leaf mould and rotten logs in the maple forest.

4.* *Bifidaria tappaniana* (C. B. Adams).

Range: "Ontario to Gulf of Mexico, west to Iowa and Kansas, southwest to Arizona, but not known from the southeastern Atlantic States, Virginia to Florida." (Vanatta and Pilsbry).

Michigan: Generally distributed in Lower Peninsula, Isle Royale.

Isle Royale: II, 1, Benson Brook, No. 150. A single specimen, the first record of this species from the Upper Peninsula.

Under a prostrate log in an open place near the lake.

5. *Vertigo ovata* Say.

Range: "Eastern United States from Maine to Texas and northward." (Dall).

Michigan: Generally distributed.

Isle Royale: Not collected in 1905. See Report 1904, p. 97.

6. *Vertigo gouldii* Binn.

Range: "Northern United States east of the Rocky Mountains and northward." (Dall.).

Michigan: Generally distributed.

Isle Royale: Not collected in 1905. See Report Exped. 1904, p. 97.

7.* *Vertigo tridentata* Wolf.

Range: "Quebec and Maine to Minnesota, south to Illinois and Ohio." (Pilsbry).

Michigan: Ann Arbor, Grand Rapids and Isle Royale.

Isle Royale: V. 2, Heath Zone and Beach near Siskowit Bay, No. 130 A.

A single specimen found under *Cladonia*. The first record from the Upper Peninsula.

8. *Vertigo* sp?

Isle Royale: I, 2, Natural Rock Clearings, Light-house Peninsula. Two unidentifiable fragments.

9. *Virtrina limpida* Gld.

Range: "Central New York and northward from New Brunswick to Alberta and Hudson Bay." (Dall).

Michigan: Upper Peninsula and northern counties in the Lower.

Isle Royale: V, 2, Heath Zone amd Beach near Siskowit Bay, No. 130 A. A single dead specimen was found under Cladonia.

10. *Vitrea binneyana* (Morse).

Range: "Quebec and Maine to Northern Michigan and British Columbia." (Dall).

Michigan: Upper Peninsula and northern counties in Lower.

Isle Royale: I, 3, Balsam-Spruce Forest, No. 140; I, 5, Jack Pine Ridges, Nos. 19 A, 81; V, 2, Heath Zone and Beach near Siskowit Bay, No. 130 A; III, '04, Desor Trail, Nos. 141 A, 142 A; V, '04, Ridge back of Club House, Nos. 144 A, 147 A.

In moist soil under loose rocks (Nos. 81 and 19 A) or in the loose leaf mold under the balsam forest, No. 140; No. 130 A under *Cladonia*; Nos. 141 A and 142 A, from leaf mould or rotten logs in yellow birch or maple forest and Nos. 144 A and No, 147 A from under bark, leaves and among moss in the forest.

11. *Euconulus fulvus* (Dr.).

Range: "Holarctic, and widely distributed southward." (Dall).

Michigan: Generally distributed.

Isle Royale: I, 5, Jack Pine Ridge, No. 19 A; V, 2, Heath Zone and Beach near Siskowit Bay, Nos. 129 A, 130 A; V. '04. Ridge back of the Club House No. 147 A. No. 15 A from under a stone; Nos. 129 A and 130 A from under *Cladonia*.

12. *Euconulus chersinus polygyratus* (Pils.).

Range: Northern United States and Canada.

Michigan: Generally distributed.

Isle Royale: I, 5, Jack Pine Ridges, No. 19 A; V. 2, Heath Zone and Beach near Siskowit Bay, No. 129 A; III, '04, Desor Trail, No. 142 A; V, '04, Ridge back of Club House, No. 147 A.

Found under a damp stone (No. 19 A); under *Cladonia* (No. 129 A); in the forest under leaf mould, bark, moss or decaying logs (No. 142 A and 147 A.).

13. *Zonitoides arborea* (Say).

Range: "North America generally and Japan." (Dall).

Michigan: Generally distributed.

Isle Royale: I, 2, Natural Rock Clearings, No. 65; I, 3, Balsam-Spruce Forest, Nos. 140, 141; I, 5, Jack Pine Ridges, Nos. 19 A, 81, 102; II, 1, Ransom Clearing, No. 150; II, 2, Tamarack Swamp, No. 113; V, 2, Heath Zone and Beach near Siskowit Bay, Nos. 118 A, 129 A, 130 A; V, 4, BalsamrBirch Forest, No. 236; III, '04, Desor Trail, Nos. 142 A, 149 A; V, '04, Ridge back of Club House, No. 147 A.

In the thin soil collected under bearberry on the dry rock clearing north of the light-house (No. 65); under loose rocks in the jack pine ridges (Nos. 19 A, 81, 102); under log in an open, sunny place (No. 150); or in leaf mold in the dense shade of the balsam forest; under Cladonia (Nos. 118 A, 129 A, 130A); and in the dense forest among litter (Nos. 142 A, 147 A, and 149 A).

14. *Zonitoides exigua* (Stinip.).

Range: "Quebec and Ontario, New England, New York, Alleghany Co., Pa. and Michigan." (Pilsbry).

Michigan: Upper Peninsula and northern counties of the Lower.

Isle Royale: III, '04, Desor Trail, Nos. 141 A, 149 A; V, '04, Back of Club House, No. 144 A.

Found only in the dense forest among litter.

15. *Zonitoides milium* (Morse).

Range: "Eastern United States and Canada, Manitoba," (Dall.)

Michigan: Generally distributed.

Isle Royale: V, 2, Heath Zone and Beach near Siskowit Bay, No. 130 A. A single specimen under *Cladonia*.

16. *Agriolimax campestris* (Binn.).

Range: "Entire United States." (Pilsbry).

Michigan: Generally distributed.

Isle Royale: V, 2, Heath Zone and Beach near Siskowit Bay, No. 133 A. Found only under *Cladonia*.

17. *Pallifera hemphilli* (W. G. Binn.).

Range: Mountains of Georgia, North Carolina, and Eastern Pennsylvania, and Michigan.

Michigan: Isle Royale, Ontonagon County and Ann Arbor.

Isle Royale: Not collected in 1905. See Report Exped. 1904, p. 96.

18.* *Pallifera dorsalis* (Binn.).

Range: New England, New York and Michigan.

Michigan: Isle Royale, Eaton and Marquette Counties.

Isle Royale: III, '04, Desor Trail, Nos. 142 A, 149 A.

Taken only in the dense hardwood forest among litter.

19. *Pyramidula alternata* (Say).

Range: "Eastern North America as far north as Nova Scotia, Lower Canada and the international boundary." (Dall).

Michigan: Generally distributed.

Isle Royale: III, '04, Desor Trail, Nos. 142 A, 143 A, 149 A; V, '04 Ridge back of Club House, No. 144 A; VIII, '04, Upper end of Siskowit Bay, No. 232,

From the litter of the maple forest (No. 142 A and 144 A and 149 A).

20. *Pyramidula cronkhitei anthonyi* (Pilsbry).

Range: "Kansas, northward to Great Slave Lake and from New England to the Sierra Nevada and south to Arizona." (Dall).

Michigan: Generally distributed in the Lower Peninsula.

Isle Royale: I, 2, Natural Rock Clearing, No. 78; Balsam-Spruce Forest, Nos. 140, 141; I, 4, Tamarack and Arbor-vitæ Swamp, No. 182; I, 5, Jack Pine Ridge, Nos. 19 A, 81, 102; II, 1, Ransom Clearing, No. 150; V, 2, Heath Zone and Beach near Siskowit Bay, No. 129 A, 130 A; V, 4, Trail through Balsam-Spruce Forest, No. 236; III, '04, Desor Trail, Nos. 141 A, 142 A, 149 A; V, '04, Back of Club House, Nos. 144 A, 147 A.

As stated in the 1904 Report, this form is apparently replaced throughout the Upper Peninsula by the var. *catskillensis* Pils.

This species shows a wide range of habitat, and may occur under or in decaying logs (No. 78, 150); under loose rocks (19 A, 81, 102); in leaf mold (140, 141, 236). Also found under Cladonia (129 A and 130 A) and in the litter of the hardwood forest (141 A, 142 A, 144 A, 147 A, and 149 A).

20a. ———— var. *albina*, (Ckll.).

Isle Royale: This form occurred in 1905 at I, 5, Jack Pine Ridge, No. 19 A; III, '04, Desor Trail, No. 141 A; V, '04, Back of Club House, No. 147 A.

Found under stones (No. 19 A) and in the hardwood litter (No. 141 A and 147 A.)

21. *Pyramidula asteriscus* (Morse).

Range: "Maine; Provinces of Quebec and Ontario, Canada." (Dall.) Also Northern Michigan.

Michigan: Isle Royale, Ontonagon County and Charlevoix.

Isle Royale: Not collected in 1905. See Report Exped. 1904, p. 97.

22.* *Helicodiscus parallelus* (Say).

Range: Eastern United States, Florida and Texas, north to Manitoba.

Michigan: Generally distributed.

Isle Royale: V, 2, Heath Zone and Beach near Siskowit Bay, Nos. 118 A, 129 A, 130 A.

All found among or under *Cladonia*, upon the rock beach slope.

23. *Punctum pygæum* (Dr.).

Range: "United States generally; Quebec; Manitoba; Victoria, Vancouver Island, Europe." (Dall).

Michigan: Generally distributed.

Isle Royale: Not collected in 1905. See Report Exped. 1904, p. 97.

24. *Sphyradium edentulum* (Dr.).

Range: "Northern Europe, Asia and America." (Dall).

Michigan: Generally distributed.

Isle Royale: Not collected in 1905. See Report Exped. 1904, p. 97. One of the specimens under No. 8 may belong here.

25.* *Cochlicopa lubrica* (Mull.).

Range: "Europe, North Africa and Asia Minor; Siberia; Kamchatka; most of North America," (Dall).

Michigan: Generally distributed.

Isle Royale: II, 1, Ransom Clearing, No. 150; V, 2, Heath Zone and Beach near Siskowit Bay, No. 130 A.

No. 150 was taken under a fallen log in an open place near the lake and No. 130 A under *Cladonia* upon the rock beach.

26.* *Vallonia pulchella* (Mull.).

Range: Europe; North Africa; Southern and Western Siberia to the Amur; Madeira; the Azores; North America from Manitoba to Florida and Montana to Nova Scotia." (Dall).

Michigan: Generally distributed.

Isle Royale: A single specimen only occurred in the collections, the exact locality of which is uncertain.

27.* *Vallonia costata* (Muller).

Range: Europe; Northern United States and northward.

Michigan: Owosso, Monroe and Isle Royale.

Isle Royale: II, 1, Benson Brook, No. 150. Apparently a rare species in Michigan, and this the first record in the Upper Peninsula. Under a fallen log in an open sunny place near the lake.

28.* *Succinea ovalis* Say.

Range: "From Louisiana to Hudson Bay and eastward to New England and Gaspe, but not west of the Mississippi valley." (Dall).

Michigan: Generally distributed.

Isle Royale: V, '04, Tamarack Swamp, No. 145 A. A single dead shell was found at the margin of a small stream flowing from the swamp.

29.* *Succinea retusa* Lea.

Range: "Northern United States, from Kentucky northward to Canada and British America." (Dall).

Michigan: Generally distributed.

Isle Royale: Only a single specimen was collected, the exact locality of which was lost.

30. *Carychium exile canadense* Clapp.

Range: Northern United States and Canada.

Michigan: Generally distributed north of the Saginaw-Grand Valley.

Isle Royale: Not collected in 1905. See Report Exped. 1904, p. 97., where it is listed as *Carychium exile*.

31. *Lymnæa stagnalis* (L.). Fig. 63.

Range: "Europe; the Caucasus; Western and Northern Asia; the Northern United States; Canada and British America." (Dall).

Michigan: Generally distributed.

Isle Royale:

Variety A. (Fig. 63, No. 1.) II, 1, Mouth of Benson Brook, No. 167; II, 4, McCargoe Cove, No. 53; III, 2, Small Island in Rock Harbor, No. 89; III, 3, Bulrush Zone, Head of Rock Harbor, Nos. 161, 162, 168; III, 4, Sumner Lake Trail, on Rock Harbor, No. 156; III, 5, Sumner Lake, No. 155; III, 6, Southwest Coves of Rock Harbor, Nos. 91, 95; North side of Rock Harbor, No. 110; IV, 6, Small Island in Tobin Harbor, No. 123; Washington Harbor (Wood).

Variety B. (Fig. 63, No. 3.) I, 1, Lake and Bay Beaches, Nos. 32, 50, 57; 3rd Cove below Camp on Light-house Peninsula, No. 7; II, 1, Mouth of Benson Brook, No. 54; III, 4, Head of Sumner Lake Trail, (Wood); V, 1, Beach at Siskowit Bay, No, 200.

Variety C. (Fig. 63, No. 6.) V, 6, South shore of Siskowit Lake, Nos. 199, 210, 211, 217.

Notes on the habitats of this species are given in detail in the chapter by H. A. Gleason.

This large and widespread species seems in this country at least, to exhibit its greatest variability in the Lake Superior Region. Two well marked varieties have already been described; one var. *higleyi* Baker from Michipicoten Island on the north shore, and the other var. *sanctæ-mariæ* Walker from the St. Mary's River. It is apparently one of the most abundant species on Isle Royale, where three very distinct forms are represented, none of which are typical and none exactly coincident with any of the described varieties. All the specimens collected fall into one of these groups which are apparently correlated with definite local conditions. For present purposes they may be designated as varieties A. B. and C. Variety A (Fig. 63, No. 1) most closely approaches to the usual North American form known as var. *appressa*, Say (Fig. 63, No. 4) from which it differs mainly in the pear-shaped rather than regularly rounded aperture. It is characteristic of the quieter waters of the long, narrow harbors which are such a remarkable feature of the island. The same form has also been collected in the St. Mary's River near the Neebish Rapids. Variety B is an inhabitant of the shores exposed to the more violent waves of the main lake. Correlated with these conditions the shell is smaller, with a short spire and a relatively large body whorl for the accommodation of the large foot necessary to enable it to retain its hold upon the rocks, among which it lives. This form (Fig. 63, No. 3) is more nearly related to the var. *higleyi* (Fig. 63, No. 5) from the north shore, but is apparently much smaller. It is about the size of the var. *sanctæmariæ* (Fig. 63, No, 2) but quite different in the shape of the spire. Variety C. (Fig. 63, No. 6) is the largest in cubic capacity yet known from this country. It was found only in Siskowit Lake, whose quiet waters and especially favorable conditions have conduced to the production of this unusually fine, thin, inflated form.

32.* *Lymnæa megasoma* Say.

Range: "Northern New England, Canada, and British America to Lat. 57° N." (Dall). Also Northern Michigan, Wisconsin and Minnesota.

Michigan: Isle Royale, St. Mary's River and Roscommon County.

Isle Royale: IV, 3, Bayou at Tobin Harbor, No, 124, (Adams). A "single large, but dead, specimen was found in a pond-like bayou which was connected with Tobin Harbor by a very narrow and short outlet.

33. *Lymnæa emarginata* Say.

Range: "Northern United States east of the Mississippi, Canada and northward." (Dall).

Michigan: Shores of the Great Lakes north of Saginaw Bay and some inland lakes from Roscommon County northward.

Isle Royale: I, 1, Lake and Bay Beaches, Nos. 24, 50, 57, 58, 59, 74, 118, and 125; 3rd Cove west of Camp on Light-house Peninsula, No. 7; III, 4, Head of Simmer Lake Trail, (Wood); V, 1, Beach at Siskowit Bay, No. 200.

This is a characteristic and abundant species along the lake beach where it was found associated with var. B. of *Lymnæa stagnalis*. The same form, but with a rather heavier shell, is very abundant along the shore of Mackinac Island. Specimens from one rock pool, No. 58, are peculiar in being longitudinally striped with white like *Lymnæa reflexa zebra* Tryon. Those from another, Nos. 59 and No. 74, are unicolored.

34. *Lymnæa pilsbryana* Walker.

(Nautilus, XXII, p. 4, Pl. I, fig. 2, 8-11, 1907).

Range: Isle Royale is the only known locality.

Isle Royale: X, '04, Washington Harbor, No. 1 (Wood). This form, so far as the collections show, is apparently confined to the west end of the island. It was doubtfully referred to *Lymnæa sumassi* Bd. in the Report Exped. 1904, p. 97. A larger suite of specimens from the original locality in Washington Harbor was collected in 1905, including a few full grown examples which confirm its specific distinctness.

35.* *Lymnæa obrussa* Say.

Range: "Northern United States and Northward." (Dall).

Michigan: Generally distributed.

Isle Royale: III, 2, Small Island in Rock Harbor, No. 89; III, 3, Bulrush Zone at western end of Rock Harbor., No. 164.

36.* *Lymnæa catascopium* Say.

Range: "Northern United States to Rocky Mountains, Canada and northward." (Dall).

Michigan: Shores of the Great Lakes and connecting rivers and lower waters of tributaries in northern counties.

Isle Royale: North shore of Rock Harbor, No. 110; III, 3, Bulrush Zone at western end of Rock Harbor, Nos. 160, 163, 164; III, 6, Southwest Coves of Rock Harbor, No. 91; IV, 2, Island No. 14, Tobin Harbor, No. 30 A; IV, 6, Small Island in Tobin Harbor, No. 123; V, 6, South shore of Siskowit Lake, No. 220.

Apparently most frequent in shallow water in places sheltered from the waves, but No. 220, a single very young specimen, was collected on the under surface of a water-lily leaf.

With one exception, the specimens from all these localities are alike and belong to the common, rather short, lake form of this species. Associated with this form at Station IV, 6, was a very thin, elongated form with the characteristic sculpture of *catascopium*, which is closely related, to, but much more fragile than, the

elongated form, which is characteristic of the lower Great Lakes.

37. *Limnæa* sp?

Isle Royale: III, 3, Bulrush Zone at western end of Rock Harbor, No. 163; IV, 2, Island No. 14 in Tobin Harbor, No, 126.

At both these localities occurred a few dead, fragmentary and more or less decayed specimens, which could hardly be referred to any of the sfpecies listed above, and yet were too imperfect to successfully identify.

38. *Physa sayii* Tapp.

Range: Northern United States and Canada.

Michigan: Generally distributed.

Isle Royale: I, 1, Lake and Bay Beaches, Nos, 50, 57, 118, 125; 3rd Cove west of Camp on Light-house Peninsula, No. 7; III, 4, Head of Simmer Lake Trail, (Wood); V, 1, Beach at Siskowit Bay, No. 200; Washington Harbor, (Wood).

The specimens from Washington Harbor are of normal thickness and more nearly typical in shape than those from the other localities, which are unusually thin.

More detailed notes on the local distribution of this species are given in the chapter by H. A. Gleason.

30.* *Physa gyrina* Say.

Range: "The United States east of the Mississippi, Canada and northward." (Dall).

Michigan: Generally distributed.

Isle Royale: II, 5, Forbes Lake, Nos. 71 A, 90; III, 5, Southwest Coves of Rock Harbor, No. 91.

Specimens No. 71 A were found on driftwood in water a few inches deep.

The specimens from Forbes Lake are a very large, inflated form. Those from the other locality are much smaller and may be one of the varying forms of No. 41, though closer to typical *gyrina* than those included under that head.

40.* *Physa aplectoides* Sterki.

Range: "Tuscarawas County, Ohio, and elsewhere." Sterki.

Michigan: Isle Royale.

Isle Royale: V, 11, Tamarack Swamp, No. 128 A.

Taken from foot-print pools in the Sedge and Buck Bean Zone about a small pond.

The occurrence of this minute species so far from its original locality in Ohio, was one of the surprises of the 1905 collection. It is a very distinct form resembling a young *Aplexa hypnorum* in shape but beautifully sculptured, especially on the apical whorls. The identification is based on comparison with topotypes of *aplectoides* received from Dr. V. Sterki.

41. *Physa* sp?

Isle Royale: II, 1, Benson Brook, No. 149, 167; III, 2, Island at West end of Rock Harbor, No. 89; II, 3, Bulrush Zone at western end of Rock Harbor, Nos. 161, 162, 163, 164; North shore of Rock Harbor, No. 110; III, 5, Simmer Lake, Nos. 77 A, 78 A, 79 A; IV, 5, Neutson's Resort at Rock Harbor, No. 44 A; IV, 6, Island in Tobin Harbor, No. 123; IV, 7, Head of Tobin Harbor, No. 127; V, 1, Beach near Siskowit Bay, No. 200; V, 6, South, shore of Siskowit Lake, Nos, 220, 221; V, 9, Outlet of Siskowit Lake, No. 238; V, 11, Swamp near Siskowit Bay, No. 126 A.

Under this head are included nearly all the Pliysce from the harbors and interior waters which, although exhibiting considerable variation in shape and size, appear to be variation of a common form. Most of the specimens are immature. The few mature examples at first glance would naturally be referred to *Physa heterostropha* Say, but the uniform sculpture of the apical whorls, which becomes more or less obsolete on the body whorl of the mature shell, forbids their reference to that species. The sculpture is that of *gyrina*, and the form may ultimately referred to that species as an extreme form, but the shape of the immature shell, its small, acute spire and deeply impressed suture is quite different from that of typical *gyrina*. In the present chaotic state of the nomenclature of the American species of *Physa* it would seem the better policy to refrain from any attempt at specific identification than to run the risk of adding to an already over-burdened synonymy.

42. *Aplexa hypnorum* (L.).

Range: "Northern Europe, Asia and America, Northern United States and Canada," (Dall).

Michigan: Generally distributed.

Isle Royale: Not collected in 1905. See Report Exped. 1904, p. 98.

43. *Planorbis trivolvis* Say.

Range: "Entire Atlantic Drainage of North America; and the Mississippi Valley and northward." (Dall).

Michigan: Generally distributed.

Isle Royale: III, 5, Sumner Lake, Nos. 78 A, 135.

In a small pool in the sedge zone of a tamarack swamp.

44. *Planorbis bicarinatus* Say.

Range: "The United States East of the Rocky Mountains; Eastern Canada; Oregon." (Dall).

Michigan: Generally distributed.

Isle Royale: III, 2, Small Island in Rock Harbor, No. 89; III, 3, Bulrush Zone at western end of Rock Harbor, Nos, 159, 160; III, 6, Southwest Coves of Rock Harbor, No. 91.

Dredged from the mud bottom at the upper end of Rock Harbor, near mouth of a small stream, in 3-5 feet of water (Nos. 159, 160).

44a. ———— var. *striatus* Baker.

Isle Royale: III, 3, Bulrush Zone at western end of Rock Harbor, No. 162; III, 5, Sumner Lake, Nos. 78 A, 79 A.

Dredged from the mud bottom of the small sluggish stream at the head of Rock Harbor (No. 162) and from the margin and sedge zone of Sumner Lake (No. 78 A, 79 A.).

44b.* var. *royalensis* Walker.

(Nautilus, XXII, p. 9-10, Pl. I, fig. 11, (1909).

Isle Royale: V, 6, South shore of Siskowit Lake, No. 210.

This novel and very distinct form, characterized by its very acute carinse and rough, irregularly corrugated surface, was one of the most interesting discoveries of the expedition.

In the mud among loose stones at a depth of about 1 foot.

45. *Planorbis campanulatus* Say.

Range: "Atlantic, Mackenzie and Hudson Bay water sheds and north to Great Slave Lake." (Dall).

Michigan: Generally distributed.

Isle Royale: III, 5, Sumner Lake, Nos. 78 A, 79 A; V, 6, South shore of Siskowit Lake, Nos. 210, 211.

In mud and among loose stones at a depth of about one foot (Nos. 210, 211) and in small pools in the Sedge Zone (Nos. 78 A, 79 A).

The specimens from Sunnier Lake are the usual form. Those from Siskowit Lake are a peculiar variety resembling the rare *Planorbis multivolvis* Case, in having apparently the apical whorls elevated above the line of the body whorl. Unfortunately the upper surface of all the specimens collected is so eroded that it is impossible to determine just what degree of elevation the spire of the perfect shell attains.

46. *Planorbis exacuous* Say.

Range: "Northern United States, east of the Rockies; Canada, etc., south to New Mexico." (Dall).

Michigan: Generally distributed.

Isle Royale: III, 2, Small Island in Rock Harbor, No, 89; III, 3, Bulrush Zone at the western end of Rock Harbor, Nos. 159, 160, 161, 162.

In the muddy bottom of a small stream flowing into Rock Harbor and in the Harbor itself, at a depth of 2-5 feet (Nos. 159 to 163).

47. *Planorbis parvus* Say.

Range: "Eastern North America from Florida to North Lat. 67°, and the Yukon Drainage System." (Dall).

Michigan: Generally distributed.

Isle Royale: I, 1, Rock Pool, No. 2, Light-house Peninsula, No. 59; III, 2, Small Island at Rock Harbor, No. 89; III, 3, Bulrush Zone at western end of Rock Harbor, Nos. 159, 160, 163, 164; III, 5, Stunner Lake, No. 79 A; III, 6, Southwest Coves, of Rock Harbor, No. 91.

As with the last species (Nos. 159, 160, 163 and 164).

48. *Planorbis hirsutus* Gld.

Range: "Washington, D. C., northward east of the Mississippi." (Dall).

Michigan: Generally distributed.

Isle Royale: Not collected in 1905. See Report Exped. 1904, p. 98,

49. *Ancylus* sp?

Isle Royale: I, 3, Balsam-spruce Forest, No. 140.

"In the damp leaf mold in the dense shade of the balsam-spruce forest."

A single broken specimen, too much damaged to identify specifically, was the only one obtained. There is apparently some mistake in regard to the locality where this specimen was found.

50. *Valvata tricarinata* Say.

Range: "From New England and Virginia westward to Missouri and northward." (Dall).

Michigan: Generally distributed.

Isle Royale: III, 2, Small Island in Rock Harbor, No. 89; III, 3, Bulrush Zone at western end of Rock Harbor (Nos. 160, 163).

In the mud in deep water at the head of Rock Harbor (Nos, 160, 163).

51. *Valvata lewisii* Currier.

Range: "Northern United States from Atlantic to Pacific and Northward." (Dall).

Michigan: Generally distributed.

Isle Royale: Not collected in 1905. See Report Exped. 1904, p. 98, cited as *Valvata sincera lewisii*.

52. *Valvata sincera nylanderi* Ball.

Range: Northern United States from Maine to Wisconsin.

Michigan: Isle Royale and Marquette County.

Isle Royale: III, 2, Small Island in Rock Harbor, No. 89; III, 3, Bulrush Zone at western end of Rock Harbor, Nos. 159, 160, 163, 164; V, 6, South Shore of Siskowit Lake, No. 220.

With *Valvata tricarinata* at the head of Rock Harbor and in shallow water in Siskowit Lake (No. 220), especially abundant on the lower side of water-lily leaves.

53. *Amnicola limosa* (Say).

Range: “Virginia to Wisconsin and Hudson Bay." (Dall).

Michigan: Generally distributed.

Isle Royale: V, 6, South shore of Siskowit Lake, No. 220, living in company with the preceding species under water-lily leaves.

54. *Amnicola lustrica* Pils.

Range: Northern United States.

Michigan: Generally distributed.

Isle Royale: III, 2, Small Island in Rock Harbor, No. 89; III, 3, Bulrush Zone at western end of Rock Harbor, Nos. 159, 160, 163, 164.

In muddy bottom in deep water (3-5 feet deep) at the head of Rock Harbor.

55. *Lampsilis luteola* (Lam).

Range: "Entire Mississippi drainage and north to the Red River of the North." (Dall).

Michigan: Generally distributed.

Isle Royale: V. 6, South shore of Siskowit Lake, Nos. 210, 211, 218.

Some of the specimens collected are very similar to the form from the Beaver Islands, Lake Michigan, referred to *Lampsilis borealis* Gray, but they are connected by intermediate specimens with the more typical form and. seem rather referable to this species than to *borealis*.

56. *Anodonta grandis footiana* Lea.

Range: Northern United States and northward.

Michigan: Generally distributed.

Isle Royale: II, 4, McCargoe Cove, No. 52; III, 2, Small Island in Rock Harbor, No. 89; III, 3, Bulrush Zone at western end of Rock Harbor, No. 168; III, 4, near head of Trail to Sumner Lake, Rock Harbor, No. 93; III, 5, Sumner Lake, No. 154; III, 6, Southwest Coves of Rock Harbor, Nos. 91, 91, 156; South Side of Rock Harbor, Nos. 109; V, 6, South Shore of Siskowit Lake, Nos. 210, 211, 218; Sargent Lake, No. 112.

Abundant in all of the lakes, especially on sandy or gravelly bottom in the smaller coves sheltered from the waves.

57. *Anodonta marginata* Say.

Range: "Drainage of the St. Lawrence River basin, including the Lakes." (Dall).

Michigan: Generally distributed.

Isle Royale: II, 1, Benson Brook Clearing, No. 80 A; II, 5, Forbes Lake, No. 90; III, 5, Sumner Lake, Nos. 94, 120, 135, 139, 154, 186, (Wood); IV, 3, Bayou at Tobin Harbor, No. 124; V, 6, South shore of Siskowit Lake, No. 210; VII, '04, Lake Desor, No. 139 A.

58.* *Sphaerium simile* (Say).

Range: "United States east of the Mississippi River; Canada, Manitoba." (Dall).

Michigan: Lake Michigan and Lake Superior.

Isle Royale: III, 5, Sumner Lake. Only two immature valves taken.

59.* *Sphaerium walkeri* Sterki.

Range: Lake Michigan and Northward.

Michigan: Generally distributed.

Isle Royale: III, 2, Small Island in Rock Harbor, No. 89. A single fragmentary specimen is doubtfully referred to this species by Dr. V. Sterki.

60.* *Musculium securis* (Prime).

Range: Northern United States, Maine to Minnesota.

Michigan: Generally distributed.

Isle Royale: III; 3, Bulrush Zone, Rock Harbor, No. 160; III, 5, Sumner Lake, Nos. 77 A, 78 A, 79, 176; V, 9, Outlet of Siskowit Lake, No. 238. A few examples only of a small form. Some immature examples from the latter locality "may be the same."

In small, shallow pools in the outlet of Siskowit Lake (No. 238) and at the margin and Sedge Zone of Sumner Lake (No. 77 A, 78 A).

61.* *Pisidium idahoense* Roper.

Range: Idaho; Washington; Alaska; Lake Michigan; Lake Superior.

Michigan: Lake Michigan and Lake Superior.

Isle Royale: III, 2, Small Island in Rock Harbor, No. 89; III, 3, Bulrush Zone, Rock Harbor, Nos. 159, 160, 162, 163. Rather common. The Isle Royale form Is similar to that from Lake Michigan and is neither as large nor as Inflated as the typical form.

Dredged from a muddy bottom, in 2-5 feet of water at the head of Rock Harbor and In a small stream flowing into it, (Nos. 159, 160, 162, 163.)

62. *Pisidium variabile* Prime.

Range: "Eastern United States, north of Virginia; Colorado and northward." (Dall).

Michigan: Generally distributed.

Isle Royale: III, 5, Sumner Lake, 77 A; III, 2, Small Island in Rock Harbor, No. 89; III, 3, Bulrush Zone, Rock Harbor, Nos. 160, 162, 163; V, 9, Outlet of Siskowit Lake, No, 238.

With the last at the head of Rock Harbor, and also in the small pools with gravel bottom in the outlet from Siskowit Lake and at the margin of Simmer Lake.

62a.* var. *brevius* Sterki.

Range: "Michigan; Minnesota and Keewatin." (Sterki.)

Michigan: Upper Peninsula and northern part of the Lower Peninsula.

Isle Royale: III, 3, Bulrush Zone, Rock Harbor, Nos. 160, 164. All the examples both of the typical form and the variety are "small and mostly immature."

With the typical form in the mud bottom in 3-5 feet of water at the head of Rock Harbor.

63.* *Pisidium affine* Sterki.

Range: "Great Lake Region, Michigan to New York; Minnesota, Illinois and Ohio (Ohio River Drainage)." (Sterki).

Michigan: Generally distributed.

Isle Royale: III, 5, Sumner Lake, Nos. 77 A, 79 A. A few examples, "quite small," from the margin and Sedge Zone.

64.* *Pisidium sargenti* Sterki?

Range: "Northern United States, New York to Minnesota." (Sterki).

Michigan: Generally distributed in Lower Peninsula; Isle Royale.

Isle Royale: III, 5, Sumner Lake, No. 176. Two specimens only, which may be *Pisidium sargenti*. One example is large, especially in contrast with the small forms of the other species. In the smaller specimen the hinge is partly reversed."

65.* *Pisidium scutellatum* Sterki.

Range: Northern United States, Michigan to Washington and northward.

Michigan: Generally distributed.

Isle Royale: III, 2, Small Island in Rock Harbor, No. 89; III, 3, Bulrush Zone, Rock Harbor, Nos. 159, 160, 163, 164; "Small, northern variety. The most common species and somewhat variable."

In the mud and silt bottom in 10 inches to 5 feet of water ait the upper end of Rock Harbor (Nos. 159, 160, 163).

66.* *Pisidium roperi* Sterki.

Range: Northern United States, Maine to Minnesota.

Michigan: Generally distributed.

Isle Royale: III, 5, Sumner Lake, No. 78; IV, 8, Trail to Greenstone Range, No. 128. "Small, but good and characteristic."

67.* *Pisidium ventricosum* Prime.

Range: Northern United States, Maine to Michigan and northward.

Michigan: Western part of the State, Kent County to Charlevoix County; Marquette County; Isle Royale.

Isle Royale: III, 5, Sumner Lake, Nos. 77 A, 79 A; III, 2, Small Island in Rock Harbor, No. 89; III, 3, Bulrush Zone at Rock Harbor, Nos. 163, 164.

In 10 inches of water in the Potamogeton Zone at the mouth of a creek at the upper end of Rock Harbor (No. 163) and at the margin and in the sedge of Sumner Lake.

68.* *Pisidium subrotundum* Sterki.

Range: "New England; Anticosti Island to Michigan." (Sterki).

Michigan: Kent, Marquette and Ontonagon counties and Isle Royale.

Isle Royale: I, 6, Sphagnum-Spruce Bog, No. 116; IV, 8, Trail to Greenstone Range, No. 128; III, 3, Bulrush Zone at western end of Rock Harbor, Nos. 159, 160; I, 4, Tamarack and Arbor Vitæ Swamp, Nos. 181, 182; V, 5, Tamarack Swamp, No. 237; V, 9, Outlet of Siskowit Lake, No. 238. A "form" of this species "common and somewhat variable."

Among dead leaves and sedges at the bottom of shallow pools in a tamarack swamp (No. 116). In silt and debris on the bottom in 4-5 feet of water (Nos. 159, 160); small sphagnum-lined pools, seldom exceeding six inches in depth in dense shade (Nos. 181, 182); among sphagnum and *Utricularia* in small streams and pools, mostly in the sun (No. 237); in shaded, shallow pools with gravelly bottom (No. 238).

69.* *Pisidium rotundatum* Prime.

Range: Northern United States, Maine to Minnesota and northward.

Michigan: Generally distributed.

Isle Royale: I, 6, Sphagnum-spruce Bog, No. 116; III, 3, Bulrush Zone, Rock Harbor No. 160; V, 5, Tamarack Swamp, No, 237; "Few and probably none mature."

Among dead leaves and sedges at the bottom of shallow pools, in shade (No. 116); among sphagnum and *Utricularia* in small, shallow streams and pools, mostly in the sun (No. 237.)

70.* *Pisidium splendidulum* Sterki.

Range: Northern United States, Maine to Michigan.

Michigan: Generally distributed.

Isle Royale: III, 5, Sumner Lake, Nos. 77 A, 79 A, 176. At margin and in the Sedge Zone.

71.* *Pisidium pauperculum* Sterki.

Range: Northern United States, Maine to Minnesota.

Michigan: Generally distributed.

Isle Royale: III, 3, Bulrush Zone at western end of Rock Harbor, No. 164. A few specimens of a small form.

72.* *Pisidium medianum* Sterki.

Range: Northern United States, Maine to Wisconsin.

Michigan: Generally distributed.

Isle Royale: III, 5, Sumner Lake, Nos. 77 A, 78 A, 79 A; III, 2, Small Island in Rock Harbor, No, 89; III, 3, Bulrush Zone at western end of Rock Harbor, Nos, 160, 164; V, 9, Outlet of Siskowit Lake, No, 238.

Near the mouth of a small creek, on a silt and mud bottom at a depth of 5 feet (No. 160); In shallow, shaded pools with gravelly bottom (No. 238).

73.* *Pisidium punctatum simplex* Sterki.

Range: "Michigan, Wisconsin and Illinois." (Sterki.)

Michigan: Carp Lake, Emmet Co. and Isle Royale.

Isle Royale: III, 3, Bulrush Zone at Western end of Rock Harbor, No. 160.

74.* *Pisidium milium* Held.

Range: Europe; Maine and Michigan.

Michigan: Generally distributed.

Isle Royale: III, 3, Bulrush Zone at western end of Rock Harbor, Nos, 160, 162. No. 162 occurred in a small creek near its mouth, on a silt and debris-covered bottom at a depth of 3 feet.

75. *Pisidium abditum* Haldeman.

Range: "'North America, from Honduras, north to Alaska." (Dall).

Michigan: Generally distributed.

Isle Royale: Not found in 1905. See Report Exped., 1904, p. 98.

76. *Pisidium* sp.?

Isle Royale: Undetermined forms of Pisidium were collected in the following localities: III, 3, Bulrush Zone at western end of Rock Harbor, Nos. 159, 160, 163; V, 5, Tamarack Swamp, No. 237.

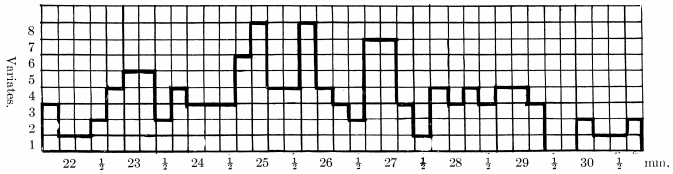

Figure 61. Variations in the shell width of Polygyra albolabris.

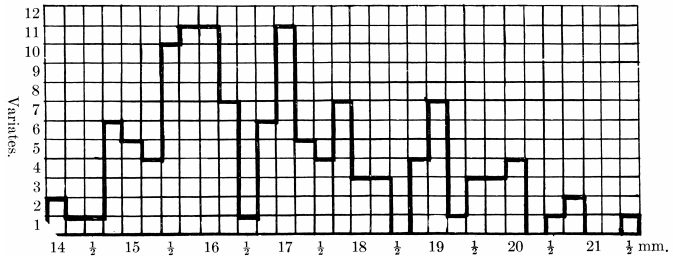

Figure 62. Variation in the shell height of Polygyra albolabris.

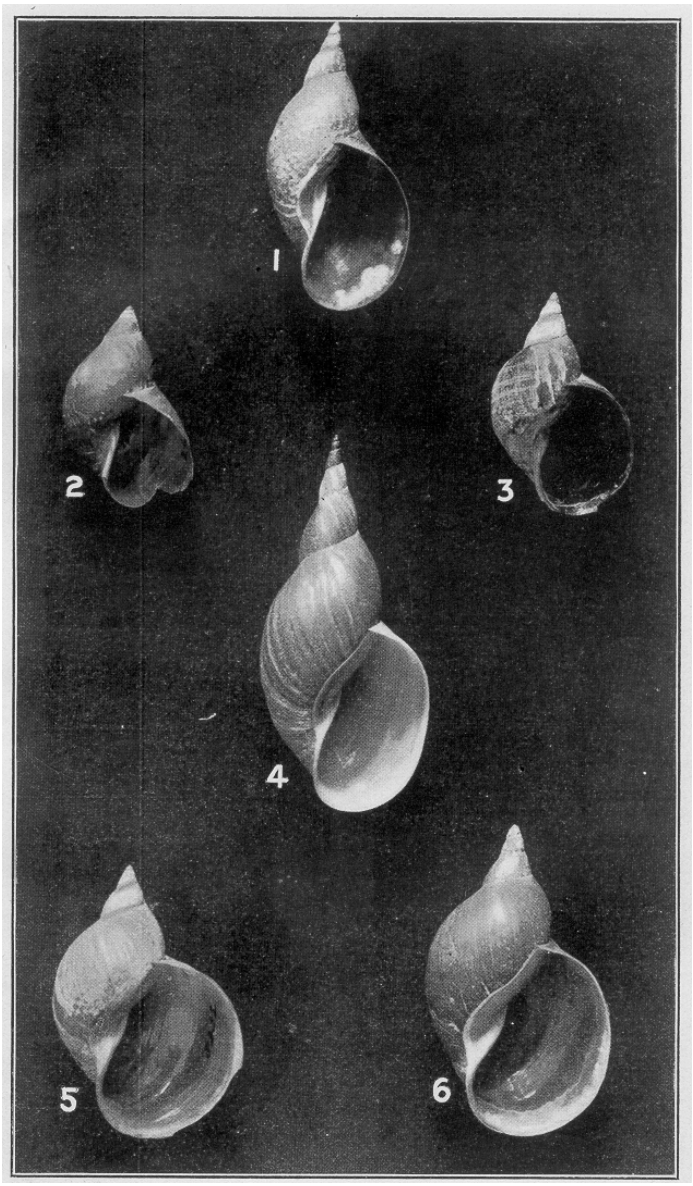

Figure 63. Lymnaea stagnalis varieties from Isle Royale.

REPORT ON THE ISLE ROYALE ORTHOPTERA OF THE 1905 EXPEDITION.

ALBERT P. MORSE, RESEARCH ASSISTANT, CARNEGIE INSTITUTION OF WASHINGTON.

1. General Remarks.

The orthoptera secured by the University Museum expedition of 1905 to Isle Royale consist of representatives of 13 species. Of these, one is a cosmopolitan roach, the Croton-bug, *Blattella germanica*, doubtless introduced in merchandise through man's agency. The others, with a single exception, are boreal Acridians characteristic of the cooler parts of central and eastern North America, whose presence in this locality was either known or to be confidently expected. The exception, *Melanoplus alaskanus*, is a

species, hitherto known only from the Northwest, whose presence on Isle Royale, in sufficient numbers to make it appear to be the dominant species of its genus there, was, to say the least, unlocked for. It would be of much interest in this connection to know the status of this species on the adjoining northern mainland.

Some striking variations are present in the representatives of certain species and will be found noted in the following list. In general, there seems to be a tendency toward an increased duskiness of coloring as shown by *Camnula pellucida*, *Hippiscus tuberculatus*, and *Circotettix verruculatus* (all geophilous species), due perhaps to humidity, perhaps to environmental coloration; also, as compared with eastern material, the specimens are of relatively large size, particularly in the cases of *Melanoplus extremus* and *fasciatus*.

The locust societies represented consist of campestral and thamnophilous groups, though all of the species are to be obtained in the clearings or about their edges, rather than in the forest.

The thamnophile species are *Chloealtis conspersa* and *abdominalis*, *Melanoplus fasciatus* and *huroni*. The campestral species, notwithstanding the generally forested character of the country, are more numerous and consist both of phytophilous and geophilous species. In the damper situations occur *Stenobothrus curtipennis*, *Mecostethus lineatus*, *Melanoplus extremus* and *femoratus*. In drier places *Camnula pellucida*, *Melanoplus alaskanus*, and *Hippiscus tuberculatus* are to be found. Characteristic of the bare rock ridges is the saxicolous *Circotettix verruculatus*. The two latter species, with their strikingly colored wings and noisy flight, are the most conspicuous members of the orthopterous fauna of the island.

The 1904 expedition secured examples of a Tettigid (*Tettix acadicus*) and of a wingless Locustarian—*Ceuthophilus seclusus*. The species of *Ceuthophilus* usually inhabit damp, dark places, under bark, in hollow logs, etc., and are among the most characteristically sylvan of our orthoptera.

The lot numbers refer to the field numbers of the collectors, those without a letter to H. A. Gleason and those followed by an A. to C. C. Adams.

2. Annotated List of Species.

Blattidae.

1. *Blattella germanica* Linn. Croton-bug. Station I, 7. camp. Lot 179. July 28, A single female with oötheca. Probably introduced in merchandise.

Acridiidae.

2. *Stenobothrus curtipennis* Harr. Stations I, 7, camp; V, 3; V, 5; I, '04 and VIII, '04. Lots 99 A., 134 A., 137, 228, 232." July 24 to Aug. 24.

This species is a characteristic inhabitant of moist, grassy or sedgy meadows. It was taken in the cassandra and hummock zone at V, 5, and in a clearing near end of Wendigo road at Washington Harbor. Both long—and short-winged forms were secured.

3. *Chloealtis abdominalis* Thom. Stations II, 3; IV, 5; and I, '04. Lots 121, 143, 154 A. July 21, 25, Aug. 24. A young male in 5th stage on July 21.

4. *Chloealtis conspersa* Harr. Stations I, 1; II, 3; and I, '04. Lots 22, 143, 144, 147, 154 A. July 6 to Aug. 24. A young male in 5th stage on July 6. Some of the males of this species show indications of the more closely reticulated spot in the tegmina so characteristic of *abdominalis*.

The species of this genus are dwellers in thicket and woodland edges, ovipositing usually in decayed, though sometimes in firm, wood.

5. *Mecostethus lineatus* Scudd. Stations II, 5; V, 5; V, 11; and I, '04. Lots 91 A., 136 A., 154 A., 180. July 8 to Aug. 24.'

Numerous immature examples of this genus are referred to this species with some doubt, and it is quite possible that some of them belong to an allied species. The hind tibiae of these young specimens are markedly fuscous.

6. *Camnula pellucida* Scudd. Stations I, 7; IV, 5; V, 3; and I, '04. Lots 121, 133, 222, 228, 154 A. July 21 to Aug. 24. Young in 4th and 5th stages on July 21 and 22.

The representatives of this species, like those of some others, are unusually dark in color, a phase of coloration probably correlated with the humid climate or soil background. This is a campestral species, occurring plentifully from Atlantic to Pacific oceans in the boreal zone, usually upon dry, upland soil.

7. *Hippiscus tuberculatus* Palis. Coral-winged Locust. Stations IV, 5; IV, 9; V, 9. Lots 121, 122, 215. July 21 to Aug. 7.

This species is represented by 6 males, 4 females, which differ markedly from typical eastern examples in being deeply infuscated, the hind tibiae coral red except on basal half of outer side, and in having the posterior process of the pronotum more produced.

This large locust is an inhabitant of clearings on dry soil. Its bright-colored wings (whence the name of Coral-winged Locust is derived) render it a conspicuous object during its powerful and usually sustained flight.

8. *Circotettix verruculatus* Kirby. Stations I, 5; I, 7; II, 3; III; IV, 5; V, 2; V, 3; V, 9. Lots 121, 131, 132, 144, 108, 147, 179, 208, 201, 212, 215, 222, 239, 27, 107 A., 135 A. July 20 to Aug. 16.

This species is represented by numerous specimens, in general very dark in color, which were secured in the cladonia zone, the beach heath zone, rock clearings and ridges. It is a typically saxicolous locust, delighting to sun itself on outcropping ledges of rock or the

neighboring patches of bare soil and usually presents a very close resemblance in coloration to its background.

9. *Melanoplus alaskanus* Scudd. Stations I, 7; II, 3; IV, 5; IV, 9; V, 2; V, 9; V, 11; and I, '04. Lots 55, 121, 122, 133, 137, 144, 146, 147, 166, 179, 215. 216, 107 A., 154 A., 136 A. July 21 to Aug. 24.

This species, described from Alaska, is apparently the dominant form of the genus occurring on Isle Royale, to judge from its abundance in the material examined and the localities whence derived. It is recorded from clearings, along trails, rock ridges, the beach heath zone, etc. As the original description was based on a small series of specimens, measurements follow to show the range of size in the material at hand. The coloration varies much individually, recalling that of *femur-rubrum* in cool, moist regions.

Length of body: ♂ 20-23.5; ♀, 23-29. Hind femora: ♂ 12-14; ♀, 12-14.5. Tegmina: ♂, 19-20.5; ♀, 17.5-23 mm.

10. *Melanoplus extremus* Walk. Stations II, 5; V, 5; V, 11. Lots 180, 99 A., 136 A. July 8. to Aug. 16.

This species was found in the cassandra and sedge zone of the swamps, and on the jack pine ridge. It is a typical inhabitant of moist meadows throughout the Canadian zone from Alaska to Nova Scotia. The examples secured are of large size and measurements are appended.

Length of body: ♂ 20-21; ♀, 26 29. Hind femora: ♂, 11.7 12.7; ♀, 13.5-14.5 Tegmina: ♂, 11.5-14.5; ♀, 13.5-15.5 mm.

11. *Melanoplus fasciatus* Barnst.-Walk. Stations II, 3; III; V, 2; V, 3; IV, 5; V, 9; III, '04. Lots 121, 131, 144, 146, 193, 207, 208, 212, 214, 231, 215, 222, 239, 101 A., 107 A., 135 A., 143 A. July 20 to Aug. 16.

This is a common and widely distributed species in the procumbens, heath and cladonia zones. It is a thamnophilous species in the east, and typically short-winged, but in the central part of the continent examples with fully developed wings and tegmina are not rare, and both forms are represented among the material secured. The average size is considerably greater than that of specimens from the east and measurements are appended.

Length of body: ♂, 19-23; ♀, 23-27. Hind femora; ♂, 10.7-12; ♀, 12-13.5. Tegmina; ♂, 11.5-18.5 (average 12.5); ♀, 10.5-18 mm.

12. *Melanoplus femoratus* Burm. Station I, 7, camp. July 24. Lot 137, a single male.

13. *Melanoplus huroni* Blatchley. Stations I, Light-house Peninsula ; I, 5; III, 5; IV, 5; IV, 7. Lots 35, 44, 121, 131, 183, 35 A. July 8 to 29. Seven females from dry, aspen-covered, burned-over ridge, rock clearings and ridges.

The Melanopli have been determined from adult examples solely. There are in addition numerous immature specimens, in several stages, representing at least three species and possibly more, which cannot be identified with certainty at present.

3. Station List, 1905 Collections.

I, 1. Lake Superior and Bay Beaches.
Chloealtis conspersa, (No. 22).

I, 5. Jack Pine Ridge.
Circotettix verruculatus, (108, 27).
Melanoplus huroni, (44).

I, 7. Camp at Light-house Clearing.
Blattella germanica, (179).
Stenobothrus curtipennis, (137).
Camnula pellucida, (133).
Circotettix verruculatus, (179).
Melanoplus alaskanus, (133, 137, 166, 179).
Melanoplus femoratus, (137).

II, 3. Rock Ridge Clearings on McCargoe Cove Trail.
Chloealtis conspersa, (143, 144, 147).
Chloealtis abdominalis, (143).
Circotettix verruculatus, (147, 144).
Melanoplus alaskanus, (144, 146, 147, 55).
Melanoplus fasciatus, (144, 146).

II, 5. Forbes Lake.
Mecostethus lineatus, (180).
Melanoplus extremus, (180).

III. Western End of Rock Harbor.
Circotettix verruculatus, (131, 132).
Melanoplus fasciatus, (131).
Melanoplus huroni, (131).

III, 5. Sumner Lake.
Melanoplus huroni, (183).

IV, 5. Clearing at Neutson's Resort.
Chloealtis abdominalis, juv., (121).
Camnula pellucida, (121).
Hippiscus tuberculatus, (121).
Circotettix verruculatus, (121).
Melanoplus alaskanus, (121).
Melanoplus huroni, (121).
Melanoplus fasciatus, (121).

IV, 7. Head of Tobin Harbor.
Melanoplus huroni, (35 A.).

IV, 9. Mountain Top.
Hippiscus tuberculatus, (122).
Melanoplus alaskanus, (122).

V, 2. Heath Zone and Beach.
Circotettix verruculatus, (A. 135, A. 107).
Melanoplus alaskanus, (107 A.).
Melanoplus fasciatus, (101 A, 135 A, 107 A).

V, 3. Rock Clearing at Camp on Siskowit Bay.
Stenobothrus curtipennis, (99 A., 228).
Camnula pellucida, (222, 228),
Circotettix verruculatus, (239, 222, 208, 201, 212).

Melanoplus fasciatus, (193, 201, 208, 212, 214, 222, 239, 231).

V, 5. Tamarack Swamp.
Stenobothrus curtipennis, (99 A.).
Mecostethus lineatus, (91 A.).
Melanoplus extremus, (99 A.).

V, 9. Outlet to Siskowit Lake.
Hippiscus tuberculatus, (215).
Melanoplus alaskanus, (215).
Melanoplus fasciatus, (215).
Circotettix verruculatus, (215).

V, 11. Tamarack-Spruce Swamp.
Mecostethus lineatus, (136 A.).
Melanoplus alaskanus, (136 A., 216).
Melanoplus extremus, (136 A.).

I, '04. Clearing on the Shore of Washington Harbor.
Stenobothrus curtipennis, (154 A.).
Chloealtis abdominalis, (154 A.).
Chloealtis conspersa, (154 A.).
Mecostethus lineatus, (154 A.).
Camnula pellucida, (154 A.).
Melanoplus alaskanus, (154 A.).
Melanoplus sp. indet ♀.

III, '04. Trail along the Top of Greenstone Range.
Melanoplus fasciatus, (143 A.).

VIII, '04. Western End of Siskowit Bay.
Stenobothrus curtipennis, (232).

NEUROPTEROID INSECTS FROM ISLE ROYALE, MICHIGAN.

DR. JAMES G. NEEDHAM, CORNELL UNIVERSITY.

A small but interesting collection of aquatic larvae of dragonflies, stoneflies and mayflies was obtained from Isle Royale, and the fine stonefly, *Pteronarcys dorsata* Say, from the Northern Peninsula. Among the dragonfly larvae were two that are hitherto undescribed, a species of *Sympetrum* too immature for description, and the cast skins and the young larva of a species of *Somatochlora*, described below. The list is as follows:

Odonata.

1. *Anax junius* Drury. A young larva from Isle Royale was collected on August 14 (No. 120 A) in a rock pool on the beach (V, 2); and another on July 29 at Summer Lake (III, 5).

2. *Aeschna* sp.? perhaps *constricta* Say. Represented by both cast skins and nymphs from Sumner Lake (III, 5), Nos. 170, 221, 72 A, 77 A, 78 A, 79 A; a rock pool on the beach (V, 2) on August 14; in the stomach of a duckling loon (*Gavia imber*) from Siskowit Lake (V, 6) August 10, No. 108 A; and from the margin of a swamp (V, 11) on August 16 (No. 126 A).

3. *Aeschna* sp? A second species, represented by a single young larva, was taken in a rock pool (V, 2) on August 14 (No. 120 A). It has lateral spines on segments 5-9 of the abdomen, that of 5 (usually absent) being very small.

4. *Somatochlora* sp? Perhaps *S. forcipata* Selys. (This suggestion as to the species is based solely on the fact that this species is known to occur commonly at Duluth, Minn.). A single young nymph in alcohol, July 26, from the head of Rock Harbor, No. 162; and a cast skin (No. 89) from Rock Harbor (III, 1) July 14, 1905. Being new to science, a description drawn from the cast skin is herewith offered.

Length 23 mm., abdomen 13 mm., hind femur 7 mm., width of head 6 mm., of abdomen 7 mm.

Body stout, hairy on all margins. Antennae very hairy, and also the legs, especially the tibiae externally. Head with a ruff of stiff rough recurved hairs overspreading the abruptly narrowed hind angles. Labium stout and wide, its hinge reaching posteriorly well between the bases of the fore legs. Median lobe prominently angulate in the middle; mental setae about thirteen each side, the outermost eight of these in a close-set uniform series; some of the smaller inner ones more or less out of line. Lateral setae eight; hook small, hardly longer than the setae, but much stouter; teeth crenulately recurved and densely spinulose margined.

The wing cases reach posteriorly to the tip of the 6th abdominal segment. Dorsal hooks on abdominal segments 3-9, beginning with a mere rudiment on the third and regularly increasing in size backward to the ninth, where somewhat surpassing the level of the tip of the 10th segment; they are spinelike on segments 4-6, but somewhat laterally flattened and distinctly decurved at the tip on segments 7-9. Lateral spines on segments 7 and 8 straight and sharp, directed straight posteriorly, at base very slightly angulate with the lateral margins of their segments, that of the 9th segment about two-thirds as long as its segment and about twice as large as that of the 8th segment. The margins of all the abdominal segments are hairy, especially posteriorly, and there is a dense fringe across the ventral spical border of the 9th segment. The superior appendage is slightly shorter than the inferiors: these are triangular and sharp pointed; the laterals equal the superior in length, and are stout and cylindric, and abruptly pointed.

The larvae of the four American species of *Somatochlora* now known may be distinguished as follows:—

1. Lateral setae of the labium eight: lateral spine of the 9th abdominal segment more than half as long as its segment, and the dorsal hook of that segment larger than its predecessors, *S. forcipata*, supposition.

Lateral setae of the labium seven: lateral spine of the 9th abdominal segment less than half as long as its segment, and the dorsal hook of that segment not larger, usually smaller, than some of its predecessors ..... 2.

2. Abdomen less than one-fourth longer than wide: lateral spines of the abdomen, short and broad, equilateral triangles, *S. tenebrosa*, supposition. ..... 3.

Abdomen more than one-half longer than broad: Lateral spines of the abdomen longer than more acute .....

3. Dorsal hooks of the abdomen of equal size on segments 6-9.

Dorsal hooks largest on the 7th and 8th segments, that of the 9th segment smaller ..... *S. linearis.*

5. *Cordulia shurtleffi* Scudder. This fine species is apparently common on Isle Royale, being represented by nymphs, Nos. 79 A, from Stunner Lake (III, 5), July 29; No. 120 A. from a rock pool on beach (V, 2) on August 14; and No. 126 A. from a swamp (V, II) on August 16.

6. *Celithemis eponina* Hagen. Two large and four small larvae. From a rock pool (V, 2) on August 14, No. 120 A.

7. *Leucorhinia intacta* Hagen. A number of larvae in bad condition, apparently this species, on July 29, No. 78 A, 79 A, from the sedge zone of Sumner Lake (III, 5).

8. *Enallagma* sp.? A number of broken larvae: Sumner Lake (III, 5), July 29, Nos. 79 A and 126 A; and a rock pool on beach (V, 2) on August 14, (No. 120 A); also from a swamp (V, 11) on August 16 (No. 126 A).

Plecoptera.

1. *Arsapnia vernalis* Newman. A number of specimens of both sexes, Nos. 24, 46, and 80 (I, 1), July 6, 11, and 14. Very abundant upon the cliff at the shore.

2. *Isopteryx cydippa* Newman. One specimen from the balsam-birch forest (V, 4), on August 14 (G. 236.)

Pteronarcys dorsata Say. A few larvae from Otter River, in Baraga County Michigan, collected by A. G. Ruthven, No. 30791, U. of M. Museum.

Ephemerida.

1. *Heptagenia* sp.? One pinned female subimago from Isle Royale in August, wholly undeterminable; another specimen from Tobin Harbor on July 20.

2. *Siphlurus* sp.? probably *S. alternata* Say. A larva from the sedge zone of Sunnier Lake (III, 5) No. 78 A, on July 29.

Neuroptera.

1. *Sialis infumata* Walker. One larva and one adult were taken onJuly 26, by H. A. Gleason, (No. 160) near the head of Rock Harbor (III, 3).

DIPTERA OF THE 1905 UNIVERSITY MUSEUM EXPEDITION TO ISLE ROYALE.

PROFESSOR JAMES S. HINE, OHIO STATE UNIVERSITY.

Much interest always attaches to a collection of insects from northern regions and when Mr. Chas. C. Adams wrote and asked me to work up the Diptera of the 1905 Isle Royale Expedition, I gladly accepted. The collection is a small one and includes a number of common and widely distributed species, but on the other hand it also includes several species of special interest. Most of the specimens were collected by Dr. H. A. Gleason, but he was aided by Mr. B. F. Savery.

As the locality is not so far from midway between the East and the West the question naturally arises as to whether the eastern or the western species predominate in the makeup of the fauna. This matter is the more interesting to me for the reason that lately I have studied a collection of Diptera from New England and also one from British Columbia. After some study of species of Diptera from boreal regions I am convinced that there is not the difference in the eastern and western faunas in the North that there is in the South. There are a number of species in the collection that are common to New England and British Columbia, but there are others that so far are not proven to have such a wide range, and it is with the latter that most interest attaches in the consideration of our question.

If the *Tabanidae* are considered we find that three species may be said to be -exclusively eastern and one exclusively western, while six are distributed entirely across the continent.

In the family *Syrphidae* are seven species that may be considered exclusively eastern, and twelve species that reach clear across the continent, but not a single one that is exclusively western.

In the *Stratiomyidae* the single species is eastern. So far as I can find Isle Royale is the farthest west the species has been taken.

In the *Bombyliidae* one species is western, and the other reaches across the continent.

In the *Therevidae* the single species is western, Montreal being the farthest east that specimens have been taken.

In the *Asilidae* two species are eastern and one is western. The western species however is hardly typical.

In the remaining families are several species that are exclusively eastern and several that reach clear across the continent, but none that are exclusively western. To sum up I find four western species and more than a dozen eastern, while there are about thirty that occur from the Atlantic to the Pacific. Therefore, although there are many species common to Isle Royale and British Columbia, the following show that the general

complection of the Isle Royale Dipterous fauna favors that of eastern rather than that of western North America.

Family *Culicidae*.

1. *Culex pipiens* Linn. The rain barrel Mosquito was taken July 11, (Station I, Sub. 1) and August 3, (V, 3). This is the common mosquito that breeds in receptacles of standing water and small pools generally, and widely distributed in this country and in Europe, having been described under various names. I hesitated somewhat in giving the specimens a specific name for the reason that they were dropped into alcohol when they were collected and lost many of their scales before they reached me.

Family *Simuliidae*.

2. *Simulium venustum* Say. Black Fly. Taken July 14 (I, 5) and July 28, (III, 5). In Ohio I have found the larvae of this species clinging to rocks in swift flowing brooks and at the outlet of a small artificial lake where the water passed through an iron pipe and dropped a foot or two on to rubbish and stones. This minature waterfall seemed to furnish ideal breeding grounds for the species, for the larvae were there in abundance and the adults were flying about in swarms. The type locality for the species is along the Ohio River near Cincinnati, but it has been identified from a number of states and from Canada. It is a matter of interest to know that the species is a member of the genus with the well known and destructive Buffalo Gnat.

Family *Stratiomyidae*.

3. *Stratiomyia badia* Walker. Judging from the large number of specimens taken the species must have been common from July 17-31. All specimens were taken at the Light-house clearing (I, 7). At Sandusky the species appears in numbers on flowers of White Sweet-clover and milkweeds, and specimens are often seen with the pollen-masses of the latter plant clinging to their feet. The Isle Royale specimens are typical in coloration but are slightly larger on an average than other specimens I have seen. The type locality is New Hampshire but its range is known to extend over a large part of northeastern North America.

Family *Tabanidae*.

4. *Chrysops carbonarius* Walker. Specimens were taken along the McCargoe Cove trail and at the head of Rock Harbor (III, 3), July 11-14. This is usually a northern species but has been taken on the eastern coast of the United States as far south as North Carolina. It belongs to the group without an apical spot and is closely related to *mitis*, the species next considered, and from which it is separated by the presence of a hyaline spot at the base of the fifth posterior cell. In these specimens this spot is very small, sometimes making it difficult to say to which species they really belong. As a usual thing specimens of *carbonarius* are noticeably smaller than specimens of *mitis*.

5. *Chrysops mitis* Osten Sacken. A number of specimens taken along the McCargoe Cove Trail, July 11, are of this species. As stated above the difference between this species and the former is not always apparent, but the specimens with the fifth posterior cell uniformly infuscated at its base are usually decidedly larger than the others. This is quite noticeably in the Isle Royale specimens. The type locality for the species is the Lake Superior region, therefore these specimens should be and are very nearly typical. Specimens of *carbonarius* from farther east usually have a distinct hyaline spot at the base of the fifth posterior cell and therefore are easily known.

6. *Chrysops frigidus* Osten Sacken. A single specimen taken August 7, by B. F. Savery (V, 3) answers the description of this species very well. Here the abdomen is variable in coloration in a series of specimens, but the wing markings are nearly constant. I have never observed or heard of the species being so abundant and troublesome as other members of the genus. Type locality Great Slave Lake and other northern regions, but it is now known from as far south as Ohio and New Jersey.

Tabanus affinis Kirby. Taken July 2, on Mackinaw Island, Michigan. A species with hairy eyes, measuring nearly 20 millimeters in length, the abdomen is broadly red on the sides and the palpi are long and slender. The type locality is Boreal America and the species may be expected anywhere from Maine to British Columbia. This specimen is typical for the species.

7. *Tabanus epistatus* Osten Sacken. Three specimens taken at Light-house clearing (1,7) July 8, 11 and 31. Similar to the last in coloration and general appearance, but smaller and the palpi are robust. Type locality Hudson Bay Territory, but now known to be widely distributed in northern United States and Canada south to Ohio and New Jersey.

8. *Tabanus lasiophthalmus* Macquart. A single specimen taken at Rock Harbor, in July, by Adams. The eyes are hairy, the abdomen is red on the sides and the size is near that of *epistatus*. The cross-veins are margined with fuscous making the wings appear spotted, a character which serves to separate it from *epistatus* and most other northern species with hairy eyes. Type locality Carolina, but it is distributed over northeastern North America south to Georgia and west to Illinois.

9. *Tabanus nivosus* Osten Sacken. Several specimens taken at Light-house clearing (I, 7) July 11, 26 and 28; (V, 3) August 7 and 9. Length about 15 millimeters with a row of large white blotches or spots on each side of the abdomen; wings clear hyaline; general color blackish. Type locality New Jersey, and known from New York and Ohio.

10. *Tabanus* sp. Specimens taken at Light-house clearing (I, 7), July 18 and 22. This, I take it, is a distinct species but it may be one of Walker's obscure forms and I hestitate to name it specifically until more material is available. The size is near that of nivosus, but the general color is reddish, and the white markings on the sides of the abdomen are not so conspicuous. There are a number of other characters which distinguish it.

11. *Tabanus illotus* Osten Sacken. Specimens taken at Light-house clearing (I, 7), July 7, 11 and 25; and (III, 3), July 14, and August 5. Eyes hairy, abdomen with a row of white spots on each side, wings with the front part of the basal half clouded with fuscous, but otherwise hyaline. The species is near the size of nivosus and appears much like that species. Type locality Hudson Bay Region, but at the present time known from Alaska and various parts of the British Possessions. Specimens from Isle Royale have the white spots on the sides of the abdomen larger than in some specimens I have observed.

12. *Tabanus insuetus* Osten Sacken. A single specimen taken by B. F. Savery August 9, (V, 3). This is the only species known from the western states, with the hairy eyes and ocelligerous tubercle absent and therefore falls in the genus *Atylotus* of some authors. Type locality Weber Lake, California. Now known from Alaska, British Columbia and several of the northwestern states.

13. *Tabanus astutus* Osten Sacken. (?) Several specimens taken at Light-house clearing (I, 7) July 26 and 28, and (V, 3) August 7 and 15, by B. F. Savery. These specimens come nearer agreeing with *astutus* than any other species I know, but there are some points in which they do not agree and for that reason I have named them *astutus* with a question. Walker described a number of species from the far north that have never been identified since. It is therefore with much interest that I receive such collections as the present. Although a number of species have a wide north and south distribution in boreal regions every collection from the north is apt to contain something of interest.

Family *Bombillidae*.

14. *Anthrax morio* Linn. Two specimens taken at Light-house clearing (I, 7), July 11 and 26. *Anthrax seminigra* and *morio* are believed to be synonyms. The species is common to Europe and North America and is distributed in the latter country from Maine to British Columbia. Nearly the basal two-thirds of the wing is black, the remainder hyaline. The outer margin of the black is irregular and begins on the costa near the apex and proceeds obliquely, gradually nearing the base.

15. *Anthrax fulviana* Say. A single specimen taken July 26, (III, 3). The whole body of this Insect Is clothed with denlse yellow pile, the legs are black and the wings hyaline with costal margin and narrow, base black. Type locality Pembina, Minnesota, and besides it has been taken in New Mexico, Washington and British Columbia.

Family *Therevidae*.

16. *Thereva frontalis* Say. Two specimens taken at Light-house clearing (I, 7) July 29, and (V, 3) August 9. Type locality Northwest Territory and specimens are at hand from Montreal, Colorado and British Columbia. The Isle Royale specimens are rather larger in size than other specimens I have seen but agree closely In coloration with Colorado examples. Those at hand from British Columbia are slightly more brownish, but the thoracic and abdominal markings are of the same form and extent in all.

Family *Asilidae*.

17. *Cyrtopogon chrysopogon* Loew. Taken at Light-house clearing (I, 7), July 6 and 10. Type locality Massachusetts. Known from Montreal, Quebec, New Jersey, New York and Florida. This record extends the westward range of the species considerably. It is black with the beard straw-yellow and the bases of all the tibiae red.

18. *Dasyllis astur* Osten Sacken. Taken at Light-house clearing (I, 7), July 7. The two specimens that I include under this name do not fully agree with the original description of the species but are nearer it than to *posticata*, and as Osten Sacken indicates certain variations in his description the specimens are given this name. In typical *astur* from British Columbia the pile on the anterior dorsum of the thorax is largely black and that on the tibiae yellow. In the Isle Royale specimens the pile on the anterior dorsum of the thorax is all yellow and that on the tibiae is black. Osten Sacken observed that specimens of *astur* taken at low altitudes had the pile on the tibiae black, and as the size agrees I believe it proper to place the specimens in this way. Type locality California, but otherwise known from Oregon, Washington and British Columbia.

19. *Asilus annulatus* Williston. Three specimens taken August 5 (V, 3). Known from northeastern North America, as far west as Kansas. The specimens appear to be typical for the species.

Family *Dolichopodidae*.

20. *Hydrophorus philombrius* Wheeler. A number of specimens taken July 11 (I, 1). I suspect there are plenty of species of this family in the Isle Royale locality but this is the only one included in the collection sent for study. The type locality is Milwaukee County, Wisconsin, and it is also recorded from Texas. These specimens are typical, agreeing in detail with the original description and figure.

Family *Syrphidae*.

21. *Chrysotoxum ventricosum* Loew. Specimens taken July 7, at Light-house clearing (I, 7). The family *Syrphidae* is a most attractive family of flies and the genus to which this species belongs is one of its finest

groups. The various species are mostly found in northern regions or at high altitudes, and are easily recognized by the oblique yellow abdominal markings and elongate antennae. This one is the largest American species of the genus and was first described from specimens taken in the District of Columbia. It is now known from New Jersey, Canada and Arizona.

22. *Pyrophaena granditarsus* Forster. A female specimen taken July 28, at Light-house clearing (I, 7). This is the same species that formerly passed under the specific name *ocymi*. It is common to Europe and North America and in the latter country is distributed from New England to British Columbia. The two sexes are very different in appearance and to some extent in structure, and it is from the front tarsi of the male that its specific name is derived.

23. *Platychirus peltatus* Meigen. Taken July 25, (II, 1). Common to Europe and North America. Widely distributed in northern North America from New England to British Columbia and Alaska.

24. *Platychirus hyperboreus* Staeger. Taken at Light-house clearing (I, 7) July 23 and 26. Type locality Greenland but widely distributed in North America. As with most species of the genus only the males can be identified satisfactorily by the known characters.

25. *Melanostoma angustatum* Williston. Specimens taken July 23 and 26, at Light-house clearing (I, 7). Type locality, state of Washington. Known also from the White Mountains and British Columbia.

26. *Syrphus americanus* Wiedemann. One specimen taken July 22, at Light-house clearing (I, 7). The species is abundant and somewhat variable in coloration and is distributed over nearly the whole United States and Canada. The larvae have been observed feeding on the grain Aphis.

27. *Syrphus diversipes* Macquart. Specimens taken August 4 and 7, (V, 3). Type locality Newfoundland. Distributed from New York to British Columbia and Alaska, reaching as far south as southern Ohio.

28. *Syrphus genualis* Williston. Taken July 24, at Light-house clearing (I, 7), July 25, (II, 1). Type locality New Hampshire and recently reported from Beulah, New Mexico.

29. *Syrphus ribesii* Linn. Specimens taken July 24 and 26 at Lighthouse clearing (I, 7). Common to Europe and North America. This is one of the most common members of the family and is almost sure to be included in local lists of Diptera as it is distributed over nearly the whole of North America. The larvae are of importance as they feed on various species of plant lice. One often sees a colony of plant lice with one of the syrphid larvae in the midst of them, and he cannot help becoming interested if he observes for a short time and endeavors to count the number of plant lice a larva is able to devour in a given time under favorable conditions.

30. *Sphaerophoria cylindrica* Say. Specimens taken July 25, 26, and 28 at Light-house clearing (I, 7) and July 25, (II, 1). Type locality Pennsylvania. Common over a wide range and included in many local lists. The larvae are reported as feeding on the grain Aphis and on that account the species is of interest to the economic entomologist. The sexes are quite different from one another and one is not likely to associate them on first acquaintance.

31. *Eristalis dimidiatus* Wiedemann. Specimens taken July 22, 24, 25 and 26 at Light-house clearing (I, 7), August 4 (V, 3) and July 25 (II, 1). About 40 specimens of this species were procured indicating that it is as common at Isle Royale as at other places. The larvae of the various species of *Eristalis* are what are known as rat-tailed larvae and are found in shallow water in swampy places or at the outlet of sewers and drains. Each larva is furnished with a posterior appendage which can be lengthened and shortened at will and which contains the posterior parts of the tracheal trunks. At the free end of the appendage are the two posterior spiracles which are kept at the surface of the water. Thus the larva is fitted so it can remain beneath the water and yet get the necessary air for carrying on respiration. The adults are common around flowers in autumn, sometimes several species visiting the same patch of asters or goldenrods as the case may be. *E. dimidiatus* is found all over eastern North America from Florida to Canada and west to Kansas.

32. *Eristalis bastardii* Macquart. Specimens taken August 4 (V, 3). I have observed this species at midday when the sun was shining, flying actively over water and have taken them in numbers at such times with a net. It is common over the greater part of northeastern North America, being found as far south as the District of Columbia.

33. *Helophilus similis* Loew. Specimens taken July 26 and 28 at Light-house clearing (I, 7). The members of this genus are peculiar in that the eyes are separated in the male as well as the female. This species is often taken in early spring from the blossoms of willow and other early flowering plants. The type locality is Georgia but it appears to be more common northward where its range extends from the Atlantic to the Pacific.

34. *Mallota cimbiciformis* Fallen. Specimens taken July 23 and 26 at Light-house clearing (I, 7). Common to Europe and North America and widely distributed over the eastern part of the latter country. The species has a resemblance to certain species of *Eristalis*, but the greatly thickened hind femora are distinctive.

35. *Xylota curvipes* Loew. One specimen taken July 26, at Lighthouse clearing (I, 7). The genus *Xylota* contains upwards of 40 North American species which in the main are reasonably easy to separate, and for that reason it is an attractive group. Various species are often observed resting on logs in damp places or that lie across small streams. In many the abdomen is distinctly elongated and the hind femora are swollen. *X. curvipes* is common

to Europe and North America, being most often taken in northern latitudes.

36. *Xylota fraudulosa* Loew. One specimen taken August 12 (V, 3). Type locality Illinois, but known in northern North America from New England to Washington reaching south to Ohio and Nebraska.

37. *Xylota pigra* Fabr. One specimen taken July 22 at Light-house clearing (I, 7). Common to Europe and North America and generally distributed over the United States and Canada. The adult has been reared from a larva taken from under the bark of a pine tree.

38. *Temnostoma aequalis* Loew. Specimens taken July 17, 22, 23, 24, 26 at Light-house clearing (I, 7) and July 25 (II, 1). This fly has somewhat the appearance of the common bald-faced hornet and one usually thinks the second time before taking it in his hand. In Ohio various species of the genus are to be found around rotten logs where the females oviposit and the larvae pass their lives as such. Type locality, English River, Hudson Bay Region. Otherwise known from New England and Colorado. The Isle Royale specimens vary slightly in abdominal and thoracic markings but on the whole agree very well with the original description.

39. *Temnostoma bombylans* Fabr. One specimen tnken July 17, at Light-house clearing (I, 7). Common to Europe and North America and widely distributed in the latter country, having been taken as far south as southern Ohio.

Family *Tachinidae*.

40. *Peleteria robusta* Wiedemann. One specimen taken July 26 at Light-house clearing (I, 7). This species is reported as occuring from Argentina to Canada and from the Atlantic to the Pacific. Wiedemann's types were taken in South America. The Isle Royale specimen has less red at the tip of the abdomen than most Ohio specimens.

The family *Tachinidae* contains a large number of species and nearly all of them are of more or less interest to the economic entomologist on account of their parasitic habits. Many injurious insects have one or more Tachinid parasites which aid in holding them in check.

41. *Echinomyia algens* Wiedemann. Two specimens taken July 14 (III, 3) and July 26 at Light-house clearing (I, 7). The types were taken in North America, but the exact locality is not given. Recent writers have reported the species from many points in Mexico and northward. It is said to be parasitic on the larvae of the moth, *Hadena lignicolor* Guenée.

Family *Sarcophagidae*.

42. *Sarcophaga sarraceniae* Riley. Flesh Fly. A specimen taken July 11 at Light-house clearing (I, 7). This is our common flesh fly, and is an important scavenger. Type locality Missouri. The species of *Sarcophaga* are not well understood in America and it may be that this is a synonym. However the name is included in many local lists of Diptera which indicates a wide range for the species.

43. *Lucilia caesar* Linn. Carrion Fly. Four specimens taken July 25 (II, 1), July 26 at Light-house clearing (I, 7) and August 5 (V, 3). Known from Europe and America. A very common carrion fly everywhere. Along the shores of the Great Lakes its larvae feed largely upon the carcases of fishes cast on the beach by the waves.

44. *Callophora viridescens* Desv. Blow Fly. Three specimens taken July 25 (II, 3) and August 7 (V, 3). This is one of the common blow flies and is widely distributed in Europe and America.

45. *Cynomyia cadaverina* Desv. Two specimens taken July 8 (I, 1). Carolina is the type locality but the species is found in most localities in the United States and Canada.

46. *Phormia terraenovae* Desv. A specimen taken August 4 (V, 3). Type locality Newfoundland. Generally distributed over North America, especially northward.

Family *Muscidae*.

47. *Musca domestica* Linn. House Fly. A specimen taken August 7 (V, 3). This species needs no particular comment here. It is found in nearly all parts of the world and has lately been proven to be connected with the transmission of typhoid fever.

Family *Anthomyidae*.

48. *Hyetodesia serva* Meigen. Five specimens taken July 11, 23 and 24 at Light-house clearing (I, 7) and August 4 (V, 3). This European species has been reported for America, but its distribution is not well understood. I have compared these specimens carefully with Schiner's description and find that they agree well, but as the group is very rich in species their determination is not always an easy matter.

Family *Sciomyzidae*.

49. *Tetanocera plebeia* Loew. A specimen taken July 26 at Lighthouse clearing (I, 7). Type locality Middle States. Specimens are at hand from British Columbia and other localities. The members of this genus are often common in marshy and damp places.

50. *Sepedon pusillus* Loew. Two specimens taken in a swamp in Cassandra and Sedge Zone (V, 2), by Max M. Peet. Type locality Middle States. Known from Ohio, New Jersey and White Mountains, New Hampshire. The various species of this genus are usually found in swamps where they may be observed flying over water.

ANNOTATED LIST OF ISLE ROYALE HYMENOPTERA.

E. G. TITUS, ENTOMOLOGIST, UTAH AGRICULTURAL EXPERIMENT STATION.

The determinations in this group were made in Washington at the U. S. National Museum, Mr. J. C. Crawford and myself working over most of the material together. Mr. Theodore Pergande, Bureau of Entomology, determined the two species of ants represented in the collection. The general collection of ants are reported up.on elsewhere by Dr. W. M. Wheeler. Mr. W. F. Fiske, at that time in the Forest-Insect section of the Bureau of Entomology, very kindly determined the Ichneumons and Siricids, both of which groups he had been working with for several years. At the time the determinations were made the writer had no expectation of writing up the notes or he would have doubtless been able to add considerable to their value by making further notes on the specimens retained at the National Museum.

Bombidae.

Bombus terricola Kby. (Det. Crawford.) T hree on flowers of *Opulaster* (II, 1) (14): about camp at Rock Harbor several specimens (133, 166 three, 179, 191) and one specimen (222) around camp at Siskowit Bay.

Geographic Range: Originally described from Canada; Kirby, 1837. Also reported by Provancher from region around Montreal and by other authors from various localities in Northern United States east of the Rocky mountains and as far south as Colorado. I have seen specimens from Massachusetts, New York, Illinois, Kansas and Colorado.

Bombus consimilis Cress. (Det. Crawford.) Two were taken around camp at Rock Harbor (36, 45).

Geographic Range: Described from New York, Cresson 1864, p. 41 and reported by Packard, 1864, p. 112.

Bombus sp. One flying over beach at end of Conglomerate bay (31); one on flowers of *D. trifida* on a jack pine ridge (23); and two about camp at Rock Harbor (A. 5, 98). These all seem to represent one species but neither Mr. Crawford or myself care to name it in the present unsettled condition of the group.

Psithyrus latitarsus Morrill (Det. Crawford.) Two around camp clearing at Rock Harbor (A 36, 45).

Geographic range: Desc. from Montana by Morril 1903, p. 224.

Megachilidae.

Monumetha albifrons Kby. (Det. Titus.) One specimen flying over ridges near Conglomerate bay, (68).

Geographic range: Desc. by Kirby 1837, p. 270 from "Lat. 65°"; again by Cresson 1864, p. 387, 388, as three separate new species from Colorado, Pikes Peak, and Slave Lake. It probably occurs over all the region from the Mackenzie river and Upper Hudson bay to the lower Rocky Mts. areas in New Mexico and westward to the Pacific. (Titus 1906, p. 158, Cockerell 1906) (1 and 2). Nothing is known of its breeding habits. I have specimens from eastern Canada and New England but have seen none from south of New York along the Atlantic region. There are mites on the Isle Royale specimens.

Xanthosarus melanophæa Smith. (Det. Titus). Taken on jack pine ridge (108); about camp at Rock Harbor (133, 166 eleven) and on flowers of *Campanula rotundifolia* in clearing at Siskowit Bay (148, 202).

Geographic range: Described from British America, Smith 1853, p. 91 and known to occur throughout the region of southern Canada, New England, New York, and in northern United States to the Pacific coast and in British Columbia. This and the following species are leaf-cutters working especially on the leaves of Rosa spp., the pieces clipped out are used in lining their nests which are usually made in old logs or dead trees, the female often utilizing the abandoned boring of some other insect. The little rolls are often found when splitting logs or wood in the fall or winter.

Xanthosarus latimanus Say. (Det. Titus). Very frequently taken about the camp clearings at Rock Harbor and Siskowit Bay (38, 49, 68, 133, 137, 153, 179, 231); also at sand beaches at head of Conglomerate bay (31); on jack pine ridges (68, 1-8); near Neutson's resort (121); on flowers of *Opulaster* (148); and on flowers of *Campanula rotundifolia* (202).

Geographic range: Described from "Arkansas" by Say 1823, p. 81, which may mean any where from Missouri to Colorado. It is one of the most common species in the United States and Canada, occurring from coast to coast and from the Gulf northward.

Anthemois sp. near *infragilis* Cresson (Det. Titus). This specimen was taken around camp at Rock Harbor (86). While it bears a close resemblance to *A. infragilis* there are sufficient differences to make it a good species and probably new. *A. infragilis* was described from New York and probably occurs in the Isle Royale region, since I have seen specimens from Canada (Titus 1906, p. 152).

Stelidae.

Cœlioxys moesta Cresson. (Det. Titus). One on flowers of *Campanula rotundifolia*, in clearing at Siskowit Bay (202) (V, 2).

Geographic range: Described from Connecticut, Cresson, 1864, p. 403; reported by Provancher, 1882, p. 241, 1883, p. 725 as *tristis*, from Canada. Occurs westward to Colorado, New Mexico and probably Utah.

Chelynia nitida Cresson. (Det. Titus). One specimen about camp at Rock Harbor (26).

Geographic Range: Desc. from New York by Cresson, 1878, as a *Stelis* and from Canada by Provancher, 1888, p. 322 as *Chelnia labiata* and in Panurgidae. Ashmead, 1896, p. 283, erected the genus *Melanostelis* for his species *betheli*, which is congeneric with *nitida* (Titus, 1906, p. 161).

Andrenidae.

Halictus lerouxii Lepeletier. (Det. Crawford). One specimen about camp at Rock Harbor (133).

Geographic range: Described by Lepeletier 1841, p. 272 from "Am. Boreal." Occurs at least as far west as Illinois, Robertson, 1893, p. 146,

Halictus versans Lovell. (Det. Crawford). Five specimens on flowers of *Physocarpus* in Ransom clearing (II, 1), (148).

Geographic range: Described from Maine by Lovell.

Prosopidae.

Prosopis basalis Smith. (Det. Crawford and Titus). One about clearing at Rock Harbor (166).

Geographic range: Described from Hudson's Bay by Smith, 1853, p. 23 and occurs from the upper Atlantic coast to at least the mountains of Colorado.

Prosopis species. (Det. Crawford). On flowers of *Opulaster* (V, 2) behind camp at Siskowit Bay (203); in camp clearing at same place (212) and two unmarked specimens. There may be two species involved here but we were unable to specifically determine them. The species of the genus breed in stems of small plants.

Crabronidae.

Crabro singularis Smith. (Det. Crawford). One specimen on sand beach on a jack pine ridge near Conglomerate bay, (108).

Geographic range: "Canada and United States."

Solenius sp. (Det. Titus and Crawford). One specimen about camp at Rock Harbor, (179).

Pemphredonida.

Diodontus adamsi n. sp. Titus (Det. Titus and Crawford). On sand beach with *Ammophila* at end of Conglomerate bay (31). Notes on *Ammophila* will apply to this species.

♀ Length 7.1 mm. Black, with scattered silvery pubescence, especially abundant on face; clypeus projecting, with two sharp teeth wide at the base, tips of mandibles reddish, palpi brown; tegulae brown, yellow in front; wings slightly infuscated; tibiae and tarsi reddish brown.

Sphegidae.

Ammophila sp. (Det. T. & C.). Three on sand beaches at head of Conglomerate bay (31); one near Tonkin bay (41); and one about camp at Rock Harbor (133). The normal habitat of this species of sand-wasp is on the sand beaches. They fly rapidly about at a height of 3-15 centimeters over the sand or gravel, alighting only on the sand. This group all store their nests with caterpillars, the holes being usually in quite hard ground. They are very sldllful in removing or covering up all traces of the place where they have worked, often going to much more labor than the occasion would seem to require. Peckhain and Peckhain, 1898, pp. 6-32, have a very interesting chapter on this subject.

Psammophila sp. (Det. T. & C.). One specimen from rock clearing near outlet of Siskowit lake (V, 9) (215).

Ceropalidae.

Entypus americanus Pal-Beauv. (Det. T. & C.). One specimen (235) captured with a specimen of *Lycosa kochi* Keys. (Det. Banks). The wasp was backing over the ground, dragging the spider, at brief intervals it dropped its prey and ran rapidly back and forth looking for its hole. It apparently had a general idea of the direction in which the nest lay but had to walk right to it in order to be certain of its location. Even a couple of centimeters was not close enough. Having found the nest the wasp searched in the same way for the spider and was backing away with it in a direct line for the hole when both were captured.

Geographic range: Della Torre gives "United States." It was described by Palisot-Beauvois, 1811, p. 117. Peckham and Peckham, 1898, pp. 125-166, describe the labors of several species belonging to this group and call them "The Spider Ravishers."

Vespidae.

Vespa diabolica Saussure. (Det. T. & C.). One specimen about camp clearing at Rock Harbor (166). Described by Saussure, 1853, p. 138. Occurs fairly common throughout the eastern United States and Canada. There have been many errors in determining species of this group so that one can hardly state the distribution of any species.

Euminidae.

Ancistrocerus capra Sauss. (Det. T. & C.). One taken about camp at Rock Harbor (133).

Geographic range: Saussure 1857, p. 273. Known to occur in northern United States and eastern Canada.

Ancistrocerus pertinax Sauss. (Det. T. & C.). Two on flowers of *Heracleum lanatum* in camp clearing at Rock Harbor (105). This species may be a true *Odynerus*. All of this group are predaceous and these probably store their nests with caterpillars. Their habits are varied,

some boring in one plant or substance and others using old burrows.

Geographic range: Saussure, 1856, p. 216. Known from northern and eastern United States and Canada.

Eumenes sp. (Det. T. & C.). One in Cladonia clearing behind camp at Siskowit Bay (201). This genus are the so-called "jug-makers" or "mason-wasps" and store their nests with small caterpillars.

Formicidae.

Formica sp. (Det. Pergande). One specimen in camp clearing at Siskowit Bay (231).

Camponotus pennsylvanicus Degeer. (Det. Pergande). One from Station IV, 1 (130), another found running over smooth sand bleach at head of Conglomerate bay (31); one at camp at Rock Harbor (104) and others at Siskowit Bay camp (212, 222 eleven, and 232). A very common species throughout eastern United States and Canada.

Chrysididae.

Chrysogona verticalis Patton. (Det. T. & C.). One specimen about camp clearing Siskowit Bay (239).

Geographic range: Described by Patton 1879, p. 67, and afterward noted by Aaron 1885, p. 226, from California and Provancher 1887, p. 215, from Canada.

Evaniidae.

Gasteruption incertus Cresson. (Det. Fiske). One at camp at Siskowit Bay (239). Mr. Fiske placed this in *Foenus* which Ashmead makes a synonyn of *Gasteruption*.

Geographic range: "Canada, Colorado" Cresson. All of this genus that have been bred were found parasitic on some species of wasp or bee.

Gasteruption tarsitorius Say. (Det. Fiske). One taken at Siskowit bay camp clearing (A. 152).

Geographic range: Eastern United States and "Canada."

Aulacus rufitarsus Cresson. (Det. Fiske). One at Rock Harbor (133); and others at Siskowit Bay (A. 152, 212 five, 231 two, 239).

Geographic range: "Canada, Colorado" Cresson.

Some of the species in this group are parasitic on Cerambycid larvae.

Ichneumonidae.

Pœmenis sp. (Det. Fiske). One about camp clearing Siskowit Bay (231). Probably a parasite on some wood-boring coleoptera.

Pimpla conquisitor Say. (Det. Fiske). One about camp clearing Hock Harbor (179).

Geographic range: "Canada; U. S." Cresson.

Doubtless parasitic on a Lepidopterous larva.

Ephialtes gigas Walsh. (Det. Fiske). One about camp at Siskowit Bay (153).

Geographic range: Described from Illinois, also reported from Canada.

Rhyssa albomaculata Cresson (Det. Fiske). Taken at Rock Harbor clearing (166), and at Siskowit Bay camp clearing (A. 152, 153, 212 six, 222, 231 two, 239).

Geographic range: "Canada; U. S." Cresson.

Species in this genus have been repeatedly bred from the larva of xylophagous saw-flies such as Urocerus. The ovipositors in some species attain the length of six or more inches, with these they are able to reach the larva of the host and lay their eggs even when the unsuspecting victim is living far inside the trunk of a tree.

Braconidae.

Apanteles sp. (Det. C. & T.). One alcoholic specimen without data.It would be impossible to even superficially determine this from the one specimen.

Gymnoscelus pedalis Cresson (Det. Fiske). All taken around camp clearing Siskowit Bay, (A. 152, 212 six, 222 three, 231, 239 six).

Geographic range: Canada, Eastern U. S. Parasitic upon some wood-boring Coleoptera.

Melanobracon sp. (Det. Fiske). Two taken at camp clearing Siskowit Bay (212).

Siricidae.

Urocerus flavipennis Kirby. (Det. Fiske) . All specimens taken in camp clearing, or near it, at Siskowit Bay (A. 152 four, 153, 91, G. 212 two, 209, 228, 231 three, 239 seven). Usually flying with a moderate velocity about the clearing, keeping at average height of 2-3 feet and not alighting. A few were found climbing up and down trunks of balsam trees in which they deposit their eggs.

Geographic range: Vancouver's Island, Kirby 1882, p. 380. Occurs across the continent.

Urocerus flavicornis Fabricius. (Det. Fiske). All taken in or near Siskowit Bay camp clearing and not differentiated at the time from the previous species (195, 201, 212, 241 two).

Geographic range: British America, Fabricius 1781, p. 418; appears to be a more northern species in its range than *U. flavipennis* though they are often taken in same localities.

Tenthridinidae.

Tenthredo mellina Nort. (Det. MacGillivray). One at Rock Harbor (136), others, on flowers of Opulaster in

camp clearing Siskowit Bay (203) and around camp, same place (208).

Geographic range: Canada and U. S.

Cimbicidae.

Cimbex americana Leach. (Det. T. & C.). Taken in rock clearing near water's edge on north side Conglomerate bay (106); also one larva in alcohol which may belong to this or the next species.

Geographic range: The earliest record for this species is Abbot 1792, plate 61, under the name of *femora* to, Linne. Leach described it in 1817, p. 33, and since that time many authors have written upon the species which is rather a common insect throughout most of the regions in North America where willows are found. The larva of this and probably the following species feed on willow leaves.

Cimbex violacea Lepeletier. (Det. T. & C.). July 13. Sta. I, 2 (71 and 55).

Geographic range: Described by Lepeletier 1823, p. 27, from North America and reported by Kirby from British America; also occurs in northern United States.

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