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NOTES ON THE FAUNA OF THE MOOSE RIVER AND THE MATTAGAMI AND ABITIBI TRIBUTARIES.*

BY M. Y. WILLIAMS.

INTRODUCTION.

During a geological trip made in the summer of 1919, between the National Transcontinental railway, and Moose Factory, the writer gathered the information contained in this article, on the fauna of the region.

The trip was made by canoe, from Fauquier on the Transcontinental railway down the Groundhog river to Mattagami river, down this to Moose river and thence to Moose Factory, which is situated below tide water nine miles up river from James bay. The return route was up Moose river to the mouth of Abitibi river, up this river to Frederick House river and up this river to the landing near Clute, fourteen miles northwest of Cochrane.

The journey was commenced on August 1st, and was completed on September 5th. Rainy weather between the 22nd and 28th of August delayed travel, and hindered observations materially.

The region traversed is wooded, except for burnt areas, some of which are old and of large extent. The clay belt as seen at Cochrane extends far down river, with the muskeg areas probably predominating over the clay ridges. High sand hills are crossed in the Abitibi canyon, and are reported elsewhere. The region south of James bay is covered with marine silt which is more fertile than the soil of the clay belt.

The rivers have incised their channels from fifty to two hundred feet into the loose deposits, their character, whether slow, rapid or torrential depending upon the rock outcrops. Above the foot of the Long Portage on Mattagami river, and the Otter portage on Abitibi river, the streams are broken, by many rapids and falls, the intervening stretches of water being either slack or of moderate current: this region is underlain by pre-Cambrian gneisses, and other crystalline rocks. Lower down, the country is underlain by limestone, sandstone and shale, and the rivers have few interruptions, although long stretches of rapids occur where the rock flows over

limestone and shale ledges.

The river banks commonly rise twenty to fifty feet to a narrow terrace. This terrace which averages about 200 feet in depth, slopes upward to the general level of the country, which is principally muskeg,—a floor of spagnum moss, laurel, and Labrador tea, studded sparsely with black spruce. The terraces are well timbered with stands of white birch, white and black poplar, and white spruce. Where the region is underlain by pre-Cambrian rocks, white cedar, Jack pine, and some tamarack occur. At the water's edge, and on the sand-bars, willows and dogwood grow in dense masses, and during the summer, golden rod, and even red clover grow along the banks at favourable places.

A distinct difference is to be noted between the water of Mattagami and Abitibi rivers. The water of the former is dark in colour, but reasonably clear, while that of the latter is very muddy. This probably accounts for the absence on the Abitibi of fish ducks, fish hawks, and other birds which prey upon fish, although these occur commonly on the Mattagami. Fishing on the Abitibi is likewise very poor.

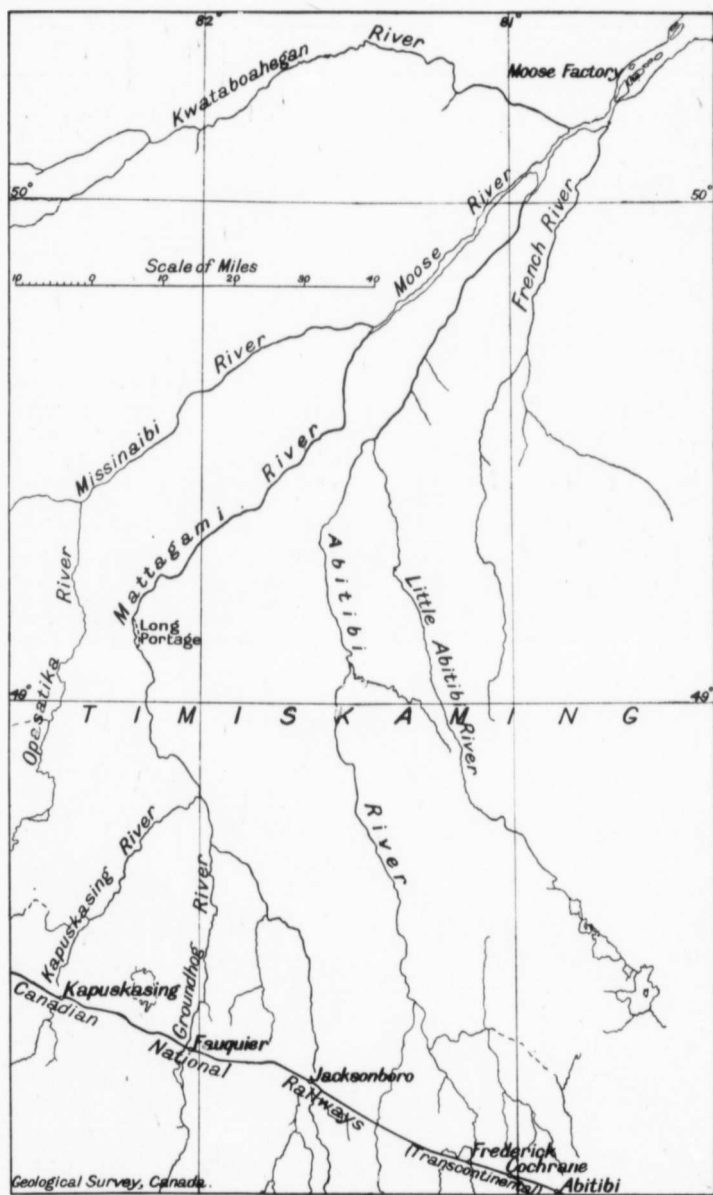
BIRDS.

COMMON LOON, *Gavia immer*. Two seen at mouth of Kapuskasing river on August 4th, flying from the direction of a small lake lying to the east.

HERRING GULL, *Larus argentatus*. Generally common along the Kapuskasing, Mattagami, and Moose rivers from the National Transcontinental railway to Moose Factory, and up as far as the second rapids above the mouth of the Abitibi river. The greatest number were seen on the Mattagami river between the mouth of the Groundhog and the foot of the Long Portage. One was seen at the foot of the Long Rapids on the Abitibi river. Immature birds in grey plumage were seen on three occasions, one being shot near the second rapids above the mouth of the Abitibi river on August 25th. Dates of observation, August 1st to 29th.

COMMON TERN, *Sterna hirundo*. Several seen almost every day spent between Moose Factory,

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Index Map, Moose River and lower Mattagami and Abitibi Rivers, Ontario.

Blacksmith's rapids and on the Abitibi river; dates August 17th to 28th. Two were shot, a male and female, in adult plumage on August 19th and 20th, one on a Bushy island, and one opposite the mouth of the French river.

AMERICAN MERGANSER, *Mergus americanus*. Three adults and several half-grown young were observed on the lower Groundhog river on August 3rd; about thirty young and old on Mattagami above the Long Rapids on August 11th; eighteen off the mouth of Missinaibi river on August 14th; one off mouth of Abitibi river on August 17th.

BLACK DUCK, *Anas rubripes*. Observed as follows:—One near La Duke rapids, Groundhog river, August 3rd; two adults and 2 immature on the lower Groundhog on August 3rd; one immature being shot; thirty off mouth of Abitibi on August 17th; two shot on Abitibi river, four miles above its mouth; one seen at second rapids of Abitibi river; ten about ten miles below Blacksmith rapids of Abitibi river; eight just below Coral Portage of Abitibi river.

GOLDEN-EYE, *Clangula clangula*. A pair on ponds below Long Portage, Mattagami river, August 8th, the female collected. A few others, not identified with certainty along Moose river.

CANADA GOOSE, *Branta canadensis*. One adult in pond at mouth of Pike creek, Mattagami river; one immature at Grand Rapids, Mattagami river; five seen on Abitibi river at second rapids above its mouth.

GREAT BLUE HERON, *Ardea herodias*. One at La Duke rapids, Groundhog river; one at New Post, Abitibi river.

CRANE, *Grus canadensis*, sp.? Fresh tracks on sand bar at low tide, on Moose river, opposite mouth of French river, August 20th. Tracks of three toes, rather thick, and about two inches in length.

WILSON'S SNIPE, *Gallinago delicata*. One seen at Moose Factory, August 18th.

SEMPALMATED SANDPIPER, *Ereunetes pusillus*. One male shot at foot of Long Rapids, Abitibi river.

GREATER YELLOW-LEGS, *Totanus melanoleucus*. One came into camp on Long Portage, Mattagami river, August 6th; three seen on Moose river at mouth of Abitibi river August 17th; five on Bushy island, August 19th; two opposite mouth of French river, August 20th; three at mouth of Abitibi August 21st; two at mouth of Abitibi river, August 23rd.

SPOTTED SANDPIPER, *Actites macularia*. Two seen at Cochrane, July 30th. Several were seen almost every day of the journey between August 1st and September 1st. One immature bird was collected on Moose river opposite the mouth of the French river, August 21st.

SEMPALMATED PLOVER, *Aegialitis semipalmata*. A flock of thirty seen at Moose Factory, August

18th; a flock, probably of this species on Abitibi river about 4 miles above its mouth, on August 23rd.

RUFFED GROUSE, *Bonasa umbellus*. One male taken on the Little Long Portage of Mattagami river, August 5th; two immature taken at Blacksmith rapids, Abitibi river, August 28th, and two more seen.

MARSH HAWK, *Circus hudsonius*. One seen at mouth of Missinaibi river, August 14th; and others seen on Moose river, as follows:—one at Grey Goose island, August 15th; one at crossing of Niven's line, August 16th; one at Bushy island, August 19th; one at mouth of French river, August 20th; one at mouth of Abitibi, August 21st. One was seen at the Coral portage on the Abitibi river on August 30th. All were in brown plumage.

SHARP-SHINNED HAWK, *Accipiter velox*. One seen on Long Portage, Mattagami river, August 8th. A small hawk, probably of this species at Niven's line on Moose river, August 16th. On Abitibi river as follows:—one about 4 miles above mouth August 23rd; one near Niven's line, August 26th; one at foot Long Rapids, August 29th; one at Coral Portage, August 30th; one at Red Sucker Creek, September 3rd; one at Cochrane, September 6th.

COOPER'S HAWK, *Accipiter cooperi*. Doubtful identifications. Niven's line, Moose river, August 16th; and second rapids above mouth of Abitibi river, August 24th. Two birds were clearly recognized as belonging to this species, one about ten miles below Blacksmith's rapids on the Abitibi river, August 27th, and the other at Blacksmith's rapids, on August 28th.

RED-TAILED HAWK, *Buteo borealis*. One at Hamilton rapids, Groundhog river, August 2nd; one at Pike creek, Mattagami river, August 11th; a fine adult with red tail at mouth of Missinaibi river, August 14th.

EAGLE, *Haliaeetus leucocephalus*, sp.? A dark-coloured eagle was seen near the crossing of Niven's line on Moose river, August 16th.

AMERICAN SPARROW HAWK, *Falco sparverius*. Five seen at Cochrane, July 30th. Two birds of this species, or else *columbarius* were seen along the lower Groundhog river. Birds satisfactorily identified were seen, one on the Long Portage of Mattagami river, on August 7th; one at the mouth of Missinaibi river on August 14th; two at the crossing of Niven's line on Moose river on August 16th; one at the mouth of Red Sucker creek, Abitibi river, September 3rd; and one at Cochrane, September 6th.

OSPREY, *Pandion haliaetus carolinensis*. Two were seen at the lignite claims on Mattagami river on August 11th, and one the following day at the Grand Rapids. On Moose river, two were seen at

the crossing of Niven's line, August 16th, and one at the mouth of Abitibi river on August 17th. On Abitibi river one was seen at the foot of the Long Rapids on August 29th, and one at the Coral Portage on August 30th.

GREAT HORNED OWL, *Bubo virginianus*. One seen at Three Carrying places, Abitibi river, Sept. 4th, and one was heard that night at our camp a few miles up Frederick House river.

HAWK OWL, *Surnia ulula*. One seen west of Cochrane, July 29th.

BELTED KINGFISHER, *Ceryle alcyon*. One seen at Cochrane, July 29th. Commonly distributed along the lower Groundhog, Mattagami, Moose, and Abitibi rivers, two or more being seen almost every day throughout the trip. The muddy waters of the Abitibi river did not appear to have the same influence on the distribution of the Kingfisher, as on most other fish-eating species. In all between thirty-five and forty individuals were seen between August 1st and September 5th.

ARCTIC THREE-TOED WOODPECKER, *Picoides arcticus*. None seen on rivers, but one individual seen on September 5th in a grove about nine miles northwest of Cochrane.

YELLOW-BELLIED SAPSUCKER, *Sphyrapicus varius*. One immature male shot on island at mouth of Missinaibi river, August 14th.

PILEATED WOODPECKER, *Phlocotomus pileatus*. A note probably made by this species was heard by the writer near Clute, twelve miles northwest of Cochrane, September 5th.

FLICKER, *Colaptes auratus*. Several seen at Cochrane, July 28th. Two seen on Mattagami river, one opposite mouth of Pike creek, August 11th, and one at Grand Rapids on August 12th. On Abitibi river, one below Niven's line, August 25th, one at same location on August 26th; one at foot of Long Rapids on August 29th; one near mouth of Frederick House river, September 4th.

NIGHT HAWK, *Chordeiles virginianus*. Two were seen at Cochrane, July 29th. Several seen every day between the lower Groundhog and the Long Portage, of Mattagami river, August 3rd to 8th, and several seen each day between the Grand rapids of Mattagami and Grey Goose island, Moose river, August 12th to 15th.

CANADA JAY, *Perisoreus canadensis*. Probably much more common than the number observed would indicate, due to their habit of remaining in seclusion until the camp site is abandoned. One heard on Groundhog river, August 1st; Mattagami river, Long Rapids, one seen each day, August 7th, 8th, and 9th. Moose river, one seen opposite mouth of French river, August 20th; Abitibi river, heard near mouth, on August 23rd and 24th; two seen near second rapids above mouth on 24th; one near

Niven's line on 25th; four at same locality on 26th; two at Blacksmith's rapids on 28th; one at foot of Long Rapids on 29th; two at Coral portage on 30th. One male collected near New Post on September 1st.

RAVEN, *Corvus corax*. Seen on Mattagami river, as follows:—one below mouth of Groundhog, August 3rd; two on Long Portage, August 10th, and one on 11th; three at mouth of Missinaibi, August 14th; two on Moose river, near Niven's line, August 16th. On Abitibi river:—one at mouth, August 17th; one at Second rapids above mouth, August 24th; one at Blacksmith's rapids, August 28th, one at foot Long Portage, August 29th; one at Coral Portage, August 30th; one at New Post, September 1st; one at Frederick House, September 4th.

AMERICAN CROW, *Corvus brachyrhynchos*. Several seen at Clute, September 5th.

HOUSE SPARROW, *Passer domesticus*. Three seen at Moose Factory, August 18th. Mr. McLeod, Factor at New Post, but formerly of Moose Factory, says that the sparrows came to Moose Factory about eight years ago, and that many die every winter.

AMERICAN GOLDFINCH, *Astragalinus tristis*, sp.? Fifteen birds probably of this species, but possibly Pine Siskins, were seen on the Lower Groundhog river, August 3rd.

SAVANAH SPARROW, *Passerculus sandwichensis*. One specimen taken at the foot of the Long Portage, Mattagami river, August 8th. These sparrows are so dark in colour as to be quite unlike the Savannah sparrows of Southern Ontario; the commonest sparrow of Moose river and the tributaries travelled.

WHITE-THROATED SPARROW, *Zonotrichia albicollis*. Fairly common, being either seen or heard almost every day of the trip. In song until August 27th.

JUNCO, *Junco hyemalis*. Well distributed. Mattagami river:—Long Portage, several August 8th; Pike Creek, two August 11th; Grand Rapids, two, August 13th. Abitibi river:—mouth, two August 17th; four miles above mouth, two, August 23rd; at Second rapids, above mouth, common, August 24th; Blacksmith's rapids, two, August 28th; Long portage, several September 2nd; Frederick House, river, common, Sept. 5th.

SWAMP SPARROW, *Melospiza georgiana*. Birds doubtfully referred to this species were seen August 13th and 14th, on the Grand rapids of Mattagami river, and again on the Second rapids above the mouth of the Abitibi river, on August 24th.

TREE SWALLOW, *Iridoprocne bicolor*. Several observed on the Groundhog river on August 2nd and 3rd, and on Mattagami river at the Long rapids on August 7th. A single bird at the second rapids above the mouth of the Abitibi on August 24th.

BANK SWALLOW, *Riparia riparia*. Nests common along Grand Rapids of Mattagami river, and also on Moose river near Niven's line. Six birds seen near mouth of Abitibi river, August 17th. Nests common near Niven's line on Abitibi river.

CEDAR WAXWING, *Bombocilla cedrorum*. On Groundhog river common August 1st to 3rd. Several on Little Long Portage, Mattagami river, August 5th. Several at Bushy island, Moose river, August 20th. Heard on Lower Abitibi August 23rd and 24th. Common at Blacksmith's rapids, and at foot of Long Portage, Abitibi river, August 28th and 29th.

RED-EYED VIREO, *Vireosylva olivacea*. Mattagami river:—one taken at foot of Long Portage, August 8th. Very common there on 8th and 9th; one at Grand rapids, August 11th. Several seen below Niven's line, Abitibi river, August 26th.

MYRTLE WARBLER, *Dendroica coronata*. Two at Grand rapids, Mattagami river, August 12th.

AMERICAN REDSTART, *Setophaga ruticilla*. One immature male taken near mouth of Abitibi river, August 21st. Several others seen.

MARYLAND YELLOW-THROAT, *Geothlypis trichas*. One seen on lower Abitibi river, August 24th.

BLACK-CAPPED CHICKADEE, *Penthestes atricapillus*. Commonly seen or heard on the portages throughout the trip.

HERMIT THRUSH, *Hylocichla guttata*. One seen at Long Portage, Mattagami river, August 7th.

AMERICAN ROBIN, *Planesticus migratorius*. Common on Groundhog, August 1st and 2nd, nest and two young, on branch five feet above bridge on Long Portage, Mattagami river, August 6th. Heard at mouth of Missinaibi river, August 15th. Two seen on Bushy island, Moose river, August 19th; heard at foot of Long Rapids, Abitibi river, August 29th; one seen at New Post, September 1st.

MAMMALS.

SHREW, *Sorex*, sp.? One seen near Lignite claims, Mattagami river, August 11th.

BLACK BEAR, *Ursus americanus*. One swam across river ahead of the canoes near Wawadasing rapids, Mattagami river, August 5th. Tracks at mouth of Missinaibi river, August 14th. Destruction of dogwood bushes due to bears common along Abitibi river below mouth of Frederick House river, September 4th.

GREY WOLF, *Canis occidentalis*. Tracks identified by Indian guides as those of wolves, common along Mattagami and Moose rivers, August 3rd-14th.

BEARDED SEAL, *Erignathus barbatus*. One taken near Moose Factory on August 18th. Others seen

on bars in river near Moose Factory.

CHIPMUNK, *Eutamias quadrivittatus borealis*. Seen occasionally on the portages of all the rivers travelled. One taken at Long Rapids, Mattagami river, August 12th.

RED SQUIRREL, *Sciurus hudsonicus*. Fairly common in heavier timber. One taken at foot of Long Portage, Mattagami river, August 8th.

BEAVER, *Castor canadensis*. Signs fairly common above Grand Rapids, Mattagami river, where an adult was seen in company with young on August 5th.

NORTHERN HARE, *Lepus americanus*. One young one caught in snare near camp at Whist Falls, Groundhog river, August 2nd. No others seen on trip.

MOOSE, *Alces americanus*. One killed by Indian, seen near Little Long Portage, Mattagami river, August 4th. A large bull killed by campers above Grand Rapids, August 5th. A yearling bull killed by our party near Lignite claims, Mattagami river, August 11th. Tracks common at mouth of Missinaibi river.

BATRACHIANS.

NORTHERN FROG, *Rana septentrionalis*? Several seen at Little Long Portage, Mattagami river, August 4th. One seen at Moose Factory, August 18th.

AMERICAN TOAD, *Bufo lentiginosus*. One specimen of a pink shade and small size seen near head of Long Rapids, Mattagami river, August 11th. One seen at Missinaibi river, August 14th; several large and small at Moose Factory, August 18th; one on August 22nd, and one on 23rd on Abitibi river three-quarters of a mile above its mouth.

REPTILES.

GARTER SNAKE, *Thamnophis sirtalis*. One seen on Little Long Portage, Mattagami river, August 4th.

FISH.

LAKE STURGEON, *Acipenser rubicundus*? One large sturgeon seen by my men on the Long Rapids of the Mattagami river.

PIKE, *Lucius lucius*. Common and very large in pools at foot of Long Portage, Mattagami river. Taken up to twelve pounds in weight, August 6th and 7th.

PICKEREL, *Stizostedion vitreum*. Common along Groundhog and Mattagami rivers. Taken up to nine pounds in weight at foot of Long Portage, Mattagami river, August 6th and 7th.

SUCKER, *Moxostoma*, sp.? One dead on shore near foot of Long Rapids, Mattagami river, August 12th.

INSECTS.

MOSQUITOES. Not very numerous along rivers, except at mouth of Missinaibi. Very plentiful at Moose Factory, on August 18th and 19th, and in

general below tide water.

MOURNING CLOAK BUTTERFLY, *Aglais antiopa* L. Two seen near foot of Long Rapids, Mattagami river, August 13th.

THE LARGER FRESHWATER CRUSTACEA OF CANADA AND ALASKA.

BY FRITS JOHANSEN.

INTRODUCTION.

Though the freshwater-crustacea are of great importance as food for fishes, birds, water-insects, etc., occurring in vast numbers even in ponds, and certain of them (Malacostraca) are conspicuous enough by their size, their occurrence in Canada and Alaska has been little studied, apart from cray-fishes. A. G. Huntsman has already called attention to this fact in his "Freshwater-Malacostraca of Ontario," (Contributions to Canadian Biology 1911-14, Fasc. II, p. 145), and he also there emphasizes how comparatively little is known about their habits and life-histories, on which their distribution in and their introduction into the innumerable ponds, creeks and lakes in Canada depends.

So far as Alaska is concerned cray-fishes are not found there (they may occur in southern Alaska), and the other freshwater-crustacea do not seem to have appealed much to the many collectors in that territory as of sufficient interest, even to the extent of their picking up a few odd specimens, so easily secured by pulling up water plants, by using a catcher from the margin of a lake or pond, or by examining stomachs of fishes caught. The writer has had personal experience of how common freshwater-crustacea are along the arctic coast of Alaska, and it is to be hoped that future collectors will connect up the collections made here with the data secured in the western provinces of Canada, by an examination of the bodies of freshwater in the more southern parts of Alaska and of Yukon Territory, so easily accessible all the year round.* As is the case for the United States so also for Canada the hitherto published records of freshwater-crustacea refer mainly to the Great Lakes and their ramifications and tributaries. The present writer has only a few new data or collections to record from this area, and has only a tourist's acquaintance with these extensive bodies of water. The present article therefore does not claim to treat the basin of the Great Lakes exhaustively; other writers are more qualified to do so, and as mentioned, these bodies of

freshwater have been studied fairly well before (see bibliography), even Georgian Bay and other purely Canadian (Ontario) localities (Huntsman).

But, thanks to the efforts of various Canadian expeditions and collectors quite a few freshwater-crustacea have been collected in Canada and the arctic part of Alaska, in various ponds, lakes and streams, particularly in more recent years. I have gone over most of the larger forms from the collections (Amphipods, Isopods, Phyllopods), except cray-fishes, in the possession of the various museums in Canada; and by letters and words I have tried to stimulate the securing of further data, in particular from hitherto quite unrepresented areas. The result has been most gratifying and the time seems now opportune to publish these many data, which perhaps will create a still greater interest in the subject. I may add that the freshwater-crustacea (Amphipoda, Phyllopoda, Cladocera, Copepoda, Ostracoda) I secured along the arctic coast of America while with the southern party of the Canadian Arctic Expedition, 1913-16, are treated in detail by various specialists in Volume VII, of the scientific reports of the said expedition (Ottawa, 1920), so I need only here refer to these reports.

To give an idea of the many widely separated localities in Canada and Alaska from which we (mainly the Victoria Memorial Museum, Ottawa) have specimens of freshwater-crustacea I mention the following places:—Teller (Port Clarence); Point Barrow, Camden Bay, Demarcation Point and Herschel Island, along the north coast of Alaska and Yukon Territory; International Boundary line between New Rampart House and Arctic coast; Cape Bathurst and various places on the south side of Dolphin and Union Strait in Arctic Canada; Fullerton on the west side of Hudson Bay; east coast of Grinnell land; Labrador coast and Newfoundland; western, northern and eastern coasts of Greenland (collections in Copenhagen); west side of Cape Breton island, N.S.; Nova Scotia, (according to Dr. Marsh's and Juday's letters to me of March 10, 11, 1920); Magdalen islands, Tadoussac and Quebec City, P. Que.;

*See recent collections recorded by Pearse (1913).

Thousand islands, N.Y.; Great Lakes; neighbourhoods of Montreal, Ottawa and Hull; various localities in middle and southern Ontario; a few localities in the middle and southern parts of Yukon Territory and the four western provinces, Manitoba, Saskatchewan, Alberta and British Columbia.

The freshwater-crustacea known from the localities given above are in some cases both Malacostraca and Entomostraca; in other cases only one of these two sub-classes; in again other cases only certain orders belonging to one or the other of these sub-classes have been collected; finally it is often only certain families or genera which occur in these more northern parts of the American continent.

The freshwater Entomostraca are mostly circumpolar in distribution, and are perhaps best treated from this point of view (as will be seen from the Canadian Arctic Expedition reports); and as the available records of them have been published rather fully in various countries, I do not intend to include such, in this article, apart from the Phyllopoda (Branchiopoda).

The freshwater Malacostraca occurring in Canada and Alaska are, however, properly to be considered continental forms, outrunners from their much more numerous representatives in the United States. It is interesting to recall in this connection, that no Decapods or Isopods are known from the arctic and subarctic regions of Canada and Alaska; and that though the Amphipods are known to occur all the way to the arctic coast of the mainland (at least west of Hudson Bay), there are no records of them hitherto from the islands composing the Canadian Arctic Archipelago, though they are probably found at least on the more southern islands. That no freshwater Malacostraca are known from Greenland is also significant. The details about this most interesting point (the distribution northward) will be given later in these articles; suffice is it to say now that the Decapoda going farthest north are certain species of cray fishes; and of Isopods and Amphipods probably only the three common forms, *Asellus communis*, *Gammarus limnaeus* and *Hyalella knickerbockeri*.

Unfortunately we have practically no records of freshwater Crustacea from the vast area outside the localities given above for this continent, except in so far as certain species (*Gammarus limnaeus*, *Hyalella knickerbockeri*), which are distributed over the whole of the mainland part of Canada and Alaska or more southern species (*Mancasellus tenax*, certain Amphipods and cray-fishes), are concerned. It is, therefore, most desirable that material be collected in the following two areas; the whole subarctic part of the continent from Alaska to the Labrador Peninsula (Ungava), and the islands composing the Canadian Arctic Archipelago. It is

my hope, that future collectors in these regions will pay far more attention to the freshwater-crustacea than has been done heretofore. Each collection will have considerable value, not only from a scientific but also from an economic point of view, particularly in a country like Canada where the freshwater occupies at least fifteen per cent of its total area, and the fish living therein which depend so largely upon these crustacea form one of our great national assets.

AMPHIPODA.

The general appearance of these crustacea, the great majority of which are found in the sea, (about two dozen species occurring in freshwater upon this continent), may be supposed to be fairly well known to the general public, who will have noticed them in great numbers in the small pools around stones or under sea-weed along beaches at low tide. They are commonly called "shrimps," though this name properly should only be used for certain "Decapod" crustacea (prawns, etc.) "Sea-weed-lice" or "beach-fleas" are really better names and are popularly used, for instance in the Scandinavian countries. Ortmann (l.c.) gives "scuds" as the popular English name for them. The main characteristics of these crustacea are an arched outline and a compressed, many segmented body; the lack of carapace and of stalked eyes; the feelers (antennae) and legs are also considerably shorter than in the true "shrimps." They swim mostly vertically in the water by bendings of the body and rapid, continuous movements of the paired "tail feet" (pleopods), while the body-legs (peraeopods) help in the balancing of the animal and the mouthparts (maxillipeds) are kept ready for any food. When they reach the water surface it will often be seen that they seem unable to descend again, and swim around in circles on their sides. The reason for this is that the air gets in under the protruding parts (pleura) of the body segments (somites), so that the animals become lighter than the water. They feed mainly upon decaying animal and vegetable matter, and are therefore, especially the smaller forms, often found among water plants, etc. It is well known how quickly meat-bones, dead fishes, etc., lowered into the sea or a lake are gnawed clean by these crustacea, so that only the skeleton-parts remain. In size they range from a few centimetres to some giant, marine, forms, several inches long. The females carry their many eggs in a sort of brood-pouch on the underside of the body between the legs, and the embryos go through their whole development here, so that when they are "born" they have practically the same appearance as their parents, a rather unusual thing among the crustacea. Even the recently emerged young ones keep for a

while to their mother and remain inside the brood-pouch, so that when such a mother animal is caught, if placed in a glass of water and disturbed by being touched with a stick, a stream of tiny young ones will be seen leaving the mother and swimming around in the water just as do the full grown amphipods. The time in the summer in which the birth of the first brood takes place in Canada and Alaska depends somewhat on the particular species and upon the latitude and longitude. Generally, it may be said, that it takes place about a month after the freshwater-ice begins to melt in the spring, in the neighborhood of Ottawa it happens in May; on the arctic coast west of Coronation gulf, Northwest Territories, in July. There seems to be an interval of two months between two successive broods at least during the summer, (May to Sept. inclusive), and probably a still longer period between the broods during the winter (October to April inclusive).

In the same way as is the case with the marine forms, which await the return of the tide upon the sand under moist sea-weed, so also are the freshwater Amphipods very tenacious to life. They will congregate under stones, boards, etc., or be found along the margin of large lakes under washed up material. It is likewise interesting that certain species at least are equally at home in sluggish, almost putrid water and in running creeks and clear mountain lakes, and that they are found in the alkali lakes of our western provinces as well as in the ponds hidden in the woods all over the country, and in springs as well as in arctic lakes. Their importance as fish-food may be gathered from the fact, that I have found the stomachs of trouts from lakes in the arctic literally "stuffed" with these crustacea, in the same way as the marine species make up the main food of fishes, seals and sea-birds in the Arctic and as is also known, in more southern latitudes.

As to the detailed difference between the various species of freshwater-amphipods known from Canada and Alaska I refer the reader to C. R. Shoemaker's report (1920) and A. G. Huntsman's paper (1915), mentioned in the introduction. A key to the determination of all the freshwater crustacea (Malacostraca), occurring in North America is given in Ortmann's article (1918), (see also bibliography for other papers).

Three families of freshwater amphipods occur on this continent all of which are represented in Canada, but probably only two of them in Alaska. The two first families are distinguished from the third (Orchestiidae) by the presence of a secondary short flagellum on the 2nd antennae (antennula), and by the fact that the last pair of tail feet (uropods) are not single, but divided into two parts (rami).

The first family (Lysianassidae) is again easily distinguished by the fact, that the 5th pair of body-legs (peraeopods) are considerably shorter than the preceding ones, a rather unique feature among the amphipods. There is only one fresh-water genus (*Pontoporeia*) belonging to this family recorded from this continent and it is doubtful whether there is more than one species, (*P. hoyi*, Smith) though two other species (varieties) have been recorded, (*P. filicornis* and *P. affinis*). On this continent the first two have so far only been found in freshwater, (deeper parts of Lakes Superior, Michigan, Ontario, Georgian Bay), the last named only in the sea.

The second family (Gammaridae) is represented upon this continent by half a dozen genera, of which however only three are known from Canada, a fourth has so far been found only in Alaska, and the rest occur in caves, and underground wells in the United States. The one Alaskan genus is a small form (*Synurella johanseni*) which I myself found in the tundra ponds at Teller, Seward Peninsula, in August, 1913. It is figured and described in detail by C. R. Shoemaker (1920). It is not likely to be found in Canada as it belongs to an Alaskan and Eurasian genus, thus reminding one strikingly of the phyllopod genus, *Polyartemia*. One of the three genera found in Canada is *Eucrangonyx*, which is distinguished from the other Canadian genus *Gammarus* by having the inner ramus of the uropods rudimentary, and by not having the tail-end (telson) nearly so deeply cleft as is the case with *Gammarus*. The shape of *Eucrangonyx* is more clumsy than that of a *Gammarus* of corresponding size. There is only one species of *Eucrangonyx* (*E. gracilis*, Smith) in Canada, hitherto known from the Great Lakes, (Superior, Michigan and Huron), Georgian Bay and Bond Lake (Toronto), while in the United States it is distributed from Rhode Island to Wisconsin. Outside of the Great Lake system it seems to be limited to Ontario and the Ottawa valley, judging from the following new records:—

De Grassi Point, W.-shore of Lake Simcoe, Ont. May 10, 30, 1917, E. M. Walker, coll., 6 specimens (4 of these are from a large, temporary forest-pool). About 30, (less than 1/2 cm. long) specimens from ponds near Bond Lake, York County, Toronto, Ont., April 19, 1920, A. G. Huntsman, coll. Collected by myself, surroundings of Ottawa, Ont.: (1) McKay Lake, Rockcliffe, April 13th, 1919, (1 small (5 mm.) immature specimen). (2) Pool-stream in swamp at Deschenes Rapids, P.Q., April 20, 1919, 4 specimens (6-10 mm.), of which two were immature, one full grown male and one mature female with many pink eggs (1/2 mm. in diameter, shape oval). (3) Fairy Lake, P.Q., May 4, 1919.

One full-grown female with pink eggs. (4) 10 specimens, pool near Gatineau Point, P.Q., May 13, 1917, (3 of the females with eggs). (5) Several specimens (all sizes; full grown female with eggs), from pool at Catfish Bay, Hull, P.Q., May 16th, 1920. (6) Pool in woods at Rockcliffe, Ont., May 24, 1919, one full grown female with newborn young in the brood-pouch. (7) Bight in Ottawa River, Hull Park, P.Q., July 6, 1919; under stones, several specimens mostly full grown females with ripe eggs and young in brood-pouch. Two young specimens from Montreal West, Que., Oct. 19, 1918, A. Willey, coll.

Some interesting facts about the life history of this species will be gleaned from the above new records. There thus seems to be at least two broods each summer, one in May, the other in July, and probably also one in September, in the surroundings of Ottawa. Its frequent occurrence in temporary pools, bights or streams is also noteworthy, and it reminds one of what is known about the phyllopod. When full grown its size is about double that of *Hyalal?*, but only half of that of *Gammarus*. It is not nearly so frequent as these two species (*H. knickerbockeri*, *G. limnaeus*), though at certain places where it is found it may be common enough, (see above under (2), Deschenes).

Though the color of freshwater amphipods is to a large extent caused by the immediate surroundings and their food, the color of *Eucrangonyx gracilis* is like that of green glass, changing to yellowish or orange in the females at the time the eggs ripen. Its geographical distribution has already been referred to.

Of the genus *Gammarus* we have two species in Canada, of which one (*G. fasciatus*) hardly occurs here at all (outside of the Great Lakes); but the other (*G. limnaeus*) is found over the whole width and breadth of the mainland part of the Dominion and Alaska. *G. fasciatus* is known from Niagara River and Lakes Superior and Michigan, also from Georgian Bay. In the United States it is found from Maine to Wisconsin. It is common enough where it occurs according to various authors (Huntsman, Shoemaker) but I have never observed or collected it myself. It resembles very much the other, more widely distributed species *G. limnaeus*, and the young of the two species are very difficult to separate.

Gammarus limnaeus is differentiated from its near relative *G. fasciatus* by the fact that the long hairs upon the terminal joint of the outer ramus of the uropods, are plumose, and not simple; a character only to be ascertained by the aid of the microscope and with not too young or imperfect specimens. It is interesting to note, that while *G. fasciatus*, as mentioned above has only a limited range in Can-

ada, *G. limnaeus* is distributed over the whole width and breadth of the Dominion* from the American border to the Arctic ocean, the reverse is the case as one goes south on this continent. Mr. Shoemaker tells me, that at Washington, D.C., *G. fasciatus* is far more common than *G. limnaeus*. The latter species is found in larger pools in lakes and in streams, the younger individuals having the habit of hiding under stones and vegetation (moss, algae, etc.), the older ones swimming around freely. As I observed them in the arctic they seem to be found only in lakes which owing to their depth do not freeze to the bottom during the winter, or in creeks (rivers) which were open (or partly so) all the year round. Where they occur in temporary pools and streams at more southern latitudes it can, according to my own observations (Ottawa and St. Lawrence rivers), mostly be explained by the fact that these temporary bodies of water were in connection with the rivers or large lakes earlier in the season, and the amphipods, therefore, probably migrated into them at that time. In the arctic I found them during the period October to June inclusive, when the lakes had thick ice and generally just below the ice. I suppose their main food then is the many Entomostraca (copepods) swimming here. That they live a pelagic life is also indicated by the fact that the many trout caught here had their stomachs filled with them at that period. When the lakes are free of ice or when the ice is thin (July to September inclusive) the amphipods literally swarm in shallow water along the margin of the lake, and seem to find their food more among the many plants (moss, algae) on the stones in such situations. The detailed data for the specimens of this species collected on the Arctic coast (Sadlerochit River, Alaska, Herschel Osland, Yukon Territory, Bernard Harbour, Northwest Territories) have been recorded on p. 16 in Shoemaker's report. Mr. Shoemaker tells me, that the specimens from the warm spring creek tributary to Sadlerochit River, and which lived in water of a temperature from 40° to above 60° F., cannot be distinguished from those from the other arctic localities except perhaps by their average, smaller size.

Curiously enough, egg-bearing females of this very common species, which I have observed so often at many localities in Canada are far less frequently† met with than is the case with the more rare *Eucrangonyx gracilis*; it is perhaps because the

*Huntsman says (l.c.) p. 151 that this species is much less abundant in the waters examined than *G. fasciatus*; but he did not then know of the many records of *G. limnaeus* from various parts of the Dominion now secured.

†Two of the specimens collected in Whitefish Creek, Lake Simcoe, Ont., June 17, 1917, by E. M. Walker were egg-bearing females.

development of the *Gammarus* eggs takes place in much shorter time, and are thus not carried for so long a period by the mother-animal compared with *Eucrangonyx*. The young ones are probably born in May, July and September in the latitude of the Great Lakes. *Gammarus limnaeus* is said to range in the United States from Maine to Utah, and has formerly been recorded from Lakes Superior, Michigan and Georgian Bay. It has also (Pearse, 1913) been recorded from lakes in the neighborhood of White Horse, Yukon Territory and Rampart House, Alaska (Porcupine River). I have (beside the Arctic ones mentioned above) a number of hitherto unpublished records from additional localities, which I give here, arranging them from east to west,—

Observed (animals escaped) in pool at Tadou-sac, P.Q., September 6th, 1919; young individuals.

Stream-pool between St. Lawrence River and Diamond Hill, Quebec City, September 19, 1919; many specimens (4.9 mm. long.)

Bight at Alexandra Bay, N.Y. (Thousand Islands), September 1st, 1919; many specimens up to 10 mm. long (females with eggs.)

I have not yet found this species around Ottawa, though the two smaller freshwater-amphipods, (*Eucrangonyx gracilis*, and *Hyaella knickerbockeri*) are common here; but Prof. E. M. Walker, of Toronto, has sent me some (½ doz.) full grown specimens of this species collected near Whitefish Creek, Lake Simcoe, Ont., on June 17, 1917.

From Manitoba I have before me ten specimens, full grown, about (2 cm. long) collected by E. Criddle, at Treesbank, (Assiniboine River), November 21, 1917; and two specimens (1 smaller, one almost full grown), from Cross Lake (about lat. 54 ½° N.) collected by F. J. Alcock in the summer of 1919.

I have no records of this species from Saskatchewan, though it undoubtedly occurs there, having been found both in Manitoba and in Alberta.

From Alberta I have before me twenty-seven specimens, about 2 cm. long, from Dodds Lake, near Edmonton, collected by a university student there on March 8, 1919 and sent to me by Dr. McLean Fraser of Nanaimo, B.C.

Also ½ dozen specimens from Miquelon Lake, Alberta (about lat. 53° N.), collected on September 30, 1918, by R. M. Anderson, of Ottawa.

Many specimens (mostly full grown) from a marsh in Cabin Lake Creek, Jasper Park, collected by W. Spreadborough, on Aug. 31, 1918.

Also 1½ doz. specimens from the plain near Red Deer and Battle Rivers, east of the foothills, Alberta (about lat. 53° N.) collected by J. B. Tyrrell, June to September, 1885.

From British Columbia I have examined the fol-

lowing specimens:—

Three large ones from Sink Lake, near Stephen, E. Kootenay county, B.C., September 26, 1883, J. B. Tyrrell, collector.

Half a dozen from Beaver Pond in valley of Kish-e-nek-na creek, (Flathead River, near International Boundary, B.C.) August 27, 1883, J. B. Tyrrell, collector.

We now come to the third family of freshwater-amphipods, namely the Orchestiidae, represented by only one species on this continent—the common *Hyaella (allorchestes) knickerbockeri*, Bate. The other species (*H. azteka* Lauss, *H. dentata*, Smith, *H. inermis* Smith) described formerly have proved to be only varieties. In addition to the characters given for the family, (p. 128) this amphipod is immediately recognized by the presence of a curved spine projecting backwards from the middle of the posterior margin of each of the first two abdominal segments, a character which can be seen with the aid of a strong magnifying glass, and reminds one strongly of certain marine (especially arctic) amphipods.*

The biology of *Hyaella knickerbockeri* has been studied by various naturalists and a rather full account of it has been given by H. H. T. Jackson (1912). He says it is a littoral form, only occurring to the depth of about one fathom of water in larger lakes, and that it prefers sluggish streams and lakes, etc., with much vegetation. He states that it feeds almost exclusively on protozoa and algae, which it gets by swimming or crawling. He found it was more active at night than during the day time, also that there was much variety in its color, and that the latter was not solely due to food in the intestine (compare *Eucrangonyx gracilis*, p. 129). The largest specimen he observed was 7.6 mm. long; the females average less than the males in length, but are deeper in the body. According to the author quoted, the species breeds throughout the year, but especially during the summer; while thus engaged the male carries the female, though releasing his hold when the moulting takes place. Soon after copulation the eggs pass into the ovarial sack (brood-pouch) of the female, but they take almost a month to hatch. Jackson paid particular attention to the moults. He found, that there is a varying period (1 to 5 weeks) between the moultings, and that each moult begins with a transverse split in the forepart of the body. Contrary to what is the case with many crustacea (for example the cray fishes) the moulted skins are not eaten by these amphipods after being cast. My own observations on the biology of this animal agree with those of Jackson except that he says it does not occur in temporary

*Shape of *Hyaella* is more robust and rounded than *Eucrangonyx* of corresponding size (see p. 129).

pools. In the district of Ottawa, however, it does occur in such pools as will be seen below. On June 22, 1919, I collected a dozen specimens of this species in McKay Lake, Rockcliffe, near Ottawa, the males were often seen embracing (carrying) the females, which had many newborn young in the brood-pouch. When I placed the amphipods in a glass with water the young ones came forth and swam freely around; rather larger examples, but still minute (2 mm. long) ones, were secured in Pink Lake, outside of Hull, P.Q., on September 22, 1919, so there must be several broods during the summer, probably at least every second month.

This species has an exceedingly wide distribution on this continent. It has been recorded from Lake Tititaca, Peru; in United States from Maine to Florida and Wisconsin and across to Mexico, California and Oregon; also 48 miles north of Rampart House, Alaska. The only records of it from Canada were formerly White Horse, Yukon Territory and the Great Lakes (Superior, Ontario, Erie, Georgian Bay) and southern Canada. I am able here to add a number of others, which show that this species occurs in Canada from the Atlantic to the Pacific and from the international boundary line in the south to a considerable distance northward, though it probably does not approach the barren grounds of Alaska and Canada. It would be most desirable to secure data to define the northern limit of this species; I did not find it along the arctic coast west of Coronation Gulf, although *Gammarus limnaeus* is common enough there. As both these amphipods are found in great numbers wherever they occur, and are easily observed and collected it should be a comparatively simple matter to get further data.

The following unpublished records of this species in Canada are based upon specimens in the Victoria Memorial Museum, Ottawa; except where otherwise stated they were all collected by me.

Four young ones from Pembroke Lake, Grand Etang, West side of Cape Breton Island,* N.S., September 2, 1917; under stones.

Three full grown specimens (1 male, 2 female) from pond on Amherst Island, Magdalen Island,* P.Q., middle of July, 1917.

Two small ones from pool at Tadousac, P.Q., September 6, 1919. Several specimens (smaller) from bight of canal at Alexandria Bay, Thousand Islands, N.Y., September 1, 1919.

A great number of specimens of all sizes and both sexes from the surroundings of Ottawa, Ont., and Hull, P.Q., in 1918 and 1919 from June to October (inclusive), both from pools, ponds, lakes,

*These records suggest strongly, that the species also occur in Newfoundland.

streams and bights of the Ottawa river. More definite Ottawa district localities are:—McLaurin Bay, Gatineau Point, outside the city of Hull, Fairy Lake, the Golf Club grounds, Pink Lake, etc., all on the Quebec side; and McKay Lake, Rockcliffe, etc., on the Ontario side. There is hardly a pool, stream or lake around Ottawa where it does not occur in great numbers.

One young specimen from creek (barred at mouth) emptying into Lake Nipissing, near North Bay, Ont., Aug. 25, 1918; among water-plants.

Three specimens from Cross Lake, Manitoba, summer, 1919, F. J. Alcock, collector.

I have no records from Saskatchewan.

Half a dozen specimens from Miquelon and Dry Meat Lake, Alberta (near Camrose), September 30, 1918, R. M. Anderson.

A couple of specimens from stream pool in woods in Jasper Park, (near Jasper station) Alberta, September, 1916.

One dozen specimens from Beaver Pond in valley of Kish-e-neh-na creek (Flathead river) B.C., August 27, 1883, J. B. Tyrrell, collector.

To sum up, our present knowledge of the distribution of freshwater amphipods in Canada and Alaska is as follows:

One species seems to be limited to the western part of Arctic Alaska; three others to the Great Lakes, the Ottawa Valley and southern Ontario, while two occur from the Atlantic to the Pacific. One of these probably does not reach the barren grounds, while the other is found as far north as the arctic coast, and may thus be termed the only true Canadian species.

Note:—In Europe there occur in freshwater,—*Gammarus pulex* and *G. fluviatilis*. The genus *Gammarus* is known already from tertiary deposits.

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POSTSCRIPT.

The summer of 1920, I spent in James Bay, and along the east side of Hudson Bay to beyond lat. 56° N. No phyllopoets nor isopods were found in freshwater, and amphipods only in James Bay, at the following places:

Gammarus limnaeus in creek-pools on the south-east side of Charlton Island, September 26 and 22.

Hyaella knickerbockeri in creek-pools in the interior of Charlton Island (south-end), July 17 and September 22; and in ponds at Moose Factory (field), July to October, and on Cape Hope Islands (about lat. 52½° N.), September 13.

All occurred in great numbers. Those secured at Moose Factory in July, comprised greenish males and yellow-brown, egg-bearing females, in copulation, besides pale, newborn ones.

CHANGES IN THE STATUS OF CERTAIN BIRDS IN THE VICINITY OF QUEBEC, P.Q.

BY HARRISON F. LEWIS.

In the year 1906, Mr. C. E. Dionne published his well-known work, "Les Oiseaux de la Province de Québec," in which, besides noting the distribution of the species of birds in Quebec Province, he stated particularly the status of the different species in the neighborhood of Quebec City, where the greater part of his own field work had been done. The area to which these local records refer is variously designated by Mr. Dionne as "près de Québec," "dans les environs de Québec," or "dans Québec," and is defined by him (footnote (1), page 20) as "within a radius of five or six leagues of Quebec, unless otherwise indicated." Since the publication of this book, Mr. Dionne has been able to do comparatively little field-work in this area.

Since July, 1918, I have been resident at Bergerville, parish of St. Colomb de Sillery, in the suburbs of Quebec, and have done such field work (chiefly in 1919 and 1920) in the vicinity of the city as my other duties have permitted. This work has made clear the fact that, in the fourteen years since 1906,

the status of a number of bird species in the area defined by Mr. Dionne as referred to above has changed markedly. There is little doubt that most, if not all, of such changes which I have noted are actual, since Mr. Dionne frequently visited in his work the vicinity of Bergerville and Gomin Wood, where most of my work has been done, although he went even more often to areas northward from Quebec City, where my observations have been occasional only. The majority of my notes relate to land birds; opportunities for observing water birds in the neighborhood where I am resident are very limited. In order to keep the record of birds of the Quebec area as accurately up-to-date as possible, and in order to render readily available some local details of the general avifaunal changes taking place in northeastern North America during the period 1906-1920, I have prepared this paper. A similar paper by Mr. L. McI. Terrill, dealing with the vicinity of Montreal ('Ottawa Nat.', Vol. XXV, No. 4, pp. 57-63, July, 1911), furnished me with the

original suggestion and an admirable model.

In the case of each species of which a change in status is hereinafter noted, I have given, following the English name, a translation of Mr. Dionne's statement concerning his observations on its occurrence here, as found in his book, such translation being terminated by Mr. Dionne's name in parentheses. Then I have summarized my own observations of the species under discussion. In order to ensure that my translations should render the meaning of Mr. Dionne's French sentences as accurately as possible, I have submitted them all to Mr. Dionne, who has most kindly verified them. I am much indebted to Mr. Dionne, not only for this aid, but also for his ever-ready assistance and encouragement in all the work of an ornithological character which I have done at and near Quebec.

The changes of status described in this paper may be divided into the following four classes:

(A) The increase in abundance of many small Warblers, Finches, Vireos, etc., normally of more or less northern breeding range. The chief known factors which may have assisted in causing these birds to increase seem to be their protection by law here and in the United States, the creation of many clearings in the forests of the north, and the absence or rarity of the domestic cat over large parts of their breeding range.

(B) The northeastward advance of five species (Crested Flycatcher, Meadowlark, Vesper Sparrow, Migrant Shrike, and House Wren), originally of more southern or southwestern breeding range. While this may represent the continuation of the northward advance of many species following the close of the last Glacial Period, there is no doubt that it has been greatly accelerated by the cutting of the forests and the settlement of the country by the white race.

(C) The diminution of two species (Eskimo Curlew and Purple Martin), due to very obscure causes.

(D) The accidental occurrence of one species (Blue-gray Gnatcatcher).

The Zone Map of North America, as published inside the front cover of F. M. Chapman's "Handbook of Birds of Eastern North America", 1912 edition, indicates the vicinity of Quebec City to be in the Canadian Zone. The Transition Zone is represented as reaching northeastward along the south bank of the St. Lawrence River about as far as to Levis, P.Q., but as not extending northeast of the Ottawa River on the north bank of the St. Lawrence. The dividing line between the two zones between Montreal and Levis, which is directly opposite Quebec, is thus made to coincide with the St. Lawrence River. There can be little doubt that this is not exactly correct, for the Tran-

sition Zone certainly crosses the Ottawa and extends northeastward along the north bank of the St. Lawrence for some distance. Whether or not it should be considered as reaching to Quebec City is a matter on which opinions may differ. It appears to me, however, that the most nearly correct position for this portion of the necessarily arbitrary dividing line between the Transition and Canadian zones is at the southern foot of the Laurentian Mountains, in general some miles north of the St. Lawrence. This would mean that a strip of the Transition zone extends along the north shore of the St. Lawrence as far as Cap Tourmente, about twenty-five miles below Quebec, where the Laurentians finally front directly on the river. A person standing on the Citadel, or even on Dufferin Terrace, at Quebec, can distinguish at a glance the low-lying cultivated, Transition (?) country immediately around the city and along the St. Lawrence in either direction from the elevated, wooded, undoubtedly Canadian mountainous country behind. The following data concerning the status of certain species of birds about Quebec may be of assistance to those interested in this question:

1. Transition species which are summer residents at Quebec: Virginia Rail (not common), Sora Rail (fairly common), Black-billed Cuckoo (irregular), Kingbird (common), Crested Flycatcher (uncommon), Prairie Horned Lark (fairly common), Bobolink (uncommon), Cowbird (uncommon), Red-winged Blackbird (uncommon), Meadowlark (fairly common), Vesper Sparrow (fairly common), Chipping Sparrow (very common), Purple Martin (rare), Blue-headed Vireo (rare), Catbird (fairly common), House Wren (uncommon), Veery (common), and Bluebird (uncommon).

2. Canadian species which are summer residents at Quebec: Pine Siskin (common), White-throated Sparrow (common), Slate-colored Junco (rare), Lincoln's Sparrow (rare), Philadelphia Vireo (not common), Tennessee Warbler (rare), Myrtle Warbler (rare), Magnolia Warbler (fairly common), Bay-breasted Warbler (rare), Blackburnian Warbler (fairly common), Water-Thrush (fairly common), Mourning Warbler (not common), Canadian Warbler (common), Winter Wren (rare), Red-breasted Nuthatch (rare), Olive-backed Thrush (uncommon), and Hermit Thrush (rare).

266. *Numenius borealis* (Forst.). Eskimo Curlew.

This Curlew is more common than the preceding species [*N. hudsonicus*] and frequently occurs on the beaches and in the fields not far from Quebec (Dionne).

No recent record of this species near Quebec is known to Mr. Dionne or myself.

452. *Myiarchus crinitus* (Linn.). Crested Flycatcher.

Mr. Dionne gives no record for this species near Quebec and has never observed it here. I found it an uncommon summer resident near Quebec in 1919 and in 1920. On August 4, 1919, an adult was seen feeding young birds out of the nest at Bergerville.

459. *Nuttallornis borealis* (Swains.). Olive-sided Flycatcher.

Up to the present I have met but three specimens in the woods near Quebec (Dionne).

I have secured the following records of this species—all of singing males—near Quebec: two on June 3, 1919; one on May 27, 1920; one on May 30, 1920; one on June 3, 1920; and one on July 12, 1920.

501. *Sturnella magna magna* (Linn.). Meadow-lark.

One individual was killed, some years ago, at Jeune-Lorette (Dionne).

In 1919 and 1920 this species was a tolerably common summer resident in the many suitable fields in the vicinity of Quebec.

514. *Hesperiphona vespertina vespertina* (W. Coop.). Evening Grosbeak.

The first one which, to my knowledge, appeared in the neighborhood of Quebec was killed March 11, 1890, at Jeune Lorette. Later, on November 24, 1903, four individuals were killed at L'Ange Gardien, and, in December, three others were taken at Ste-Foy (Dionne).

Mr. Dionne informs me that a few others appeared near Quebec between 1903 and 1919. On December 26, 1919, I saw a flock of this species, containing four adult males and nine dull-colored birds, between Quebec and Ste-Foy. (See 'Bird-Lore,' Vol. XXII, No. 1, p. 15, January-February, 1920, "Christmas Bird Census, 1919, Quebec, P.Q."). During the remainder of the winter of 1919-20 I observed this species near Quebec on twelve additional occasions, the number of individuals noted on any one occasion ranging from one to five. It was last seen on March 26, 1920.

533. *Spinus pinus pinus* (Wils.). Pine Siskin.

Each autumn we see some small flocks of them in the vicinity of Quebec and even in the gardens and parks of the city. Elsewhere also it is common and it spends the winter in the deep woods (Dionne).

In 1919 and 1920 this was a common summer resident about Quebec, but I have not remarked it in winter.

540. *Poocetes gramineus gramineus* (Gmel.). Vesper Sparrow.

It is rare about Quebec; so far I have seen but four specimens of it (Dionne).

This species was a regular and tolerably common

summer resident near Quebec in 1919 and 1920; a few even summered within the city limits.

567. *Junco hyemalis hyemalis* (Linn.). Slate-colored Junco.

It is likewise very common and occurs in flocks in spring and autumn near Quebec and in the neighboring districts; it does not occur here in summer (Dionne).

The Junco is now a rare summer resident in the immediate vicinity of my residence at Bergerville, where I noted it repeatedly during the summers of 1919 and 1920. On June 21, 1919, I saw an adult Junco feeding a young one out of the nest at Bergerville.

583. *Melospiza lincolni lincolni* (Aud.). Lincoln's Sparrow.

It occurs accidentally near Quebec; up to the present time I have killed three specimens only (Dionne).

In May, 1919, I twice observed an individual of this species near Quebec. In 1920, I observed the species near Quebec as follows: May 11 (one), May 18 (one), May 21 (one), May 23 (three), May 24 (one), May 25 (one), May 27 (one), May 28 (one), May 30 (one), May 31 (two), June 1 (one), July 12 (one), July 25 (one), September 26 (one), October 10 (one). I was absent from Quebec from June 5 to June 27 in 1920. I am confident that Lincoln's Sparrow is a rare summer resident in sphagnum swamps in Gomin Wood, near Quebec, where nearly all of the above observations were made.

584. *Melospiza georgiana* (Lath.). Swamp Sparrow.

In the spring of 1878 I killed several specimens of it at the foot of the slope north of the heights of Ste-Foy, but I have seen it nowhere else (Dionne.).

In 1919 and 1920 this species was a tolerably common summer resident in all the many suitable swampy areas which I visited near Quebec.

611. *Progne subis subis* (Linn.). Purple Martin.

It is common at Quebec as well as at Montreal and nests in these places (Dionne).

The Purple Martin was rare at Quebec in the summers of 1919 and 1920. Mr. Dionne informs me that it has been so since about 1909. I saw it more frequently in 1920 than in the preceding year, which leads me to hope that it is now on the increase.

618. *Bombycilla garrula* (Linn.). Bohemian Waxwing.

Couper says that it occurs sometimes, during severe winters, in small flocks in the woods about Quebec. In the winter of 1890 I obtained six individuals which had been killed at Chateau-Richer, and since then I have seen but two others, some years

later; doubtless it should be found in our woods at that season (Dionne).

On February 22, 1920, I first observed this species near Quebec, when I saw two flocks, one containing five individuals, the other about one hundred and twenty. Other flocks, containing usually about forty birds each, were seen on several occasions from that date until April 12, 1920. Several times they were observed within the city limits.

622.e. *Lanius ludovicianus migrans* Palmer. Migrant Shrike.

I have not yet observed it near Quebec; but it should, however, occur here (Dionne).

On May 2, 1920, I observed a pair of birds of this subspecies near Ste-Foy. They were carefully examined with binoculars from a distance of a few feet only, and were positively identified. On a few other occasions I have seen near Quebec, but at a greater distance from me, Shrikes which were probably of this subspecies, but as I was unable, under these conditions, to distinguish them with certainty from the Northern Shrike, which I have identified here several times, I did not record them.

626. *Vireosylva philadelphia* (Cass.). Philadelphia Vireo.

Mr. Dionne gave no record of the occurrence of this species nearer to Quebec than Tadoussac, where it was observed by Dr. Dwight. In 1919 and 1920 I found it to be a not common breeding bird in the immediate vicinity of Quebec.

629. *Lanivireo solitarius solitarius* (Wils.). Blueheaded Vireo.

Up to the present time I have seen but four specimens of it, which I killed in the woods to the north of Quebec, one of them at Cap Tourmente near St-Joachim (Dionne).

In the vicinity of Quebec I have observed one individual of this species on each of the following dates: May 18, 1919; May 20, 1919; June 30, 1919; May 18, 1920.

636. *Mniotilta varia* (Linn.). Black and white Warbler.

It is hardly common in the vicinity of Quebec, although some are seen each year in spring and autumn (Dionne).

In 1919 and 1920 I found this Warbler to be a common migrant in spring and fall and an uncommon summer resident near Quebec.

645. *Vermivora rubricapilla rubricapilla* (Wils.). Nashville Warbler.

It is uncommon about Quebec; I have seen so far but two individuals, killed in July, 1878 (Dionne).

This species was found in 1919 and 1920 to be a regular, uncommon summer resident, locally tolerably common in the vicinity of Quebec.

647. *Vermivora peregrina* (Wils.). Tennessee Warbler.

I have seen it but once in the woods about Quebec, toward the end of May, 1886, and, in a flock of seven individuals, of which five were killed, there was but a single female (Dionne).

In 1919, I observed this species near Quebec from May 19 to July 5, and in 1920 from May 21 to July 17. In those years it was a not common or a tolerably common spring migrant and a rare summer resident. Probably it occurs in the fall also, but so far I have not recorded it here at that season.

650. *Dendroica tigrina* (Gmel.). Cape May Warbler.

I have not been able so far to obtain more than three specimens, two of which were killed near Quebec in 1878, and the other one much further north some years later (Dionne).

Mr. Dionne has since recorded this Warbler's unusual abundance near Quebec in the spring of 1912. ('The Auk,' Vol. XXIX, No. 4, p. 545, Oct., 1912.)

In 1919 I observed at least five different males of this species, the first on May 22, the last on June 1. In 1920, I observed seven males of the species, the first on May 19, the last on May 30. All of these records were obtained near Quebec. I have no records of females and no fall records.

655. *Dendroica coronata* (Linn.). Myrtle Warbler.

This species, which travels in small flocks during its migrations, arrives here very early in the spring, and afterward disappears, to go further north to nest (Dionne).

In 1919 and 1920 a few of this species remained near Quebec during the entire summer each year, and probably nested there.

660. *Dendroica castanea* (Wils.). Bay-breasted Warbler.

It is rare about Quebec; up to the present I have seen but five specimens (Dionne).

The following summary contains my observations of this species in the immediate vicinity of Quebec in 1919 and 1920: May 24, 1919 (one); May 26 (one); June 1 (one); June 3 (one); August 23 (two); May 23, 1920 (one); May 24 (one); May 28 (one); May 29 (two); May 30 (two); May 31 (one); July 1 (two); July 12 (one); September 15 (one).

661. *Dendroica striata* (Forst.). Black-poll Warbler.

I killed five, one day in autumn, about fifteen years ago, and I have seen some on some occasions since, but very rarely (Dionne).

In 1919, I observed this species near Quebec on five different days, first on May 30 and last on June 6, the total number of individuals noted being

not less than six. In 1920, I observed it in the same region in spring on seven different days, first on May 27 and last on June 4. It was then tolerably common for a time, eleven individuals being recorded on June 3. The only fall records which I have for this warbler at Quebec are: September 9, 1920 (two); September 11 (one); September 23 (two).

662. *Dendroica fusca* (Mull.). Blackburnian Warbler.

This beautiful warbler is not common in our woods about Quebec (Dionne).

This species was common in 1919 and tolerably common in 1920 as a summer resident in the vicinity of Quebec.

679. *Oporonis philadelphia* (Wils.). Mourning Warbler.

Occurs accidentally at Montreal and at Quebec (Dionne).

The Mourning Warbler was a not common summer resident near Quebec in 1919 and 1920. In the course of a three-mile walk on June 3, 1919, in the immediate vicinity of Quebec, I observed eight males of this species, and during a similar walk on June 13, 1919, I observed seven.

686. *Wilsonia canadensis* (Linn.). Canadian Warbler.

This species is usually uncommon (Dionne).

The Canadian Warbler was a common summer resident about Quebec in 1919 and was tolerably common in 1920.

721. *Troglodytes aedon aedon* (Vieill.). House Wren.

In the first part of July, 1880, I captured a female which had just made its nest in a hole in one of the corners of a small arbor in the garden of the Quebec Seminary, which is the only time that I have seen it here (Dionne).

As a summer resident about Quebec this bird was recorded by me as rare in 1919 and as uncommon in 1920. Probably "uncommon" would more cor-

rectly represent its status in 1919. Two or three pairs spend the summer on the cliffs bordering the St. Lawrence just below Merici Convent, and a number of other pairs are scattered through the suburban districts each summer.

751. *Poliptila caerulea caerulea* (Linn.). Blue-gray Gnatcatcher.

This species was not included by Mr. Dionne in his book because, when that book was written, there was no record acceptable to him of its occurrence in the Province of Quebec. One stray individual was observed by me within the limits of Quebec City on May 18, 1920. (See 'The Auk,' Vol. XXXVII, No. 3, pp. 464-465, July, 1920.)

757. *Hylocichla aliciae aliciae* (Baird). Gray-cheeked Thrush.

Mr. Dionne does not speak of any occurrence of this Thrush near Quebec City.

The only positive identification of it here which I have obtained so far was made by me in Gomin Wood on May 21, 1920, when I watched a single individual for some time at close range with binoculars. I was able to see clearly its uniform olive upperparts and its gray lores, and to note the lack of obvious buffy on the sides of the throat and breast. The bird, although chased about a good deal by me, remained absolutely silent, whereas Olive-backed Thrushes, when they arrive at Quebec, where they are summer residents, freely utter their characteristic notes. I have twice visited in Nova Scotia the breeding haunts of *H. a. bicknelli*, which differs from this subspecies in size only, and have there seen undoubted specimens of the species and noted their peculiarities of coloration, and I am well acquainted with the Olive-backed Thrush in the field.

On two or three other occasions in late May I have seen near Quebec solitary Thrushes which were probably Gray-cheeked Thrushes, but which I was unable to approach and see well enough to make satisfactory identifications.



THE FERNS OF HATLEY, STANSTEAD COUNTY, QUEBEC, 1920.

BY H. MOUSLEY.

In my second paper on the orchids of Hatley, "THE CANADIAN FIELD-NATURALIST," Vol. XXXIV, 1920, No. 3, p. 44, I intimated that probably about forty species and varieties of ferns had been collected here in 1919, and that these would be dealt with in a separate paper. This it had been my intention to do early this year, but from one cause or another the matter has had to be postponed. This delay, which at first appeared vexatious, has really been beneficial, as it has given me another season in which to further prosecute my studies and at the same time add some new species to the list. For the benefit of those interested in ferns only, and who may not have read any of my previous papers on the birds, orchids and butterflies of the district, it seems almost necessary to again say a few words on the nature of the country surrounding Hatley. The village itself lies at an elevation of about 1,000 feet above the sea level, being backed on its eastern side by a ridge of hills rising some three hundred feet higher. The ground on the western side eventually slopes away until it reaches the level of Lake Massawippe (about 530 feet) a fine sheet of water nine miles in length, with an average breadth of about one mile. On its western shore, another ridge of hills known as the Massawippi Hills rises some 900 feet above the level of the lake. The country all round is well wooded, and there are numerous small streams most of which eventually find their way into the lake. In the deciduous woods, the prevailing trees are maple, birch, ash, elm, beech, cherry, butternut and poplar, whilst the coniferous ones consist of spruce, fir, hemlock, pine, tamarack and cedars. The geological strata for the most part consists of a fine-grained sedimentary rock, containing pyrite in some cases, whilst slightly calcareous in others, with veins of quartz appearing here and there, as well as granite. As in common with the rest of the Eastern Townships, the soils have been almost entirely formed during the glacial period, which is the most recent outstanding geological event in the history of this district. Any soils which previously existed, were apparently largely carried away by the movement of the ice, and even the solid rock was deeply eroded. On the retreat of the glacier, there was left a blanket of unconsolidated materials, composed of a heterogeneous mixture derived from both far and near, and including probably a small proportion only of old soils, together with a much larger proportion of rock, fragments ranging in size from a flour to huge boulders of a ton weight. Following the retreat of the glacier, this blanket has, until the present day, been subjected to the ordinary physiographic pro-

cesses of weathering and transportation by frost, streams, etc., resulting in a decomposition of the materials, and a tendency for the smaller particles to be continually moved downhill, and deposited as alluvium, etc. While the area south-east of the Massawippi valley is underlain by somewhat calcareous slates slightly metamorphosed, and the area to the north-west by highly metamorphosed volcanics and sediments, these rocks, as indicated above, have had a general rather than a detailed influence on the composition of the overlying soil.

As with the butterflies and orchids, most of my collecting has been done on the western side of the village, although there are some famous localities on the eastern side, one of which contains the only known station for Braun's Holly Fern, *Polystichum Braunii*. On this side lies also Barnston Pinnacle, a rocky bluff rising almost sheer out of Baldwin's Pond for a height of 600 feet. Mount Orford (2,860 feet) to the north is another rocky locality, but both of these places are some distance from my home and have only been visited once some years ago, when ferns were not being taken into consideration. Some of the smaller *Aspleniums* I think ought certainly to be found in these two localities, and perhaps the Male Fern, *Thelypteris Filix-mas*. Burrough's Falls to the south, and the gorge through which the river runs at Coaticook on the east, and the shores of Lake Massawippi in places are also rocky, but even these it has been found quite impossible to so far work properly, which may account for the scarcity in my list of purely rock-loving ferns. Of the other species enumerated most of them occur in more or less profusion, but there are some that seem to call for special attention, and these I propose to deal with in the order in which they appear in the list, which is that of Gray's Manual, seventh edition, the nomenclature of which, however, has been altered in accordance with the more advanced ideas, as set forth in Mr. C. A. Weatherby's paper, "Changes in the Nomenclature of the Gray's Manual Ferns," "Rhodora," Vol. XXI, 1919, No. 250, pp. 173-179. Most botanists, I believe, are in agreement with these changes although some will not admit the priority of *Thelypteris* for the Shield Ferns, and still use the name *Dryopteris* for this family. However, as Mr. Weatherby says on page 174, "*Thelypteris* remains the earliest valid name for *Aspidium* of the Manual, and much as one regrets adding another to the numerous names this genus has already borne, it must be taken up. Rules are of no use unless conscientiously followed." It seems

to me that Mr. Weatherby is right in what he says for if ever this bugbear nomenclature is to be laid by the heels, not only in this, but in all the other sciences, personal opinions will have to be made subservient, and rules strictly adhered to. For this reason I have followed the new order of things to the letter, as laid down in Mr. Weatherby's paper.

COMMON POLYPODY, *Polypodium vulgare* L. This fern so far does not appear to be the common one it usually is in most places. Certainly several stations for it have been found, but in none of them can it be said to be anything like abundant, nor have any of its numerous varieties been noted.

NARROW-LEAVED SPLEENWORT, *Athyrium angustifolium* (Michx.) Milde. Only one station for this smooth and delicately leaved fern has been found so far. This is in the centre of a large wood which has been partially cleared, and here in somewhat of a gully which is usually wet, is *angustifolium* found in some profusion, its principal companion being the Ostrich Fern, *Pteretis nodulosa*.

CHRISTMAS FERN, *Polystichum acrostichoides* var. *Scheinitzii* (Beck) Small. In one corner of the above wood that harbours *A. angustifolium*, this variety of the Christmas Fern can be found in almost if not greater abundance than the type, the sori appearing in some cases on the tips of every pinnæ, which are toothed, and the fronds usually larger than in typical plants; no doubt due to the cutting down of the trees in this particular part of the wood, which allows the sunlight to act as a strong stimulus, thus producing plants of extra luxuriance; see "How Ferns Grow," Slosson, 1906, pp. 88-89.

BRAUN'S HOLLY FERN, *Polystichum Braunii* (Spencer) Fee. This handsome and uncommon fern with its long chaffy stalks has only been found in one locality known as the Gulf on the east side of the village. Here during the present season I counted over thirty plants. The time is probably not far distant when misfortune may overtake this species in the shape of being ushered into a new genus, when it will be known as *Aetopteron Braunii* (Spencer) comb. nov. See "American Fern Journal," Vol. X, 1920, pp. 88-89. Will finality in nomenclatural matters be ever reached?

BROAD BEECH FERN, *Thelypteris hexagonoptera* (Michx.), n. comb. The Broad Beech Fern is apparently rare here, as I have only come across a very few examples so far, and these mostly small ones. With regard to the difficulty sometimes experienced in determining this species from the Long Beech Fern, *Thelypteris Phegopteris*, I would here like to draw attention to an article by Mr. C. A. Weatherby entitled, "A Neglected Character in the Beech Ferns," which appeared in the "American Fern Journal," Vol. IX, 1919, No. 4, pp. 121-122, in which the author points out how the difference

in the shape, size and coloring of the scales, which in both species are borne along the main mid-rib on the under side of the fronds, forms an almost certain index to the species. I have found this hitherto neglected character most useful in determining my specimens. Another character in the Beech Ferns is described by Mr. E. H. Clarkson in "The American Fern Journal," Vol. X, 1920, No. 2, p. 60. Here it is pointed out that when the fronds of the Long Beech Fern die down in the autumn the coiled tops of the next year's croziers may be seen protruding a little above the ground. This is never the case with the Broad Beech Fern whose croziers do not appear in the fall nor yet in very early spring. Fine fresh green fronds of it, however, can be found in September when *Phegopteris* is of a dull olive colour and no new fronds whatever are to be seen. In this country one can hardly walk in some of the woods without treading the Beech and Oak Fern, *Thelypteris Dryopteris*, under foot, and yet if I remember rightly neither of them are common in England, at all events I can only call to mind having once seen them at Bolton Abbey, in Yorkshire, and there only in one particular wood. The order in which the Beech Ferns appear in my list is different to that of the Manual, and has been made necessary by the new classification as set forth in Mr. Weatherby's paper. See page 176.

THE MARGINAL SHIELD FERN, *Thelypteris marginalis* (L.) Nieuwl. This is a well distributed fern but more abundant in some localities than others. Probably the Gulf already referred to is the best station for it, and here I have found a few examples of the var. *elegans*, J. Robinson, a handsome form with larger fronds and lobed or toothed pinnules.

GOLDIE'S FERN, *Thelypteris Goldiana* (Hook) Nieuwl. l.c. This large and very handsome species is what may be termed one of the rarer or more exclusive ferns, and I only know of two stations for it, one in the Gulf, and the other in the same wood where *A. angustifolium* is found. Only a very few plants occur at either place.

BOOT'S SHIELD FERN, *Thelypteris Bootii* (Tuckerm.) Nieuwl. Hardly sufficient time has yet been given to this species to express any very decided opinion, as to its rarity or otherwise. I am inclined to think, however, that it is fairly well distributed.

CLINTON'S WOOD FERN, *Thelypteris cristata* var. *Clintoniana* (D. C. Eaton), n. comb. The same remark applies equally well to this species as to Goldie's Fern, both being found in the same localities and in about equal limited numbers.

SPREADING WOOD FERN, *Thelypteris spinulosa* var. *americana* (Fisch.), n. comb. This form of the Spinulose Wood Fern appears to be by no means rare, and can be found, I think, in most of the large woods. The type and various varieties, however,

such as *Boottii*, *intermedium* and *americana* (the latter formerly known as *dilatatum*) are by no means always easy to determine, and more time will have to be spent on them before any very definite opinion can be expressed as to their distribution.

BULBLET BLADDER FERN, *Cystopteris bulbifera* (L.) Bernh. It seems strange to have to speak of a fern as a nuisance, but that is what this species really is at times. It abounds everywhere not only on the rocks, but in the woods as well. I remember once visiting Burrough's Falls in the hope of finding some of the smaller rock ferns. I soon gave up the search as the rocks were simply smothered with this species, and it would have been impossible to detect any of the small Aspleniums with such a blanket over them. The Fragile Bladder Fern, *Cystopteris fragilis*, is not nearly so abundant and can really be said to be rare in comparison with the Bulblet.

SMOOTH WOODSIA, *Woodsia glabella*, R. Br. This rare and delicate little fern I look upon as one of my best finds. The only locality for it is situated on the eastern shore of Lake Massawippi, between the railway station of that name and Perkin's Point. I first found it on May 24 of this year (1920) almost at the foot of a rocky railway slope and I am pleased to say there was quite a little colony of it, all the plants I examined being heavily fruited.

OSTRICH FERN, *Pteretis nodulosa* (Michx.) Nieuwl. Of the large ferns this in my opinion is the handsomest, although the great *Osmundas* run it very close. The reason for its masquerading under the names *Pteretis nodulosa* and not *Onoclea Struthiopteris* as heretofore, will be found fully explained in Mr. Weatherby's paper already referred to.

ROYAL FERN, *Osmunda regalis* L., var. *spectabilis* (Willd.) Gray. Seeing that the American Royal Fern differs from the European in the shape of its pinnules it has been thought desirable to make it a geographic variety, hence the var. *spectabilis*, see Weatherby as above.

CINNAMON FERN, *Osmunda cinnamomea* L. Possibly of the three *Osmundas* this is the most widely distributed. On August 22, 1919, I came across a peculiar frond growing apparently from a root of *Osmunda Claytoniana*, which I gathered and pressed, there being only this one example. From the disposition of the pinnules I took it to be var. *dubia* Grout. On September 7, 1920, however, I came across another similar frond very near the same spot, which clearly belonged to *O. cinnamomea*. This caused me to more carefully examine the previous frond at the base of some of whose pinnæ, by means of a magnifying glass, I found the little woolly tufts, thereby clearly establishing its identity as *cinnamomea*. I also found where I had gathered it the year previous that there was a root of

cinnamomea and *Claytoniana* growing almost interlocked, and as there were several fronds of the latter and only this one of the former I had taken it as belonging to *Claytoniana*. The pinnæ of these fronds are placed far apart on the rachis the upper ones being from 2.5 to 3.5 cm., and the lower ones 4 cm. apart. The pinnules which are somewhat toothed or lobed are also from 5 to 10 mm. apart which gives the whole frond a very light and open appearance. As far as I can gather there is no name for this variety, or may it be a cross between these two *Osmundas*?

ADDER'S TONGUE FERN, *Ophioglossum vulgatum* L. As it is proposed to make the family Ophioglossaceae the subject of a further paper, at some future time, I only propose in the present instance to deal very briefly with each species. The present one I find in the damp hollows of almost every mowing field, as well as on the dry knolls of some of the upland pastures. In the latter situations, environment plays an important part in the growth of the species, many of the plants only attaining a height of from 3 to 9 cm., whereas those growing in the damper situations run from 20 to 33 cm.

MOONWORT, *Botrychium Lunaria* (L.) Sw. This rare little fern was only discovered in June of the present year (1920) in two localities, in one of which only one plant was found, and about half a dozen in the other. These latter seem referable to the form known as *onondagense* Underw.

MATRICARY GRAPE FERN, *Botrychium ramosum* (Roth.) Aschers. In 1919 this species was particularly abundant in one station on sloping ground under cedars, but this year comparatively few plants could be found, although at another new station, also on sloping ground, but under deciduous trees, quite a number could have been gathered.

COMMON GRAPE FERN, *Botrychium obliquum* Mulh. This species and the var. *dissectum* Spreng, I had the gratification of adding to the list of Quebec ferns on December 21, 1918, as recorded in "THE CANADIAN FIELD-NATURALIST," Vol. XXXIII, 1919, No. 5, p. 97. At that time only one example of each was found, and nothing was known of their distribution. Now, however, I am able to state that both are abundantly distributed, *obliquum* being much the commoner of the two.

TERNATE GRAPE FERN, *Botrychium ternatum* (Thunb.) Sw., var. *intermedium* D. C. Eaton. This is another well distributed species, but not nearly so plentiful as *obliquum*.

RATTLESNAKE FERN, *Botrychium virginianum* (L.) Sw. There is hardly a wood in which this species is not more or less abundant, the plants ranging in height from 8 to 60 cm.

It may here be of interest to mention, that of the forty-one species and varieties enumerated, all have

been gathered within an area of four square miles, which area could still further be reduced to three square miles if we except *Woodsia glabella*. In the United States a friendly rivalry exists as to which State holds the record for the best fern localities. At present the State of Vermont which adjoins our County of Stanstead claims premier honors (the same as it does for the orchids,) having three localities, Willoughby Lake, Dorset and Manchester where thirty-five, and Pittsford, where thirty-four true species of ferns have been collected. In view of this it has recently been said that apparently only Vermont can compete effectively with Vermont, a statement which I hope ere long to refute, seeing that my list of true ferns for Hatley now stands at twenty-eight species, and this for only two years work, whereas most, if not all, of the above lists have been in the making for over twenty years. It seems strange in view of Gosse's diversified love of natural history subjects, he should have entirely ignored the ferns, for we find no mention whatever of them in his "*The Canadian Naturalist*," 1840, written whilst residing in these parts from 1835-38.

In conclusion, my best thanks are due to Mr. William R. Maxon, who after the death of Mr. James M. Macoun, kindly undertook to verify my determinations, and who in many other ways has given me much valuable help and assistance which has greatly facilitated the writing of this paper. To Dr. Harvie I am indebted for the information regarding the geological formation of this district, and for naming samples of rock submitted.

LIST OF THE FERNS OF HATLEY, 1920.

POLYPODIACEÆ.

- Polypodium vulgare* L. Common Polypody.
Adiantum pedatum L. Maidenhair.
Pteridium latiusculum (Desv.) Maxon. Common Brake, Bracken.
Athyrium angustifolium (Michx.) Milde. Narrow-leaved Spleenwort.
Athyrium acrostichoides (Sw.) Diels. Silvery Spleenwort.
Athyrium angustum (Willd.) Presl. Lady Fern.
Polystichum acrostichoides (Michx.) Schott. Christmas Fern.
Polystichum acrostichoides var. *Scheinitzii* (Beck) Small (var. *incisum* Gray).
Polystichum Braunii (Spenner) Fee. Braun's Holly Fern.
Thelypteris palustris Schott. Marsh Fern.
Thelypteris noveboracensis (L.) Nieuwl. l.c. New York Fern.
Thelypteris Phegopteris (L.) Slosson. Long Beech Fern.

- Thelypteris hexagonoptera* (Michx.), n. comb. Broad Beech Fern.
Thelypteris Dryopteris (L.) Slosson. Oak Fern.
Thelypteris marginalis (L.) Nieuwl. l.c. Marginal Shield Fern.
Thelypteris marginalis var. *elegans* J. Robinson.
Thelypteris Goldiana (Hook.) Nieuwl. l.c. Goldie's Fern.
Thelypteris Bootii (Tuckerm.) Nieuwl. Boot's Shield Fern.
Thelypteris cristata (L.) Nieuwl. l.c. Crested Shield Fern.
Thelypteris cristata, var. *Clintoniana* (D. C. Eaton), n. comb. Clinton's Wood Fern.
Thelypteris spinulosa, var. *intermedia* (Muhl.), n. comb. Spinulose Wood Fern.
Thelypteris spinulosa, var. *americana* (Fisch.), n. comb. Spreading Wood Fern.
Cystopteris bulbifera (L.) Bernh. Bulblet Bladder Fern.
Cystopteris fragilis (L.) Bernh. Fragile Bladder Fern.
Woodsia glabella R. Br. Smooth Woodsia.
Denstaedtia punctilobula (Michx.) Moore. Hay-scented Fern.
Onoclea sensibilis L. Sensitive Fern.
Onoclea sensibilis var. *obtusilobata* (Schkuhr.) Torr.
Pteretis nodulosa (Michx.) Nieuwl. Ostrich Fern.

OSMUNDACEÆ.

- Osmunda regalis* L., var. *spectabilis* (Willd.) Gray. Royal Fern.
Osmunda Claytoniana L. Interrupted Fern.
Osmunda cinnamomea L. Cinnamon Fern.

OPHIOGLOSSACEÆ.

- Ophioglossum vulgatum* L. Adder's tongue.
Botrychium Lunaria (L.) Sw. Moonwort.
Botrychium ramosum (Roth.) Aschers. Matricary Grape Fern.
Botrychium obliquum Muhl. Common Grape Fern.
Botrychium obliquum var. *elongatum* Gilbert & Haberer.
Botrychium obliquum var. *dissectum* (Spreng) Clute. Feathery Grape Fern.
Botrychium obliquum var. *oneidense* (Gilbert) Waters.
Botrychium ternatum (Thunb.) Sw., var. *intermedium* D. C. Eaton. Ternate Grape Fern.
Botrychium virginianum (L.) Sw. Rattlesnake Fern.