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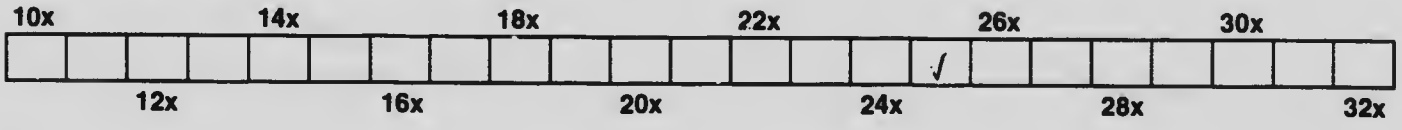

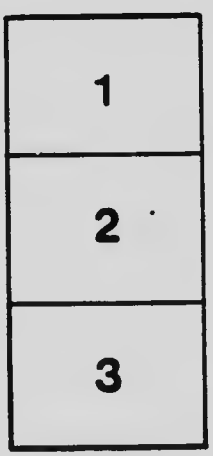

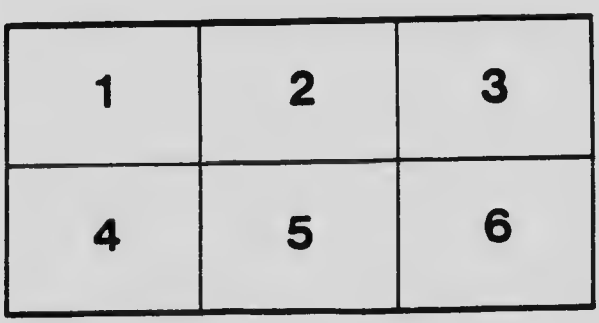

REPORT

OF THE

CANADIAN ARCTIC EXPEDITION 1913-18

VOLUME III: INSECTS

PART K: INSECT LIFE ON THE WESTERN ARCTIC COAST OF AMERICA

By FRITS JOHANSEN

OTTAWA
THOMAS MULVEY
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1921

Issued November 7, 1921

Report of the Canadian Arctic Expedition, 1913-18

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Insect Life on the Western Arctic Coast of America

By FRITS JOHANSEN[1]

Introduction

The territory covered by the Canadian Arctic Expedition, 1913-18 stretches from Wrangell island (about latitude 71 degrees north, longitude 17[illegible] degrees west) off Siberia to the new land found north of the Canadian Arctic archipelago (about latitude 80 degrees north, longitude 100 degrees west).

Much of this area, however, was passed only on ship or during sledge-expeditions, and from some localities no collections of insects or plants were made.

The expedition was divided into a northern and a southern party, the northern exploring principally the Arctic ocean and Canadian Arctic archipelago, while the southern investigated the continental coast. Owing to the unfortunate loss of the naturalist of the northern party [illegible]r. James Murray, with the "Karluk," off Wrangell island, in 1914, the collection made up to then by that party were lost, but the few specimens collected later have a considerable value, owing to the high latitude in which they were found.

Reports on all the entomological specimens appear in this volume. Rearing experiments were made with more than a hundred various insects, etc., but owing to the difficulties incident to a trip of this description, only a quarter of the experiments were successful.

Investigations were made at:[2]

Teller, Alaska (July-August, 1913).

Camden bay, Alaska (September, 1913 to July, 1914).

Demarcation point, Alaska (May, 1914).

Herschel island, Yukon (July, 1914 and August, 1916).

Peninsula south of Dolphin and Union strait, Northwest Territories (August, 1914 to July, 1916).

Lower part of Coppermine river, Northwest Territories (February-May, 1915).

Some insects were collected in Alaska at Nome, Latouche and Ketchikan; and at Cape Bathurst, Victoria island and Coronation Gulf, Northwest Territories.

In the present article the natural conditions and the insect life in these localities are described, but descriptive geographical details are omitted. With this series of reports is included a list of flowering plants, by Theo. Holm and the late J. M. Macoun, and vegetation is, therefore, referred to only when it affects insect life.[3] The region where the forest insects were found lies in the transition zone between the arctic and the subarctic, on the boundary of the barren grounds, and at some distance from the coast; but it is included in this report because the forest insects are described in the report on Coleoptera.

To this report are added data regarding insect life on some of the islands in the Canadian Arctic archipelago, and a comparison is made between these insects and those of Greenland.

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[1]The report as originally submitted by the author has been considerably cut down and has been recast into impersonal form to conform to the other reports of the series.

[2]See map of Western Arctic Coast of America, Fig. 1, p. 41K.

[3]Specific plant identifications in the present paper are from collections determined by Macoun and Holm. (See Vol. V, Part A, Vascular Plants.)

SOUTH SIDE OF SEWARD PENINSULA, ALASKA (NOME AND TELLER)

This district has been so often and so well described that further description in this report appears unnecessary.

Though the character of the country and climate around Nome is practically the same as at Port Clarence (Teller), that of the coast line is different. At Teller, a long, low sandspit runs from the southeast parallel to the mainland and embraces the spacious harbour of Port Clarence. At the head of the port two sandspits, on the southern of which Teller is situated, mark the entrance to Grantley harbour, which is continued by a channel to Imuruk lake.

The southern spit, only a few feet above the sea, consists of gravel and sand with grass-tufts and flowering plants including *Papaver nudicaule*, *Chamaerium latifolium*, *Artemisia* and *Honckenyia peploides;* the tundra, best developed in depressions, is characterized by creeping willows, *Carex*, etc. A few larger depressions (some artificial) contain water even in August (Pl. V, fig. 1). Just west of the town a large lake stretches almost across the sandspit, separated from Grantley harbour by a swamp, and from Port Clarence by sand hills. This lake is a case of recent marine formations, for marine diatoms are found in it, and Commander Trollope's chart of the place made in 1854 shows a lagoon with an outlet to Port Clarence and connected at high tide with Grantley harbour. Since that time the ends of the lagoon have been filled in by beach-deposits for about 100 yards on each side, leaving a couple of ponds on the Port Clarence side.

On the other sides the lake is surrounded by low hills and elevated tundra intersected by small streams, which carry the melting snow in spring time, but later are dry. The depressions of the higher tundra enclose a few ponds in which are mosses, *Hippuris*, *Utricularia*, etc.; and in the gulches among the hills and in shelter of the banks, willows attain a fair size, though not so high as at Nome. *Hippuris*, *Carex*, etc., cover most of the lake shore, growing on mud or gravel-bottoms; and swamps occur between the lake and the surrounding tundra. (Pl. V, fig. 1).

Insects were very plentiful here, but some of the plants plentiful at Nome were absent, owing, perhaps, to the higher altitude.

The fauna and flora of this part of Seward peninsula may best be compared to the Kotzebue sound area and the Mackenzie delta beyond the tree limit, but little is known of insect life in either of these districts.

The fauna, flora, climate, and general nature of the Nome and Teller areas are so similar that their insect life is here treated as identical. The fresh-water insects include:—

(*a*) On the surface: Collembola, and swarms of peculiar flies (*Hydrophorus signiferus*) jumping around like the well-known water-bugs (*Hydrometra*). They evade capture by flying, but afterwards "slide" backwards to the surface to pursue their predacious habits. Their development probably takes place in the water, to which they are far more attached as imagines than is the case with tipulidae, mosquitoes, and other aquatic diptera.

(*b*) Under the surface: coleopterous, trichopterous, and dipterous larvæ, besides the bug *Arctocorixa* sp. and various water-beetles (Dytiscidœ) as *Ilybius angustior*, *Agabus nigripalpis*, *Agabus infuscatus*, *Colymbetes dolobratus*.

The development of the dytiscid larvæ (*Agabus* sp.) outside of the water is interesting. In the sand or mud flats surrounding the lake, the larvæ make their open pupal cells, sheltered by any stone, board, tin can, old sacks, or such waste material as is found near a town or camping place. This material, obstructing the sunlight, renders vegetation scarce and deformed, and the surface is better able to retain the moisture.

A variety of invertebrates were found there, ranging from snails (*Succinea* and *Agriolimax*), myriapods (*Cryophilus alaskanus*, *Arctogeophilus glacialis*, *Ezembius stejnegeri*), mites, spiders (*Pardosa glacialis*), and collembola, to

various insect larvæ (diptera, especially tipulids, and coleoptera) and more secretive living insects (elaterid and carabid beetles *Elaphrus riparius*, *Amara brunnipennis*, *Pterosticus vindicatus*, *P. similis*, *Peophila eschscholzii*, *Bembidium complanulum*, small homoptera, etc.). The finding of myriapods is interesting, because it is the most northern record so far of this order on the American continent. On the tundra itself an occasional hairy lepidopterous larva may be seen, and tiny mites, spiders (*Mieraneeta crassimana*, *Tmetieus brunneus* and hemiptera; or a phryganeoid (*Anabolia marginata*) resting its frail body on a grass-leaf. Curculionid beetles are also at work as larvæ or adults, and a great number of flies are seen, among which the caribou bot-fly, *Oedemagena* (*Hypoderma*) *tarandi*, is perhaps the most interesting, owing to its bumblebee-like appearance and life history. Various species of bumblebees (*Bombus kirbyellus*, *B. polaris*, *B. sylvicola*, *B. pleuralis*, *B. lucorum*, *B. frigidus*) are all attracted to *Epilobium spicatum* and other flowering plants (*Iris*. *Aconitum*, *Delphinium*, Leguminosæ, *Campanula*, *Pedicularis*, etc.), when the male willow catkins have fallen off. The plant which attracts most of the insects at Nome is, however, the imposing *Heracleum lanatum*, which in protected places is more than six feet high and spreads its enormous, sweet-scented cymes towards the sun. On its flowers a number of different flies collect, the tipulid, *Dieranomyia alascaensis*, a phryganeoid (*Limnephelus* sp.), *Vespa marginata*, and the big green saw-fly, *Rhodogaster religua;* also various ichneumonids, butterflies, and moths as *Eurymus palaeno chippewa* Edw., *Eucosma* sp., and other microlepidoptera. Few butterflies are seen at the end of August, but an easily scared geometrid moth (*Lygris destinata* L.) is very common at that time. Swarms of mosquitoes (*Aëdes* sp.) make themselves felt rather forcibly in the shelter of the gully-banks or over the various ponds and pools on warm, quiet days. The shrubby willows harbour a variety of insects. Mites and saw-flies make galls in the leaves, or the latter are fastened together by a small lepidopterous larva, which skeletonizes the sides of the leaves thus turned inwards. *Litheeolletis* (?) larvæ mining in the leaves of *Petasites*, *Artemisia*, *Saxifraga*, etc., were also observed, and a spider with its web between plant leaves, spinning some of these together as a breeding chamber, where the eggs and recently emerged young may be found at the end of August.

On the tall willow-bushes in the gullies inland the leaf-eating or gall-forming sawfly larvæ (sometimes infected with chalcid parasites) are found. A grey, ball-shaped nest of *Vespa marginata* is occasionally suspended from the lower branches or trunks of these small trees, and partly hidden by the foliage or vegetation, but may be obtained with less risk from the inside of old tin cans or boxes which may be lying around.

Vegetation and insect life in the hills back of the coastal tundra are scantier than on the lowland. Apart from flies and mosquitoes, everywhere present, the most characteristic insect is the bumblebee, but spiders, mites, collembola, small beetles, moths, and craneflies are also found.

Various small arthropods are also found under driftwood and other washed up material on the beach.

The wingless parasites (mallophaga, fleas and lice) on birds, mammal, and human beings, and the foreign insects introduced by whites during the last two decades complete the insect-life in this region.

FROM BERING STRAIT TO POINT BARROW, ALASKA

Little is known of the insects in this region, and no collections were made by the Canadian Arctic Expedition.

The flora and insect-fauna of this region seem to have the same general character as that east of Point Barrow, except perhaps the inner part of Kotzebue sound, where the flora is said to be unusually luxuriant, and the insect life correspondingly richer.

A few insects were collected at Point Barrow (cape Smyth), by the United States International Polar Expedition (Murdoch), and have been provisionally identified by Riley, in the report of the said expedition (Washington, 1884), as follows:—

Chironomus sp.	Diptera.
Scatophaga sp.	
Tachinid (*Euphorocera*?)	
Anthomyia sp.	
Tipulid (*Ctenophora* sp.)	
Can. Entomol., 1917-1918.	
Tipula coracina Alex.	
Cordylura sp.	
Oedemagena tarandi	
Phryganeoid	Neuropteroids.
Perlid (*Leptocerus* sp.)	
Bombus modcratus	Hymenoptera.
" *sylvicola*	
Urocerus flavicornis	
Dosychira rossi	Lepidoptera.
Amara obtusa	Coleoptera.
Chrysomelid	

COAST BETWEEN POINT BARROW AND MACKENZIE DELTA

The Arctic mountains stretch from cape Lisburne to the Mackenzie delta and their foothills merge gradually into the coastal plain that reaches the Arctic ocean. The beach is formed, sometimes by tundra bluffs up to 30 feet in height and sometimes by low alluvial plains fringed by sandpits and lagoons. The chains of islands off the coast have a similar composition. The width of the coastal plain is greatest at point Barrow, where it is more than 150 miles, but decreases to the southwest, so that the mountains are within 12 miles of the ocean at a point east of the 141st meridian, and the foothills sometimes usurp the place of the plain. The rivers, some very large, of this part of Alaska and Yukon receive many tributaries from the foothills, and when these lateral creeks have finally been left behind, the watercourses run fairly straight to the north, for the hills along the Mackenzie delta prevent an eastern outflow. Ground ice is found to varying depths, especially west of Camden bay. The vegetation is the typical Arctic tundra, best developed in valley-bottoms and in the extensive coastal swamps where most of the many lakes or ponds are situated (Pl. V, fig. 2). An enormous quantity of driftwood, from the Mackenzie, lines the beach at certain places, and the coastline is subjected to a continuous erosion by waves or screw-ice at some parts and upbuilding by sand and gravel at others. Even where the coastal plain is missing, as east of Stokes point, lagoons, sandbars, and gravel spits are formed at or near the mouths of rivers. Shingle point is a conspicuous example of this, presenting a shelter for boats.

Herschel island[1] and the coast opposite and eastward are well covered by vegetation, which is surprisingly abundant on low or protected parts.

The developments of plant and insect life are so intimately connected that the study of one involves the study of both, and also, of course, of climatic conditions, the influence of which has been dealt with in the report on climate and in Mr. F. W. L. Sladen's report.[2] The development of plant-life especially affects the non-predacious insects such as certain coleoptera, diptera and the lepidoptera, sawflies, and bees.

Such plants as mosses, *Cassiope*, *Saxifraga*, *Ranunculus*, etc., which, during the melting of the snow, are immersed in water, bear green or new leaves at the beginning of May—earlier than is the case with those plants that draw their power only from the sun.

[1] For topographical description see Geol. Surv., Can., Sum. Rept., 1915, p. 236, J. J. O'Neill.
[2] Report Canadian Arctic Exped., 1915-18, III, G. 1919.

Apart from mosses and grasses and Cyperaceæ whose first new leaves are less easily noticed, new leaves and buds were found on plants as follows:—

CAMDEN BAY TO DEMARCATION POINT, 1914

May 1-10

Cerastium alpinum
Empetrum nigrum
Ledum palustre
Cassiope tetragona

May 21-31

Arenaria peploides }
Martensia maritima } buds only.
Potentilla pulchella }
Saxifraga decipiens
Papaver nudicaule
Cochlearia groenlandica
Oxytropis nigrescens

June 11-20, New leaves:

Salix pulchra
S. reticulata
Ranunculus nivalis
Anemone parviflora
Taraxacum lyratum
Artemisia comata
Papaver nudicaule
Dryas integrifolia
Lupinus nootkatensis (buds only)
Hedysarum alpinus
Carex stans.
Primula borealis
Flumus mollis
Epilobium latifolium

May 11-20

Vaccinium caespitosum
Oxytropis nigrescens }
Betula glandulosa } leaf-buds only.
Pedicularis lanata }
Saxifraga oppositifolia (new leaves, little developed).
S. hieracifolia
Dryas integrifolia

June 1-10, New leaves:

Various Caryophyllacea
Saxifraga (e.g. *S. bronchialis* *S tricuspidata*)
" Compositæ
Pedicularis lanata
Pyrola grandiflora
Oxyria digyna
Caltha palustris
Equisetum arvense (buds only)
Salix pulchra (only buds)
Hippuris vulgaris (only buds)

June 21-30, New leaves:

Equisetum arvense
Stellaria longipes
Silene acaulis
Polemonium boreale
Petasites frigida
Lloydia serotina
Rubus chamaemorus
Empetrum nigrum

From July onward all the plants have new leaves.

Flowers of the following plants were found. See also Vascular Plants Collected in Arctic North America by the "*Gjöa*" Expedition (Ostenfeld, 1910).

June 3-4

Salix pulchra (female)
Eriophorum vaginatum
Saxifraga oppositifolia

June 11-15

Salix pulchra (male)
Lycopodium selago
Ranunculus nivalis
Anemone parviflora
Salix Richardsonii (male and female)

June 17-20

Salix rotundifolia (male and female)
S. ovalifolia var. *camdensis* (male and female)
Cochlearia groenlandica
Oxyria digyna
Oxytropis nigrescens
Potentilla pulchella
Pedicularis lanata
Dryas integrifolia

June 21-24

Draba alpina. D. fladnizensis
Oxytropis nigrescens

June 27-28

Papaver nudicaule
Cassiope tetragona
Primula borealis
Lloydia serotina
Pedicularis arctica
Ranunculus sulphureus
Caltha palustris
Petasites frigida
Salix reticulata
Saxifraga nelsoniana

June 29-30

Pedicularis sudetica
Carex variflora
Polygonum viviparum
Luzula niralis
Alsine arctica
Silene acaulis

July 2-7

Eriophorum angustifolium
E. Scheuchzeri
Carex rigida
Lagotis glauca
Polemonium boreale
Cerastium alpinum
Ranunculus Pallasii
Saxifraga hirculus
S. decipiens
Lupinus nootkatensis
Phaca frigida
Parrya macrocarpa

July 11
Artemisia comata

July 17
Taraxacum lyratum
Alopecurus alpinus
Astragalus alpinus
Saxifraga rivularis
S. hieraciifolia
Saussurea angustifolia
Pedicularis capitata
Eutrema edwardsii
Stellaria humifusa
Saxifraga cernua
Luchnis apetala
Senecio atropurpureus
Hierochloë pauciflora
Carex reducta, C. stans
Luzula spicata
Hippuris vulgaris

July 26-29 (Martin point, Alaska)
Elymus mollis
Glyceria tenella
Sedum rhodiola
Stellaria longipes
Halianthus peploides
Carex reducta
Carex incurva
Dupontia Fischeri
Mertensia maritima
etc.

August 3 (Icy reef, Alaska)
Draba nivalis
Arctogrostis latifolia
Crepis nana
Epilobium latifolium
Festuca ovina var. *brevifolia*
Poa arctica
Androsace Chamaejasme

Flowers of *Empetrum nigrum* were found on May 6, 1914, but this may have been a 1913 flower.

Observations on flowers were also made at Shingle point and on Herschel island, Yukon, in the beginning and middle of August, 1914 and 1916. The vegetation at these two localities, and at others equally close to the Mackenzie delta, is apparently a week or more earlier than along the coast west of the International boundary line.

No new flowers were observed west of Mackenzie delta after August 21. The Compositae and grasses are the dominating ones in the end of August.

From the beginning or middle of September the frost gradually kills off the flowers and green leaves, and about the end of September, when the first snow has fallen, the dead fruit-stems and leaves are the main plant parts observed, though hibernating leaf-buds are sometimes seen.

INSECT LIFE ON ALASKAN ARCTIC COAST

October, 1913, to April, 1914.

Insects are scarce along the Alaskan Arctic coast after October and are found only under stones and driftwood, or by digging in the frozen tundra or cutting holes in the freshwater ice. Entomological investigations in northeast Greenland have shown that the hibernation of insects in that region[1] is very similar to that of insects in northern Alaska, though the American Arctic is richer in the number of species, which are mostly different from the Greenlandic.

The main objective of the hibernating insects is to find, before the snow and frost come, some place where the spring water can best be avoided. They therefore take every advantage of cover especially of those places likely to become free of snow in the early spring. In this, not all are successful, but they are more likely to be found, during the winter, on such exposed localities than on lower ones that have a better vegetation (Pl. III, fig. 1). An exception is, however, formed by certain larvæ, such as large diptera, e.g., tipulidæ, which hibernate down in the ground until the medium surrounding them thaws. Aquatic insects and larvæ that inhabit water all through the year endeavour to bore themselves into the mud, and failing this, are killed, and hibernate only as eggs when the water freezes to the bottom.

Insects hibernating in the latter part of September, of course remain in that state during the winter, though probably in decreased numbers, a great many being killed when the temperature falls to zero Fahrenheit. Most hibernating insects can withstand temperatures down to 50 degrees below, and the mortality may be ascribed rather to factors in the life-cycle of each particular insect than to the cold.

[1] See Meddelelser om Grönland, Vols. 19 (Deichmann) and 43 (Johnsen).

In the fresh waters of northern Alaska insects and larvæ are abundant, even in winter, as compared with those on land. They were observed in frozen ponds and lakes and in a warm creek, a tributary to Sadlerochit river, back of Camden bay. In a pond only 4 feet deep, on which the ice was 10 inches thick on October 9, many copepods, *Limnocalanus johanseni* Marsh, ostracods, and other minute animals, and a number of midge larvæ were found. Ponds such as this would, of course, freeze to the bottom later in the winter. From a neighbouring stream a perlid nymph was obtained from beneath the ice. Examinations of the lakes and ponds in spring and early summer led to the conclusion that the following forms hibernate in or near fresh water:—

Aquatic diptera—larvæe (especially tipulids and muscids).
Dytiscid—beetles.
Trichoptera—larvæ and perlid larvæ.
Mosquitoes—females, a few (*Aëdes* sp.).
Various midge larvæ.
Hydrachnid mites.

The warm creek back of Camden bay has its source in three springs, at the foot of a mountain about 25 miles from the coast, and flows for a few miles nearly parallel to Sadlerochit river before joining it. Its rather luxuriant vegetation consists of grasses, sedges, and green algæ[1] on the sandy and muddy bottom, and of an algæ-crust and mosses, as a carpet, on the submerged stones. Parts of stones just above water carried a white crust of siliceous or calcareous algæ, and stones above high-watermark, had a luxurious growth of lichens. The water at the source was steaming and had a temperature here of about 60 degrees F., but became colder as the stream was descended. The steam and the open character of the stream contrasted strangely with the surrounding snow-clad, silent tundra (November, 1913).

In this warm water (above 35 degrees F.), a number of grayling, *Thymallus signifer* Rich, and trout were seen feeding on the rich invertebrate life, which consisted of larvæ of midges, perlids, and phryganeoids. A species of phryganeoid larvæ typical of streaming water, was living inside gravel cocoons attached to the underside of the stones. There were also many amphipods (*Gammarus limnæus*) and small clams (*Pisidium*) and hundreds of snails (*Lymnea caperata*) were clinging to the mosses and algæ. All these, with many microscopic forms, made an unusually rich animal collection.

Apart from the insects found in the warm springs and creeks which keep open all winter, there appears to be no difference between insect life in the upland and that at the coast, except that some species (*Bombus*, *Vespa*, and ants) take advantage of cliff-crevices or old bark on the taller willow trees, to build their nests or to hibernate as larvæ. Observations up the Sadlerochit river were, however, made in November, at which time the cold had killed most of the insects, and much snow covered the ground.

In the reports of the various specialists, information is given concerning the seasonal occurrence of the various insects in their immature stages; and it will be seen that the life history of insects is much the same in the Canadian Arctic as in more southern latitudes. The following tentative table summarizes very roughly the facts concerning the hibernating of arctic insects, not including parasites:—

[1] See this series of reports, IV, Part A, Freshwater Algæ and Freshwater Diatoms.

Order	Family	Genus	Hibernate as
Orthoptera	Acrididæ	.....	Nymphs?
Neuropteroids	Perlidæ	.....	Nymphs?
	Ephemeridæ	.....	Larva (Nymphs)
	Megaloptera	*Hemerobius*	Larva (Nymphs)
	Trichoptera	.....	Larva (Nymphs)
Lepidoptera	Butterflies	.....	Larva (Pupa?)
	Moths	.....	Larva, Pupa (?), Imago (?)
Diptera	.....	All those with larva and pupa stages in fresh water and in the ground, except mosquitoes.	Larva
		All others and mosquitoes	Larva (Pupa?)
Coleoptera	.....	.....	Imago.
Hymenoptera	Sawflies	.....	Larva, pupa, or Imago.
	Bees and wasps	.....	Larva or pupa.
	Parasitic wasps	.....	A few queens.
Rhynchota	Hemiptera	.....	Larva?
	Homoptera	.....	Nymphs?
		.....	Nymphs?

The three periods of each month under which insect life is described in the following pages must not be taken too literally; future investigations may extend considerably the period in which certain species are out, and also add species not yet found. Nor can observations on reared insects be considered to hold good for insects living under normal conditions. In the main, however, the data given are correct, especially for the more common forms.

Beginning of May, 1-10

Early in May (1914) the weather was warm, the snow started to melt, and the shallow tundra ponds became free of ice. In these ponds various big dipterous larvæ, especially tipulids (*Stygeropis* sp., etc.), were found lying dead on the bottom or already actively boring in the soft mud. Dytiscid beetles, midge larvæ, etc., are probably also present, but were not noticed until later in the month.

The other hibernating insects, carabid beetles (*Pterostichus mandibularis, P. agonus, Nebria* sp.), lepidopterous larvæ, collembola, flies, spiders, and mites are still found in plant tufts, under stones, and driftwood, etc., as during September and the winter, keeping immobile until exposed directly to the sun.

Middle of May, 11-21

Even now the hibernating insects are found immobile in their hiding places. The following typical instances are taken from the writer's field-journal:

> "May 12, 1914. Demarcation point, Alaska. "Found a full-grown Agrotid (?)-larva $3\frac{1}{2}$ cm. long stuck into a *Dryas* plant on the coastal tundra. The larva lay curled up between the leaves and twigs about $\frac{1}{4}$-inch below the surface and hidden by dead leaves. Below the larva the ground was completely frozen. When removed the larva moved very slowly; and when laid in a box only used its abdominal feet to take a grip. Later, when brought into the house, the larva livened up completely and began to crawl around. Efforts to rear it were unsuccessful. The day was calm and sunny; temperature from 9 degrees to 30 degrees F. and higher on direct exposures."

The first flies of the year, three kinds, probably hibernating forms, were seen May 13, 1914, at Demarcation point (Pl. III, fig. 2). The weather was still clear, but warmer (35 degrees F.) One species of the flies, *Phormia terranovae*,

kept to the south side of the house where the thermometer, hanging free, showed 40 degrees F. at 2 p.m.; on the refuse heaps outside the house the two smaller species (*Fucellia ariciiformis* and *Scatella brunnipennis*) were common; all of them were very much alive.

Early in May owing to the snow and hibernation period the tundra provided poor results in insects, but a few days later, better results were obtained. Under driftwood many collembola of different sizes, white, orange, and violet were found, and various small spiders, with egg cocoons of spiders and mites. The small fly, *Scatella brunnipennis* favoured specially the driftwood on moist, sandy ground. Carabid beetles were seen, and young hemiptera (*Chiloxanthus stellatus*) coloured as dead grass and difficult to catch, as were some smaller flies with a similar habitat.

Muscid larvæ (*Rhamphomyia* sp.), orange or green sawfly pupæ (*Amauronematus cogitatus*), in transparent pupating cocoons in a special little cell communicating with the air, various beetle larvæ or pupæ, and small staphylinid and carabid beetles, etc., were found in snow-free moss-pillows; and, on the tundra plants, the hairy larvæ of all sizes, and cocoons with larvæ or pupæ of the moth *Gynaephora rossi* and probably, also, of *Hyphoraia alpina*. Sometimes these cocoons contain only the larvæ or pupæ skins or eggs (on the outside) from previous years, or the pupæ cases of the parasitic tachinid fly, (*Euphorocera getida*). Spiders and leafhoppers (*Chiloxanthus*) are common in the grass.

A small lepidopterous larva is also seen. It has a brown colour, but is paler on the ventral side; it has a chitinous-brown head and neckband and dark thoracic feet. It spins two willow leaves together and skeletonizes them, remaining inside where the larvæ evidently hibernate.

In the now completely melted tundra ponds are smaller, long-legged flies (*Hydrophorus?*) and a number of different collembola (*Podura aquatica*, *Isotoma palustris*, etc.) which are of three sizes. The smallest and most common are black-blue; some, a little larger are grey-brown, and a few—the largest—are green. Smaller dytiscid beetles (*Agabus nigripalpis*, *Hydroporus hameralis*, *H. tartaricus*) are busily investigating the mud. Tiny, dark red water-mites move rapidly around in the water, propelled by their hairy legs, and searching for their prey, of which the brownish midge larvæ (*Tanypus* sp.?) which wriggle along near the surface are probably the most important. Crawling on the muddy bottom are other somewhat larger watermites with tile-red body and dark purple legs; and dark coloured midge larvæ inside mud tubes. Most conspicuous are the big dipterous larvæ (tipulids, etc.); one species (*Stygeropis* sp.) keeps its long, hairy, anal processes surrounding the spiracles spread out at the surface and floats thus in the water; or it wriggles along over the mud bottom, with the "fan" closed; another species digs, with its head and lateral "legs" conspicuous furrows (tunnels) in the mud, the larvæ when working being completely hidden at one end of the furrow. Other larvæ, found dead, perhaps belong to the genus *Tipula*.

The temperature of the pond mud at 5 p.m., May 21, 1914, at Demarcation point, was 55.5 degrees, or 15.5 degrees warmer than the atmosphere. The ponds, though sometimes free of ice in early May, occasionally freeze over again, but this appears to have no effect on the aquatic animals, though alternating freezing and melting may continue until June.

End of May, 22-31

Insect life during this period is very similar to that observed in the few preceding and following days. The weather was cold and hazy or rainy, and not favourable to rapid development of insect life. Some plants get new leaves about the beginning of May and most of them by the end of May, so that, apart from predacious and carrion-feeding forms, the insects found in May are only larvæ or pupæ, the imagines first appearing when the flowers come out in June.

June 1-9

Excepting the flies mentioned as appearing in May, few insects are seen on the wing even in the beginning of June. Two kinds of flies, however, were observed on Barter island, Alaska; the brown species of *Scatophaga* and minute, black ones, common around freshwater ponds after June 1. In exceptionally early seasons, the *Bombus* queens may be out. (Pl. IV, figs. 1-2).

The greatest number of insects on the ground, besides those mentioned under May, were:

Under driftwood: colonies of Homoptera (wool lice?) 1.3 mm. long, clustered to or creeping slowly on the lower side of or in the cracks of logs. They have dark antennæ and legs, and are flesh-coloured, with a white-grey "coat" especially dorsally, of waxy, grey secretions. The slender, worm-like myectophilid (?) larvæ of a transparent white or yellow brown colour, besides collembola, mites, etc., are found in rotten driftwood.

In the tundra moss, carabid beetles and various larvæ of coleoptera and tipulids, *T. arctica*, etc., flies, both adults and pupæ, spiders, mites, etc., and small orange-coloured *Cecidomyia* larvæ half hidden in the corners of wet sphagnum leaves, are found.

Larvæ and cocoons of *Gynaephora rossi* with or without parasitic tachinid pupæ are also seen on the tundra, the larvæ feeding on *Salix* buds and *Saxifraga oppositifolia* leaves.

In the ice-free tundra ponds young mosquito larvæ (*Aëdes* sp.) of various sizes, besides copepods, "winter eggs" of *Daphnia pulex*, etc., are present.

June 10-20

The most conspicuous insects now seen for the first time, are queens of bumblebees (*Bombus sylvicola, B. polaris*, etc.) mostly in strong speed and high flight the first days, but later feeding on the male catkins of the various species of *Salix* just out.

Flies (*Cynomyia cadaverina, Scaeva pyrastri*, etc.) are now also out. A black and white striped species (*Syrphus sodalis?*) is typical of the higher, dry places on the tundra; when approached they rise and hover for a while before flying away. The first sawflies, *Amauronematus* sp. and ichneumonids (*Aptesius nivarius*) were seen; the flight of the former is much like that of ants, and only lasts for a short while.

The various arthropods found earlier in the season under stones, driftwood, etc., have now come out from their hiding places. Minute, brown beetles may be seen on the wing on calm, sunny days; and the various carabidæ (*Asaphidion* sp., *Amara brunnipennis*, etc.) besides an occasional curculionid or chrysomelid beetle (*Chrysomela subsulcata*) are found on the tundra, and various spiders (*Lycosa pictilis*, etc.), small hemiptera, etc., and immature stages of various insects.

In the tundra ponds are spiders and small flies (*Leptocera transversalis?*), besides the common, aquatic animals, such as small trichopterous larvæ, dytiscid-beetles, mosquito and tipulid larvæ, mites, etc.

June 21-30

At the end of June a number of flying insects are out—the first tipulid adults (*Stygeropis parryi*, etc.,) mosquitoes (a few *Aëdes* sp.), and tineoid imagines (*Eucosma* sp.). These small moths and the hemiptera (*Euscelis hyperboreus*) are characteristic of places having rich vegetation (*Salix*, grasses, etc.), in shelter of tundra-bluffs, where the many dead leaves afford good colour protection (brown). On approach the microlepidoptera fly up in a fluttering swirl, and suddenly drop, which makes them difficult to observe and eat l.. *Bombus arcticus* queens and various flies and sawflies were also found.

On the tundra plants are various hemiptera (*Euscelis hyperboreus, Calacanthia trybomi*, etc.) and spiders (*Xysticus bimaculatus, Lycosa* sp.); the *Lycosa* makes a funnel-shaped web in fissures of the ground, in which it takes refuge, often first dropping its prey consisting of tipulids, flies, beetles, or other spiders; the *Xysticus* are found among leaves. Now and then a decomposed dead animal harbouring muscid-eggs or larvæ attracts the beetle *Silpha lapponica*. On driftwood sticks or dead leaves are cakes of red mite eggs (*Bryobia praetiosa*) from which the equally red larvæ will emerge in a few days. Conspicuous also are the larvæ and cocoons of *Gynaephora rossi*. The first moths of this species now emerge, unless parasitized by the tachinid fly (*Eurphorocera gelida*) or by an ichneumonid wasp (*Amblyteles* sp.). Of the former (fly) as many as six pupa cases may be found together with the larval skin of the lepidopterous host; some of the cases contain the dead fly-pupa (pale, with grey hairs and legs, eyes red-brown) and attached to it six or more parasitic chalcid larvæ, which later emerge in August through small holes in the pupa case of the fly. Or the *Gynaephora* cocoon may contain the dead lepidopterous larva or pupa, which on opening will be found to contain a fat, white ichneumonid larva filling out most of the host, the internal parts of which it has devoured, while the skin of the caterpillar host protects it from drying up. Sometimes the parasite kills the *Gynaephora* larva before the latter succeeds in making its cocoon and pupating; it is then found that the ichneumonid pupa (another species?) has spun itself to the ground, the caterpillar skin above protecting it from discovery by birds and other enemies.

By digging, or in plants, various larvæ or pupæ of insects (weevils, tipulids, etc.) may be observed.

The freshwater ponds and lakes now contain a rich life. Craneflies, emerging from their pupa cases, float on the surface, or fly over the water, when not resting on grass leaves, etc. Swarms of small flies swarm or spring on the water surface; often they are seen in copulation. The first perlid adults crawl up on grass leaves above the water and leave behind the nymphal skins on the surface. Swimming in the water are thousands of mosquito larvæ now grown considerably (*Aëdes* sp. etc.), copepods and the nauplii of the common phyllopod (*Branchinecta paludosa*), besides mites (*Curvipes reighardi*), etc. Crawling or resting on submerged logs, etc., are the large red *Chironomus* larvæ in their mud tubes. They are now pupating, the pupa emerging from its tube to the surface where it floats on one side, until it has shed its larva skin and can assume a vertical position.

July 1–10

The following insects are now seen:—

Flies	*Rhamphomyia erinacioides*	
	Syrphus sodalis	
	Aricia borealis	
	Phorbia brevitarsis	
	Piophila borealis	
	Botanobia frit	
	Tipula subarctica	Craneflies with nymphs of mites (Hydrachnids?) on some of them.
	Tipula arctica	
	Stygeropis parrii	
	Trichyphona brevifurcata	
	Sawflies (*Amauronematus* sp.)	
	Ichneumon fly (on willow plants)	
Midges	*Tanypus alascensis*	
	Chironomus sp.	
Mosquitoes	*Aëdes nearcticus*	
Bumblebees	*Bombus* sp.	
Butterflies	*Brenthis frigga alaskensis*	
	B. frigga improba	
	B. polaris	
	Colias hecla glacialis	
Moths	*Diasemia alaskalis*	
	Eucosma sp.	
	Gynaephora rossi	
	Hyphorata alpina	

The first butterflies of the season appear at this time (*Brenthis frigga alaskensis* and *B. f. improba*). The smaller form (*improba*) has a fluttering flight and settle on plants with the wings spread out, moving them up and down in the manner characteristic of this genus. Though seen on swampy ground, it seems to favour the drier brown-coloured tundra and the bluffs with their richer growth of flowers. The larger form (*B. f. alaskensis*) is found in similar places, but has a wilder flight and remains longer on the wing. The *colias* butterflies (*Colias hecla glacialis*) appear about the same time, but as noted by D. Jenness on Barter island, the *brenthis* species are slower, more zigzagging in their flight, and do not appear to travel such long distances at a stretch.

Lepidopterous larvæ, 5 mm. long, yellow-green, but head and thoracic legs brown, skeletonize the leaves of *Salix reticulata* and spin them together with the catkins, thus deforming both. Full-grown black, flat hemiptera (*Chiloxanthes stellatus*) are seen in the dried-out ponds, but appear not to use their wings and to avoid water. Around those ponds with a rich vegetation washed-up plants and shells of a snail (*Aplexa hypnorum*) are common.

July 11–21

Additional insects observed:

Bumblebees	*Bombus kirbyellus*
Butterflies	*Brenthis charielea*
	Colias nastes
Moths	*Pyla arctiella*
	Eucrostis fasciata

Scattered driftwood affords good colour protection to certain flies and microlepidoptera.

The ponds, many dry or nearly so, contain the usual life of snails, mites, copepods, metanauplii of *Branchinecta paludosa*, worms, dytiscid beetles, etc. A few predacious larvæ of water-beetles, their discarded skins floating on the surface, feed on the abundant young phyllopods. Three common species of *Salix*—*S. pulchra*, *S. richardsonii*, *S. ovalifolia* var. *camdensis*—have finished flowering, but a fourth, *S. reticulata*, lasts a little longer. The male catkins drop off, but the females remain until the seedwool comes out, or perhaps throughout the winter. Those insects (principally *Bombi*) depending upon the male catkins, must therefore, be satisfied with other flowers, but the sawfly larvæ (different species) boring in the carpels of the female catkins or forming galls on the willow leaves are not so affected.

July 22–31

Toward the end of July, a number of other plants (*Papaver nudicaule*, *Cochlearia officinalis*, *Oxytropis* sp., *Saxifraga oppositifolia*, *Potentilla* sp., etc.) have finished flowering or nearly so, so that the insects must seek other flowers.

On Herschel island the following were noted in addition to the common insects:—

Flies:

Rhamphomyia herschelli
R. conservativa
Melanostoma sp.
Phorbia sp.
Limnophora sp
Sphærophoria cylindrica
Ichneumonids (*Stenomacrus borealis*)
(Spiders) *Pardosa groenlandica*
(Mites) *Bdella frigida*

In Ponds and Lakes

(Mites) *Lebertorris*
Copepods (*Diaptomus*, *Cyclops*, etc.)
Amphipods (*Gammarus limnaeus*)
Cladocera (*Daphnia*, etc.)
Larvæ of *Chironomus* and *Tanypus* (Midges)

On the leaves of the various species of *Salix* are seen galls caused by sawfly larvæ (*Pontania* sp.) Other sawfly larvæ bore in the female catkins of these willows; the larvæ eat their way into the carpels and from these into the main axis of the catkin, which they hollow out. Their presence is detected by the dried-out character of the catkin and by the brown excrement outside.

The two large moths, the arctiid *Hyphoraia alpina* and the lymantriid, *Gynaephora rossi*, appear at about this time. The hairy larvæ of these are difficult to distinguish, especially as the colour of the hairs change after each moulting, but generally the *Hyphoraia* larvæ are the larger and lack the yellow hair-spines on the middle of the back, so that its colour is more uniformly brown. The pupa of the *Hyphoraia* is bald and coal-black and larger than that of the *Gynaephora*. The *Hyphoraia* cocoons, also, are larger—about the size of a pigeon's egg—and more perfect, with the outer layer smoother and whiter than the brownish, more closely spun cocoon of the *Gynaephora*. *Hyphoraia* appears to be quite free from the tachinid parasite *Euphorocera gelida* and almost free from ichneumonid parasites, but the *Gynaephora* is attacked by both. In spite of this, *Gynaephora* is the more abundant. The males first appear active and well developed, and when the females appear, copulation at once takes place, though the female is in a crumbled state, and so little developed that they can only crawl around. The first act of the females, after being left by the male, is to lay their eggs.

At Martin point, Alaska, at the end of July, 1911, examination was made of the extensive lagoons. They contain about 6 inches of brackish water, covering a bottom sometimes sandy, sometimes gravelly, and, in the deeper places, muddy, the mud being mainly the tubes and excrement of red *Chironomus* larvæ. Some of the ponds contained floating masses of green, thread-like algæ. On the water were flies and the common blue collembola; in the water were the fry of a sculpin (*Oncocottus quadricornis*), water-beetle larvæ, copepods (*Eurytemora* sp., etc.), many full grown male and female *Branchinecta paludosa* and *Lepidurus arcticus* of various sizes, besides the common *Daphnia pulex*. Some of these lagoons were at high tide connected with the beach water; and the temperature of their water was during the middle of the day about 50 degrees F., though the temperature of the air was only around freezing point.

August 1–10

Several more plants (*Lloydia*, *Ranunculus*, *Parrya*, *Eutrema*, *Polemonium*, etc.) of importance to insects finish their flowering at this time and are replaced by flowers of a great number of Compositæ.

August 11–20

On Herschel island flying insects were few. The berry-like galls on the leaves of the various species of Salix (*S. richardsonii*, *S. anglorum*, *S. reticulata*, etc.) caused by sawfly larvæ (*Pontania* sp.) were very common, from the size of a pinhead to that of a bean, the larvæ inside being of a corresponding size. The colour of the larvæ was pale yellow; the head dark grey, eyes black, thoracic legs light grey. Adults of several species were reared from them and emerged in the following July.

The ponds contained a rich life of invertebrates, of which the large phyllopods (*Branchinecta paludosa*) various cladocera (*Eurycercus*, etc.) and copepods (*Diaptomus*, etc.), small midge larvæ and phryganeoid larvæ in tubes, snails (*Aplexa hypnorum*), and worms were the most common (Pl. VII, figs. 1–2).

August 21–31

Insect life is rapidly declining, especially among the less hardy (neuropteroids, lepidoptera, mosquitoes, wasps, sawflies) few of which are seen on the wing, though others (flies, coleoptera, bees, hemiptera) are still numerous.

September 1–30

By the beginning of September, 1913, the first signs of winter were apparent. On September 3, a landing was made on Spy island,[1] one of the Jones Islands off the Colville delta, where the only animal life noticed was a few small spiders (*Typhocraestus spitsbergensis*) in plant tufts, and colonies of small grey-violet collembola together with a few oligochaete worms and fly larvæ under the washed-up layer of algæ around the large lagoon. A few of the more hardy insects (flies, etc.) are still on the wing on warm, calm days, besides a number of insects on the ground. The hairy *Gynaephora* or *Hyphoraia* larvæ are crawling around looking for hibernating quarters.

The close of summer arrives between the end of August, at point Barrow, and the middle of September, at the Mackenzie delta, the point being about one degree farther north than the delta.

In the middle of September, 1913, winter had set in at Camden bay. At the end of the month an occasional warm day may melt much of the snow, and insects, though in their quarters for the winter (see below), are more lively. Insects on the wing are absent, but *Scatella brunnipennis*, seemingly associated with the excrement of mice (*Microtus* sp.), whose burrows are common, may be found under driftwood. Small spiders, mites, and Collembola, beetles, carabidae, staphylinidae, the latter in colonies, *Chrysomela subsulcata*, dytiscidae, besides larvæ and pupae of these beetles are also seen in moss-pillows (beetle pupæ often in special small cells), and many empty pupa cases and cocoons of flies and hymenoptera, fly-larvæ, etc. The hemipteron (*Chiloxanthes stellatus*) seems to be one of the few insects moving around freely at the middle of September. A cocoon with a sawfly larvæ was found on a willow branch; but most of the sawflies now hibernate in the ground or among dead leaves.

Large elaterid (?) larvæ are present among plant roots in frozen ground and minute orange dipterous larvæ bore in the root of *Pedicularis*. The depth at which the larvæ of the common tipulids hibernate is interesting. They are found not only in the moss, but about one inch below the plant cover, in solidly frozen "muck." The larva makes, before the ground freezes, a cell a little larger than itself and communicating with the air. In this cell the stiff-frozen larvæ lie, heads uppermost, awaiting spring.

All these hibernating insects on cold days seem to be frozen still or hardly move, but when brought into a warm place will liven up again. The temperture of the snow-covered ground is generally one or two degrees warmer than the air.

MACKENZIE DELTA TO CAPE BATHURST

Trees (not willows) grow farther north along the Mackenzie river than in other parts of the American Arctic except in the region north of Great Bear lake and in the Arctic mountains. North of the woods the delta is one maze of low, flat, alluvial islands covered with dense thickets of willows and alders which gradually diminish in height and luxuriance as the outer rim of the islands is approached (Pl. II, fig. 1). Hills continue south along the east branch of the delta and on the exposed small islands Garry, Pelly, Kendall, Pullen, Hooper, etc., but everywhere the soil is mud and clay. Little is known of the vegetation in these "barren" parts of the delta, and only a few insects have been collected. Plant and insect life seems to be the same both east and west of the delta.

Some hymenoptera and coleoptera were collected by R. M. Anderson[2], 1910, in the barren and wooded parts of the Mackenzie delta.

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1 Vegetation is very scarce on this sandy island.

2 "My Life with the Eskimos" (V. Stefansson), New York, 1913, Appendix p. 449.

Judging from the climatic conditions, and the size and extension of the willows, both the vegetation and the insect life must be unusually luxuriant, at least on those portions of the islands in the delta which are not flooded in the spring, or are not too far from the mainland.

Toker point is about the eastern limit of Mackenzie delta. The coast is low and flat with numerous lakes and ponds. Some of the islands, such as Nicholson island, and points such as Maitland point, cape Dalhousie, are, however, higher and consist of slate or clay. Farther inland, the so-called "mud-volcanoes" are a characteristic feature of the country. The coast between Nicholson island and cape Bathurst presents gently swelling hills, as high as 200 feet a couple of miles from the beach, and with much vegetation.

It may be assumed that the proximity of this part of the coast to the Mackenzie delta with its comparatively warm and long summer, and to the woods there and along the Eskimo lakes and Anderson river farther east, favours vegetation and insect life.

The east coast of Bathurst peninsula presents steep, slaty cliffs, but the west coast and the two Baillie islands which it faces, are composed mainly of tundra bluffs underlain in places by ground-ice.

Cape Bathurst—village and harbour—is situated at the end of the peninsula on a long spit of gravel and sand, whose shingle bears no lichens, proving that the sea sometimes covers the spit. Where the spit joins the tundra is a belt of tundra sods and barren muck left by the sea, and the bluffs are steeply cut by gullies made by water in the spring. These gullies merge into swampy depressions between the higher parts of the tundra, south of which the typical tundra stretches far inland.

The following insects, etc., were noted at Cape Bathurst: —

Mosquitoes (*Aëdes nearcticus*)
Diptera (*Arctia borealis*, etc.)
Microlepidoptera
Bumblebees
Hemiptera (leaf-hoppers)
Sawfly larvæ (*Pontania* sp.)
Midge and water-beetle larvæ
Copepods (*Cyclops* sp.)
Cladocera (*Daphnia, Chydorus, Eurycerus*)
Snails (*Aplexa hypnorum*)
Worms (*Lumbriculus, Henlea*, etc.)

COAST FROM FRANKLIN BAY TO STAPYLTON BAY

The following insects were collected at Langton bay by V. Stefansson and R. M. Anderson, 1910–11. (See "My Life with the Eskimo," p. 419, and Report of the Canadian Arctic Expedition, 1913-18, vol. iii).

Melanoplus frigidus (grasshopper)	Orthoptera
Bombus sylvicola (June 15, 1910)	Hymenoptera
Pterostichus agonus	Carabidæ
P. hyperboreus	Carabidæ
Amara brunnipennis	Carabidæ
Carabus chamissonis	Carabidæ
Galerucella decora	Chrysomelidæ
Haltica bimarginata	Chrysomelidæ
Coccinella quinquenotata	Coccinellidæ
C. nugatoria	Coccinellidæ
Melanophila longipes	Buprestidæ
Silpha lapponica	Silphidæ
Lepyrus gemellus	Rhyncophora
L. capucinus	Rhyncophora
Tricalophus stefanssoni	Rhyncophora

The vegetation and insect life in this section are somewhat similar to those west of cape Bathurst. Stefansson states in "My Life with the Eskimo" that mosquitoes became numerous at Langton bay by June 20, and that, by the end of July, the skins of caribou are full of holes made by the escaping bot

fly, which grows beneath the hide during winter. On the Cape Parry peninsula the coast begins to show outcrops of dolomite in the low cliffs. (Pl. VIII, fig. 1).

The coast around Young point is exceedingly stony, with dolomite outcrops or low cliffs with much debris and gravel. Near the beach, vegetation is entirely absent, but, inland, mosses and lichens are developed, especially in moist places. Here and there a few tufts of *Dryas integrifolia* or *Saxifraga tricuspidata* are seen. Farther inland, vegetation is more apparent, mainly around ponds and in the connecting tundra.

At Young point insect life was similar to but less rich than at Bernard harbour. On July 18, 1916, the weather was cloudy or overcast. The following insects, etc., were observed:—

Diptera: *Aëdes nearcticus*
Rhamphomyia conservativa
Aricia borealis
Bombus kirbyellus
(Mite) *Bdella arctica*
Spiders (a few)
Fairy shrimps (*Branchinecta paludosa*)

Vegetation and insect life in the cape Bexley area are exceedingly poor, probably very similar to Young point. A few specimens were collected here in May, 1915, viz., a small spider and fly from under a stone, and some midge larvæ and small dipterous pupæ among green algæ at the beach.

BERNARD HARBOUR—COCKBURN POINT AREA

Generally speaking the coast becomes gradually lower from cape Bexley to east of Bernard harbour, and the outcrops of limestone or dolomite are first found some distance inland. At Cockburn point the coast is low and flat and composed of gravel, limestone fragments and boulders. The country inland is similar to that at Bernard harbour, with boulder-strewn ridges of sand and gravel running out from the higher land behind. The more eastern of two small islands (Pihumalerksiak of the Eskimos) about a mile off Cockburn point was visited in the middle of July, 1916, and some details about its natural features learned. The other island is quite similar.

The island is about 12 feet above sea-level, and is composed of dolomitic limestone, which crops out as flat beds on the north side of the island, but otherwise the rock is mostly covered by gravel and vegetation. The vegetation grows around small ponds (probably all dried up in August), or moss-bogs, or around the boulders, and at the stone heaps (meat-caches) made by visiting Eskimos, where the plants often attain a luxuriant growth. Otherwise, only patches and tufts of plants are found here and there, generally speaking the vegetation is rather scarce and stunted, except in the shelter of the smaller cliffs.

The entomological results were limited to a small sawfly imago and the common, white collembola under stones and driftwood. In the wet moss were secured other dark-blue collembola (*Achorutes armatus*) and some oligochaete worms (*Mesenchytraeus, Henlea, Enchytraeus* sp.), beside the mite *Calumna lucens*. There can, of course, be no doubt that at least the larger and more powerful flying insects often visit the island, or may even live there, but the inclement weather at the time of the expedition's visit militated against insect life.

The character of the country at Bernard harbour proper (including Chantry island), is well shown on the contour map prepared by the southern party of the expedition.

With the exception of Chantry island all the islands in the outer harbour at Bernard harbour are composed of gravel, sand, and boulders and are less than 25 feet high. Chantry island is about 85 feet high and of a composition similar to the higher part of the mainland coast.

The rock exposures and areas covered by limestone fragments are barren of vegetation, except for lichens, and vegetation is best developed in the valleys and on the sandy slopes, around the ponds or lakes. On Chantry island are found most of the plants and insects represented on the mainland. The smaller islands in the outer harbour, however, are too exposed for the development of much vegetation and are unable to support some of the plants found on the mainland. Consequently, their insect life is also very limited (Pl. VIII, fig. 2).

The following insects were collected on the harbour island during the middle of May, 1915.

Ichneumon suturalis (wasp)
Brenthis and Noctuid larvæ
Spiders (*Lycosa* sp.)
Carabid beetles (*Amara brunnipennis*)
Lepidopterous and dipterous pupal skins

On Chantry island were collected in the middle of June, 1916:

Bombus spp. (*B. sylvicola*, etc.)
(*Gynaephora* larvæ) Lepidoptera
Collembola
Mycetophilid larvæ
Mosquitoes and midges (larvæ and pupæ)
Dytiscids (adults and larvæ)
Mites (*Bdella decipiens*, *Thaas stolli*, *Curvipes veiglardi*, *Hydrophantes ruber*)
Copepods (*Cyclops magnus*)
Ostracods
Cladocera (*Daphnia* sp.)

Newly born nauplii and metanauplii of the fairy-shrimp (*Branchinecta paludosa*) were found hiding among the stones in some of the ponds on Chantry island. The temperature of the margin water in the ponds at about 2 p.m. was 50 degrees F. (air 44 degrees F.). There was a considerable difference in the ponds in regard to invertebrate life, those on the higher part of the island being very barren of life.

A comparison of the weather during September of 1914 and 1915 and its influence upon the vegetation and insect life at Bernard harbour is interesting. In 1914 the generally mild weather allowed plants to keep their flowers and ripen their seeds far into the month, and to live until October. Although snow fell in the latter half of the month, most of it soon melted, and freshwater pools did not freeze over until the end of the month. The more hardy of the insects, coleoptera, hemiptera, and also spiders, moved freely around on the ground, though few flying insects were seen after the first week of September.

But in 1915 stormy and wintry weather prevailed during the first fortnight, resulting in the immediate and lasting freezing over of land and water and the subduing of plant and insect life. The milder weather at the end of September was not sufficient to resuscitate them.

VEGETATION AROUND BERNARD HARBOUR

The vegetation found here is similar to that on the coast farther west, and will be treated in the same way here (compare pp. 7–8).

1915

New Leaves observed:

April.

***Saxifraga tricuspidata* (inner leaves; middle of month).**
***S. oppositifolia* (inner leaves; end of month).**
Dryas integrifolia (inner leaves; end of month).

May (Middle of Month).

Saxifraga oppositifolia (bud leaves; only when in or near melting water).
***S. tricuspidata* (bud leaves).**

May (End of Month).

***Cerastium alpinum* (gravelly places; bud leaves).**
Cassiope tetragona (bud leaves; only when in or near melting water).

June.

***Potentilla nivea* (leaf buds; June 10).**
Arctostaphylos alpina (leaves, June 10; also old leaves and berries).
Silene acaulis (some new leaves; June 11).
Dryas integrifolia (some new leaves; June 11).
Mosses (some new leaves; June 14).
Artemisia hyperborea (new leaves; June 20, where exposed to the sun).
Rhododendron lapponicum (some new leaves; June 23).
Betula glandulosa (new leaves; June 23; also old catkins).
Elymus mollis (new leaves; June 24).
Oxyria digyna (new leaves; June 27).
Salix reticulata (new leaves; June 27).
Oxytropis sp. (new leaves; June 27).
Carex scirpoidea, C. rupestris (new leaves; June 28).
Ranunculus affinis (new leaves; June 28).

July.

Statice armeria (new leaves; July 2).
Epilobium latifolium (new leaves; July 6).

1915

First Flowers observed:

Saxifraga oppositifolia (June 7 on hilltops, June 12).
Salix anglorum (first male catkins; June 23).
***Anemone parviflora* (June 28; in shelter of boulders).**
Pedicularis lanata (June 28).
Draba alpina (June 28).
Salix anglorum (first female catkins; June 28)

July 1-15.

Eriphorum Scheuchzeri
Dryas integrifolia
Oxytropis arctobia
Potentilla nivea
Arctostaphylos alpina
Parrya macrocarpa
Androsace Chamaejasme
Braya purpurascens
Carex subspathacea
Astragalus aboriginorum
Lesquerella arctica
Silene acaulis
Oxyria digyna
Eriophorum angustifolium
Stellaria longipes
Plantago lanceolata
Antennaria candida
Equisetum arvense
Alopecurus alpinus
Statice armeria
Castilleja pallida
Papaver nudicaule
Erigeron compositus

July 16-31.

Hallanthus peploides
Hedysarum Mackenzii
Saxifraga decipiens
Chrysanthemum integrifolium
Cerastium alpinum
Artemisia hyperborea
Carex scirpoidea, C. rupestris
Taraxacum ceratophorum
Ranunculus affinis
Lychnis affinis
Draba corymbosa
Hesperis pallasii
Saxifraga tricuspidata
Astragalus alpinus
Pedicularis capitata
Oxytropis campestris, O. nigres
Lychnis apetala
Pedicularis sudetica
Senecio frigidus
Androsace septentrionalis
Salix pulchra (male and female; perhaps earlier).
Draba nivalis (perhaps earlier).
Salix reticulata (male and female).
Rhododendron lapponicum (perhaps earlier).
***Betula glandulosa* (young catkins).**
Cassiope tetragona
Oxytropis Roaldii
Polygonum viviparum
Epilobium latifolium
Stellaria humifusa
Sisymbrium sophioides

The flowering period, generally speaking, is about one month for each species. A few observations relating to this matter, of such vital importance to the insects, are given:

1915

Middle of July.

Salix anglorum; male catkins dropped.
Eriphorum Scheuchzeri; unripe fruits.

....

End of July.

Salix pulchra; male catkins dropped.
Eriophorum angustifolium; unripe fruits.

Beginning of August.

Oxyria digyna; unripe fruits.
Anemone parviflora **(June 28; in shelter of boulders).**
Draba nivalis; unripe fruits.

Middle of August.

Dryas integrifolia; unripe fruits (a few flowers).
Saxifraga oppositifolia; unripe fruits

End of August.

Androsace septentrionalis; unripe fruits.
Juncus spp.; unripe fruits.
Carex spp.; unripe fruits.
Arctostaphylos alpina; unripe fruits.
Pedicularis lanata; unripe fruits (a few flowers).

September

Though most of the plants have finished their bloom, compositae and grasses are still in flower. If a severe frost comes, as in 1915, about the middle of the month, many of the plants will fail to ripen their seeds, but otherwise it is possible for the flowers of many of the species to finish the cycle. Besides the species given above as having finished their flowering during July and August, seeds of the following were collected during September, 1915.

Various grasses (*Elymus*, ***Alopecurus***, *Poa*, etc.)
Cochlearia groenlandica
Erigeron compositus
Oxytropis nigrescens
Taraxacum ceratophorum
Pedicularis spp.
Artemisia sp.
Lychnis affinis
Armeria vulgaris (***Statice armeria***)

1916

The first flowers of *Saxifraga oppositifolia* were found the last days of May on a south exposed, snow-free slope, and from *Salix anglorum* the catkins had just emerged. The earliest flowering plants (*Saxifraga*, *Pedicularis*, *Anemone*, *Draba*, *Eriophorum*, *etc.*) also had flower buds now (1916). On June 6, *Salix pulchra* had the r le catkins of the size of a big pea.

By the middle of June the first flowers, the male catkins, of *Salix anglorum* were out on Chantry island, and some days later, June 20, those of *Salix pulchra*. The first flowers of the following species were found:

June 22-23.

Dryas integrifolia
Androsace Chamaejasme
Pedicularis lanata
Oxyria digyna
Lesquerella arctica
Draba alpina
Braya purpurascens
Eriopharum Scheuchzeri

July 1-15

Oxytropis arctobia
Parrya arctica
Eutrema Edwardsii
Silene acaulis
Ulopeurus alpinus
Cochlearia groenlandica
Anemone parviflora (probably earlier).
Arctostaphylos alpina
Stellaria longipes, S. humifusa
Oxytropis campestris
Castilleja pallida
Artemisia hyperborea
Cassiope tetragona
Papaver nudicaule
Plantago lanceolata
Astragalus aboriginorum
Hesperis pallasii
Carex spp.
Eriophorum agustifolium
Ranunculus affinis
Equisetum arvense
Rhododendron lapponicum
Potentilla spp.
Pedicularis spp. (*arctica*, etc.)
Primula stricta
Erigeron compositus (probably earlier).
Saxifraga tricuspidata, S. decipiens
Lychnis apetala
Chrysanthemum integrifolium
Statice armeria (probably earlier)
Saxifraga hirculus, S. rivularis
Lychnis affinis
Taraxacum ceratophorum (probably earlier).
Halianthus peploides
Androsace septentrionalis
Mertensia maritima
Salix reticulata
Arnica alpina
Draba nivalis
Antennaria alpina
Erigeron uniflorus
Senecio palustris
Cerastium alpinum

INSECT LIFE

Observations for Winters 1914-15 and 1915-16

Insects are scarce in the neighbourhood of Bernard harbour from October to April, inclusive. The best collecting places during the winter are under the shingles—mostly limestone—particularly upon peninsulas and points, where various orange or olive-coloured collembola, besides small reddish mites (*Bryobia praetiosa*), and the common small spiders are common. Of other insects only small hemiptera, flies, staphylinid beetles, beetle-larvæ, or caterpillars, and occasionally a frozen tipulid larva were observed.

No insects were seen on the wing, but parasitic insects, both mallophaga on the birds, and the fleas and lice on the mammals and Eskimos, were observed. Most conspicuous, however, are the larvæ of the bot-fly (*Oedemagena tarandi*) in the caribou (*Rangifer arcticus*). In November, the grubs are about 1 mm. long, and are found under the skin or in the muscles of their host. They were about 2 mm. long and were encysted on the inner side of their host's skin and in the muscles. The bigger ones had already perfected their emergence holes through the skin and had their posterior end (spiracles) turned toward these openings.

The lakes and ponds contain a large amount of invertebrates during the winter. The insects secured in these lakes were mainly midge larvæ or pupæ in their mud-tubes (*Tanytarsus* sp.) the same stages of trichoptera, and other neuropteroids, perlids, etc., probably are also present, besides water mites (*Lebertia porosa*, etc.).

The summer weather at Bernard harbour in 1916 began about the end of May, but wintry weather predominated during the first half of June, with the net result that insect and plant life was considerably retarded, though earlier than in 1915.

May 1-10, 1915

Collembola, (*Isotoma viridis, Entomobrya comparata*, etc.), carabid (*Lebia*, sp. etc.), and staphylinid beetles were noted. Empty hymenoptera cocoons were very common under stones. These cocoons and the empty fly-puparia also found under stones or among plants, are from the previous year, or still older.

May 1-10, 1916

Flies came out, but became numerous only with the warm weather. They probably represent individuals which hibernated as adults. On patches free of snow, caterpillars and smaller more occult living insects may be seen (Pl. IX, fig. 1).

May 11-20, 1915

The first fly was noticed on May 18 and on the same day a large (probably hibernating) parasitic wasp (*Ichneumon suturalis*) and collembola, mites (*Bdella decipiens*), small spiders, caterpillars, beetle larvæ, carabids (*Amara brunnipennis*, etc.), all under loose, flat stones. Two of these caterpillars were observed on July 11 to be parasitized by hymenopterous larvæ; three other caterpillars pupated July 13-20.

May 21-31, 1916

Many flies were out on May 21, both the big blue and two smaller species, carabid beetles, spiders, and an ichneumonid wasp were noticed on this day, and the common collembola, spiders, mites, caterpillars, and dipterous larvæ. These dipterous larvæ (*Tipula arctica*, etc.) were placed for rearing (No. 106) and made galleries in the sand in the jar before pupating in June. Parasitic hymenopterous larvæ were noticed in one of the crane-fly larvæ, but efforts to rear it were unsuccessful. Four adults (*Tipula arctica*) emerged July 7. One species of caterpillar was about 1 cm. long, and occurred in numbers crawling on a snow-free, dry sand dune near the beach. These larvæ had perhaps hibernated and they made their cocoons in June. One of the big spiders (*Lycosa* sp.) was caught on May 31 in its funnel-shaped web. The mouth of this web was about 2 cm. in diameter.

The usually warm weather favoured the development of insect life in fresh water; collembola (*Isotoma palustris*, *Smithurides aquaticus*, etc.), surface-spiders, copepods, dytiscid beetles (*Colymbetes dolobratus*) and mites (*Galumna lucens*) were observed. Freshly-hatched mosquito larvæ (*Aëdes* sp.) 2-4 mm. long, were noticed on May 31, or eighteen days earlier than in 1915. On the same day various dytiscid beetles (*Hydroporus* sp., *Coptambus unguicularis*, *Agabus nigripalpis*), oligochaete worms (*Henlea* sp.) were also seen, as were tipulid (?) larvæ, midge larvæ, and the empty puparia of *Mydaeina obscura*.

May 21-31, 1915

The following additional insects were noted:

Carabid beetles (*Amara hamatopa*)
Spiders (see above).
Weevils (*Trichocnubus stefanssoni*)
Flies (*Phormia coerulea* and a minute "jumping" fly)

Parasitic insects are not greatly influenced by weather and it is, therefore, unnecessary to deal with them under monthly subdivisions. Observations were made of the two diptera that infest the caribou. All efforts to rear these grubs[2] from larvæ were unsuccessful, although several methods of rearing were tried. Some of the almost full-grown larvæ were placed on fresh caribou meat, some in bits of caribou skin with larvæ *in situ*, some in a jar with sand, and even a whole caribou skin containing grubs was rolled up to prevent drying. The grubs were never brought through the pupal stage, although some were kept for more than a year. The field observations agree with the account given by G. M. Douglas on the caribou between Great Bear lake and Coppermine river.[1]

Two female adults[2] were caught at Bernard harbour July 14, 1916. The grubs in the caribou skins examined at the end of May, 1915 and 1916, were very numerous and all big. Only two, not full grown, larvæ (22 mm. long) were found; they were wholly white except the light brown fringes of body spines and the dark brown, apical head dot and terminal spiracles. All the other larvæ were from 25 to 30 mm. long; the younger (smaller) of these had the chitinous head, the terminal spiracles, and the body-spines dark brown, and fine dots of lighter

[1] Douglas, G. M., "Lands Forlorn." 1914, p. [illegible]; photograph of grub-infested caribou skin, p. 192.

[2] (*Edemagena tarandi* (Linné).

brown pigment were scattered regularly in the furrows between the body-tubercles (spine-carriers).

From this latter stage there were all grades of transitions to the dark pupæ (pre-pupæ) (see below); the main colour of the larvæ changing gradually from white to a dirty brown, and finally to almost black (post-larvæ, pre-pupæ), the body tubercles being most strongly coloured in all the larvæ; the chitinous parts also become black. In the black-brown post-larvæ (pre-pupæ) the colour of head, spiracles, and body-spines shades into that of the whole larva.

A shortening of the larvæ now takes place, the terminals being retracted, so that the segments lie telescopically one inside the other. The body-spines and body-tubercles, formerly so pronounced in full grown larvæ, seem to shrink in, so that the segments are smoother and the transversal diameter of the post-larvæ increases until it is almost as large (about 17 mm.) as the longitudinal one. The larval skin dries and becomes more chitinized and stiffer, so as to protect the pupa inside. Of the post-larvæ only six were found in three skins; and the black colour of the pupa shows through its enclosing cyst, though the cyst is less pronounced than in the younger larvæ, because the grub lies half-protruded from its exit-hole, hidden by its host's hairs. A few of the exit-holes were already empty (except for the grub excrement) and the cyst inside (formed by the inner part of the caribou-skin around the larvæ) had become contignous to the surrounding skin.

In spite, therefore, of all the annoyance and pain caused by these grubs, it seems that the caribou skins heal quickly after the parasites drop out. By the end of June no grubs are in the skin, the holes they made are almost healed and it may be assumed that the pupæ leave the caribou about the end of May and lie on the ground for about a month before the flies appear. Life in the latter stage is probably only short and exclusively devoted to copulation and the laying of eggs on the caribou's hairs, after which the grubs bore through the skin.

The other dipterous parasite of the caribou is also an oestrid, identified by Mr. J. R. Malloch as *Cephenomyia* sp. and was noted at the end of May, 1916. About twelve grubs 2-3mm long were lying in the nasal passage of the caribou, where they can easily attach themselves by the aid of their mouth-hooks and hang suspended. The smallest ones were white-yellow, with red-brown segmentally arranged spinehooks, black jaws, and anal spiracles. The older ones had the spines darker, and grey-black dot pigment on the dorsal side of the body segments. The oldest ones had still more black pigment (especially behind and ventrally) and still darker spines. Efforts to rear the larvæ were unsuccessful.

This is probably the *Tabanus* larvæ about which Grenfell writes and which he figures in his book on Labrador. The eggs are laid in the nostrils of the caribou, and the grubs probably spend all their time in the nasal, bronchial and œsophagel passages of their host.

June 1-10, 1916

A weevil (*Lepyrus palustris*) was found on June 1, and the first bumblebee (*Bombus hyperborcus*) was observed. The ponds yielded midge and large dipterous larvæ. Some of these latter have a habit of mud-burrowing, but one species seems to be more dependent on air, for it occasionally comes to the surface with the five long, ciliated appendages that surround the spiracles spread in star-like fashion. The adhesion of the surface and the hairy appendages appears to be sufficient to keep the whole larvæ suspended. In this position they may frequently be seen burrowing head first in the mud of shallow water. Dytiscid beetles and a small brick-red water mite were noted. On June 8 three caterpillars, collected at the harbour, were placed for rearing. One, a large naked larva, had evidently been washed out from its feeding ground

by melting water. A month later it was in only its post-larval stage and had made its cocoon; it died later. Another, also a naked larva, but only half the size, found in its web, pupated twelve days later; and the imago (a moth) emerged July 10, 1916 (Rearing 113). The third, more hairy, pupated later; but no imago emerged.

On June 10 a carabid larva was placed for rearing. It pupated August 8, but the imago was not discovered until September (Rearing 115). The habits of a dipterous and lepidopterous larva boring in the flower-stem and root of the common *Pedicularis lanata* were noted. The dipterous larva occupies only the upper part of the pith and lies hidden there, often several together, the younger larvæ in grooves in the pith, the older in a burrow resembling that made by the lepidopterous larva. These dipterous larvæ and a few living pupæ collected June 10–16, 1916, were placed for rearing (Rearing 72). One imago emerged July 6. Other larvæ were collected July 16–18, 1915, and pupated three months later, but came no farther.

The boring caterpillars were of a small species, naked and of a brownish colour; they mined both in the pith and in the upper part of the knotty root of the plant. When this larva has the whole stem to itself, it burrows to the top through which the frass is pushed out; but it stops burrowing just short of the "chamber" with the dipterous larvæ and then makes its hole in the outer part of the stem or in the upper part of the root. In 1915 these larvæ were first noticed in July, but in 1916 on June 10. The larvæ kept for rearing made pupating cocoons on July 7, 1916, but never pupated, though efforts were made to keep whole infested *Pedicularis* plants.

June 1–10, 1915

By June 2, the common insects had come from their shelters to enjoy the mild weather. A brown ichneumonid wasp (*Ophion* sp.) was caught inland, and the next day, farther inland, many of the common carabid beetles, a carabid larva, several spiders and small, white collembola and two caterpillars. One of these naked caterpillars proved, later, to be parasitized and the braconid (*Apanteles* sp.) pupæ were discovered July 11, the adults emerging July 16 to August 16 (Rearing 40a). The other naked caterpillar (Rearing 50) began its cocoon a week after it was collected and pupated July 5, 1915; the imago (a small grey moth with black cross-bands on the wings) emerged August 10, 1915.

The stomachs of insectivorous birds (Passeres, plovers, etc.) which arrived at Bernard harbour from the month of June on, were examined. The ingenuity of these birds in finding food is astonishing; that they do not starve is shown by the following content of the gizzard of a golden plover, *Pluvialis dominica*: 1 caterpillar, 1 tipulid larva, 2 curculionid larvæ, and half a dozen carabid beetles and weevils. A snow bunting, *Plectrophenax nivalis*, had in its stomach two caterpillars about 1 cm. long.

June 11–20, 1916

Bumblebees (queens) are now seen frequently and are often infested with the parasitic mites (*Parasitus bomborum*) attached mainly to the ventral side. *Saxifraga oppositifolia* is about the only food flower now available, the male catkins of the common willow (*Salix anglorum*) not ripening until after June 15. The usual insects (spiders, carabid beetles, flies, hemipters (*Chiloxanthes stellatus*, etc.) are common, the hemipters now not found exclusively under stones and in plants, but running about freely. On June 20, a big curculionid larva (*Trichalophus stefanssoni*), white, with brown head, was found in its pupating cell under a loose flat stone. It was placed for rearing (No. 122), and during the first week of August it pupated; the beetle emerged about a month later.

In the harbour creek perlid larvæ were noticed. In the ponds mosquito larvæ (*Aëdes* sp.) were almost full grown; those placed for rearing (No. 109) began pupating two days later, and the adults emerged during the first week in July. Large dipterous larvæ (tipulid) burrowing in the mud were also seen.

June 11–20, 1915

On June 18, the first bumblebees (queens) of the year were noticed, but none were caught. On the same day some small flies (*Fucellia punctipennis*) were seen half jumping, half flying on the loose sand of an exposed slope. Minute diptera were observed on a snow-free, gravelly flat, but they did not congregate in swarms. Though flying insects were few, large numbers of other insects were found under stones, in plants, etc. In such places the earlier Carabid beetles, spiders, mites, collembola, etc., besides an occasional weevil or insect larva (tipulidæ, curculionidæ, nematidæ), were frequent. In rotten driftwood were found the mite *Rhagidia gelida* and different collembola (*Onchiurus 12-punctatus*, *Achorutes tullbergi*, etc.). Caterpillars found under stones, on plants, etc., were placed for rearing. One of these (Rearing 51) proved to be parasitized, but lived for about two months, and even began its cocoon; when two large hymenopterous cocoons burst forth, their host died, though slowly. Ponds became richer in invertebrates as the month progresses. At first only a few collembola (*Isotoma palustris*) are seen upon the water, or a couple of dytiscid beetles are busily digging or swimming in waterholes. Mud- and freshwater-algæ support a rich life of microscopic animals (worms, rotifera, etc.).

Most of the temporary ponds are barren of microscopic life; it seems to be a question of suitability of the bottom mud more than of anything else.

On June 18, collembola (*Achorutes armatus*, *Folsomia quadrioculata*, *Tetracanthella wahlgreni*), dytiscid-beetles, or larvæ and many copepods (*Cyclops magnus*) were found in a pond, and, the first time this year, mosquito larvæ (*Aëdes nearcticus*) only a few days old and 3-4 mm. long. Some of the mosquito larvæ were placed for rearing (Rearing 59); at the end of the month the largest had double their length, and they began pupating ten days later. The first-reared imagines emerged in the middle of July; their pupa stage is thus of very short duration. In the mud of this pond were found two days later a white dipterous larva and white oligochæte worms; the water temperature was then 44.1 degrees F., (air 32.2 degrees F., noon).

June 21–30, 1916

The first female mosquitoes (*Aëdes* sp.) appeared on June 21, and by the end of the month became numerous and very annoying, especially in low-lying and sheltered places. The first crane-flies (*Tipula* sp., etc.) were also noticed on June 21, and their number rapidly increased. Flies, of course, were also common, and the bumblebee queens (*Bombus sylvicola*, *B. neoborcus*, etc.) were busily engaged on the early flowers. Many small midges were noticed above or in the creek outlet.

Various spiders (newborn, pale, grey brown; *Pucticus alatus*, etc.), mites (*Scutovertex nigrofemoratus*), collembola, caterpillars, etc., were prevalent.

An almost dry pond contained, the last day of the month, besides the usual dytiscid beetles and mites (*Thyas stolli*), many dytiscid larvæ about 1mm. long, and a number of mosquito pupæ (*Aëdes nearticus*), but very few mosquito larvæ. More interesting, however, were the entomostraca, namely, both sexes of the phyllopod, *Branchinecta paludosa*, now almost full grown. Younger stages of the same branchipod were found in a brackish pond, and many young water fleas (*Daphnia pulex*), midge larvæ and pupæ were found among the thread-algæ in the creek outlet. In the creek back of the harbour the imagines (*Nemoura*

sp.) emerging from perlid nymphs were noticed. The nymphs were crawling up on the stones in the creek. Attached to these stones by their rear suctorial disk-wart were simuliid (black-fly) larvæ up to 1 cm. long. About a dozen were sitting together on each stone and when the stones were lifted, the larvæ released their hold and tried to slip off. When placed in a tumbler, they could easily climb up the glass by the aid of their thoracic (central) "wart-leg" and the suctorial disk at their hind end, somewhat after the manner of a spanner worm. Or they would spin threads from the water-surface to the inside of the glass and ascend on them, but they are not able to float without these threads. When at rest, these larvæ attached themselves to the glass or to the threads by their hind disk and kept the body straight out or at some angle. Only then are their famous plumose gills to be seen on the expanded neck. These are folded up and stretched out, one at a time, continuously, with varying quickness; there is about one second between two "strokes," simultaneously with the maxillæ, but the latter move both together.

The powerful and varied means of locomotion possessed by these simuliids is due to their living in running water, the scarcity of which around Bernard harbour at this period probably explains the scarcity of the fly. Farther east, the species is very common. Efforts to rear the larvæ were unsuccessful.

June 21-30, 1915

Flying insects now are often met with (*Bombus neoborcus*, etc., all queens various flies, etc.) but the majority of insects are still upon the ground.

The ponds and lakes around the harbour, the lakes being only partly free of ice, were examined. In the ponds were the common mosquito larvæ (*Aëdes nearcticus*) and an occasional fly larva (*Rhamphomyia* sp.), freshwater snails (*Aplexa hypnorum*) attached to grass leaves or as empty shells upon the mud bottom, dytiscid beetles, midge larvæ tubes of caddis-flies, etc., and two kinds of water mites. One of these mites (*Thyas stolli*) is 1–1½ mm. long, has black eyes, and a round and flattened abdomen of a bright rose colour. It is always seen crawling over the mud bottom. The other mite (*Curvipes reighardi*) is less than 1 mm. long and has the ball-shaped abdomen tile-red with the legs and cephalothorax still darker. It is not so often seen crawling, but generally paddles with all its long-haired legs, rising or sinking in the water at will.

The large lakes contain various trichopterous larvæ in their tubes; they will attach themselves even to a baited hook. The usual dytiscid beetles and various midge larvæ (*Chironomus* sp., etc.), and the larger dipterous larvæ are present. Crawling on the bottom in the marginal water are perlid larvæ (nymphs), evidently near their final transformation, for over the snow covering the lake ice one mild day (June 25) a number of imagines (*Capnia nearctica*), probably of the same species, were seen crawling with wings already, but not fully developed. They may have come up through cracks in the ice, or from the ice-free marginal water. The direction in which they crawled indicated an instinctive knowledge of the location of the shore, even if they are far out on the lake. They perhaps make for the shore to copulate, but their life as imagines is probably very short. Three months later in the same locality, similar instances, but on a larger scale, were seen, only it was then trichopterous imagines. On these lakes the usual collembola (*Podura aquatica*, etc.) assembled in large colonies, the full-grown blue ones carrying their small, brown, young ones on their backs in grebe style. Minute, jumping-flying flies were also common. A larger fly with similar locomotion had half a dozen minute, flat, round mites on the central side of the first abdominal rings.

July 1-10, 1915

Many flowers are out, resulting in a great number of insects. The flying varieties include flies, crane-flies, midges, and mosquitoes. The crane-flies are typical of dry tundra places and are frequent on ponds. Of hymenoptera, various

ichneumonids and an occasional sawfly (*Euura arctica*, etc.) are seen, but bumblebees (*Bombus arcticus, B. polaris*, etc.) of both sexes, are the most common. Butterflies now appear for the first time; they comprise species of *Brenthis* and *Oeneis* characteristic of dry tundra swamp. *Colias* (*Eurymus*) species characteristic of wet tundra swamp, and *Erebia fasciata* characteristic of tundra swamp. *Brenthis* flies only for a short while at a stretch and is easily caught, but *Colias* flutters along for a long time before settling. Owing to its colour *Oeneis* is almost impossible to discern on the ground; when scared, its flight is long and nearly straight. *Erebia fasciata* is even more difficult to catch, its flight being higher and longer than that of *Oeneis*. Various moths (*Anarta* sp., *Totamo* sp., *Napaea* sp., *Homoglaea* sp., etc.) are now out; most of them are typical of the drier part of the tundra, stony patches, etc., with which their colour blends so well. The large, spotted moth *Hyphoraia* (*Bombyx*) *festiva* now emerges from the cocoons spun to stones, plants, etc.

Of ground insects, various caterpillars, spiders, mites, beetles, etc., may be seen. A small hemiptera (*Orthotylus* sp.?) which resembles an aphid, takes refuge in plant tufts; it is described on the next page.

The temperature of the ponds on the 3rd, taken at 3.30 p.m. was .5 degrees F. or 5 degrees higher than that of the atmosphere. The insects noticed were some fly larvæ and a great number of midge larvæ, and pupæ of various kinds. Attempts to rear them were without success. Larvæ and adults of the large dytiscid beetle (*Colymbetes dolobratus*) were seen; the former were gathering food on the mud bottom, but the latter preferred the rich moss encircling the ponds.

Collembola (*Achorutes sensilis*) and the puparia of the fly (*Mydaeina obscura*) (Rearing 78) are on the ponds; in the water or burrowing in the mud are various mites (*Eylais falcata*, etc.). In the placid water of the mouth of the large creek larvæ of midges, ephemeroids, perlids, mosquitoes, turbellaria, etc. are found; and on July 10, the *Simulium* larvæ already mentioned had pupated inside their chitinous "house"-cone attached to the same submerged stones on which the larvæ were found. The few pupæ found were scattered over stones, not many on one stone. Each pupa is fastened by the pointed end of its cone, the "gills" protruding from the broad opening at the other end, the pupæ thus having easy access to the water. On the expansion of the creek as it leaves the lake a rich growth of *Hippuris*, etc., from which all stages of *Chironomus* and other midges were collected. In the lake south of the harbour, great masses of dead, freshly-emerged midges were seen floating, sometimes forming almost a "carpet," and supplying food for the trout and stickle-back. These flies had perhaps been killed by parasites, for on placing some of them in formalin, white worms (*Gordius?*) emerged from their bodies. Or perhaps the waves on the now completely open lake had caused their death.

July 1–10, 1915

A great number of different insects were on the wing. Many bumblebees (*Bombus polaris, B. sylvicola, B. neoboreus*, etc.), all queens, were infested with the parasitic mites (*Parasitus bomborum*) which also crawl over the male willow catkins and the flowers of the common *Pedicularis lanata*. The behaviour of the mites on the flowers was quite different from those on the bees. The latter clung to the hairs of their host, their four pair of legs serving as grips, and they drop off only when their host is put into the killing-bottle. But the mites on the flowers moved freely around by the three last pairs of legs, the first pair being used as constantly vibrating feelers, like a wasp's antennæ. They frequently scratched the abdomen with their legs, and are prone to fight. They had perhaps been left on the flowers by their host and were waiting for a bumblebee to which they could attach themselves. Various other hymenoptera were caught and many of the butterflies and moths before mentioned which now appear. Moths and *Colias* were first noticed on the 3rd, and soon became

common. The first *Brenthis* were seen on the 6th, the first *Oeneis* on the 7th, the first *Erebia* on the 9th. An occasional phryganeoid imago is seen and a great variety of flies, crane-flies, (tipulidæ), and midges. Small jumping-flies were common on dry seaweed July 1. The first biting mosquitoes (*Aëdes* sp.) were seen July 9, at the harbour, and soon became troublesome.

Among the many insects found upon the ground, large spiders (*Lycosa* sp.) are seen feeding on other spiders, and beetles. Minute, dark-red mites (*Trombidium sucidum*) frequents the gravelly slopes with southern exposure, where an occasional weevil (*Sitona* sp., *Trichalophus* sp.) or chrysomelid beetle, and the common carabids may also be seen. The minute hemiptera (*Orthotylus* sp.?) are seen only on calm, sunny days or in well-sheltered places, otherwise remaining hidden in the plant tufts (*Oxytropis*, *Potentilla*, etc.). They make a noise something like the chirp of the grasshopper. They were first noticed July 6 and were in different stages; the smallest ones moulted, embedding their trunks in a plant stem; the somewhat larger ones had orange abdomen, head, and wings, with blue-black eyes and dark, brown legs. The largest were green with head, eyes, wings, and legs light brown. All had two pairs of rudimentary wings. Other small, wingless, dark brown hemiptera 2 mm. long, were seen. Puparia of various flies taken from plants and moss were placed for rearing on 7th (Rearing 67) and from one of these the imago emerged five days later.

Among the various lepidopterous larvæ and pupæ was the caterpillar mining in the stems and root of *Pedicularis lanata* noticed for the first time this year on the 4th. A cocoon collected on the 7th, had a smooth, black pupa 2 cm. long attached to a stone and proved to be the rare moth *Hyporaia festiva*: the imago emerged on July 24, and began to lay its eggs two weeks later (Rearing 68).

A pond on the tundra near the harbour contained only white oligochaete worms (*Henlea* sp.), thus showing a surprising lack of insect life as compared with other ponds. In a nearby pond were noticed two days later—larvæ of midges, dytiscids and in the overflow from the pond an abundance of animalculæ. On July 6, many larvæ, of all sizes, and pupæ of common mosquitoes (*Aëdes* sp.) were found in ponds, and several intermediate stages were noticed; first the abdomen shows the pupal characters; then the thorax; and soon the "pre-pupa" much paler than the immediately following pupa appears. The pupæ are easy to rear, as they need no food, and about a week later the adults emerge (Rearing 59, 59*a*). Efforts to rear the dytiscid larvæ with these mosquito larvæ as food, failed.

July 11–20, 1916

On the 14th inst., the shores of Dolphin and Union strait were visited and a great number of flying insects were observed. Mosquitoes (*Aëdes nearcticus*) were troublesome in sheltered places; flies, *Pogomyia quadrisetosa*, *Rhamphomyia conservativa*, etc.) were noticed on the flowers of *Dryas*, *Potentilla*, etc.; (Pl. I, fig. 1), and two female bot-flies. *Œdemagena* (*Hypoderma*) *tarandi*, were captured. They made no sound until placed in the killing bottle when they produced a buzzing noise of short duration. These are the flies whose maggots are found in the caribou. Many bumblebees (*Bombus sylvicola*, etc.), butterflies (*Colias* sp., *Oeneis* sp., *Brenthis* sp., *Lycaena aquilo*), and various moths were collected; the butterflies had wings scaleless and somewhat torn, where exposed to the wind on the open tundra; the moths were found principally upon the sheltered slopes of gravel ridges. The common invertebrates, including insects, were observed in ponds; even a waterhole with brackish water and many green algæ contained midge larvæ, and was teeming with dark-red copepods (*Eurytemora* sp.) a favourite food for the phyllopods (*Branchinecta paludosa*), also found here.

July 11–20, 1915

Insect life at Bernard harbour is now at its h The following flying insects were observed:—

Sawflies: *Pontania subpallida, Amauronematus magnus*, etc.
Bumblebees: all three sexes almost all infected with *Parasitus bomborum*
Wasps *Ichneumon* sp., *Ipanteles* sp., etc.
Flies: *Pfalina* sp., *Rhamphomma* sp. *Phorbia* sp.
Crane-flies: *Limnobia* sp., *Tipula* sp.
Mosquitoes *Aedes* sp.
Phryganeoids.
Perlidæ } Adults
Ephemeroidæ }
Butterflies: *Brenthis* sp., *Colias*, sp., *Oeneis*, sp., *Erebia*, sp.
Moths

The ground is alive with insect life. Mites (*Trombidium* sp., etc.) are common and their eggs (*Bryobia praetiosa*) are deposited on dead willow leaves, from which the young ones (nymphs) are just emerging. Many spiders (*Lycosa* sp.), are seen, the larger of which line the interior of crevices or lemming-burrows with web; they also construct nets outside for capture, something like a large moth cocoon. The spiders often carrying egg-sacks, devour their prey (other spiders, beetles, etc.), inside the burrows or "cocoons." The "cocoons" up to about 3 cm. in diameter are almost globular and firmly spun of close-lying threads, with a "window" of slighter construction. This "cocoon" is perhaps a protective web, closing the burrow outwardly, and used by the female only until the eggs hatch and the young are able to take care of themselves. Collembola, beetles and beetle larvæ (weevils, carabids, etc.) are common. Of hemiptera, various small, wingless forms (*Euscelis hyperboreus, Calacanthia tryboui*, etc.) abound in plant tufts. The common Saldid (*Chiloxanthes stellatus*) has already been referred to (page 11K). A microlepidopter is also common and characteristic of sandy slopes, but seems never to use its wings; it keeps them as a roof for the body, crawls up on the sand and slides suddenly down, when scared, like a leaf-hopper, which insect it resembles in shape and colour. Various lepidopterous larvæ or pupæ were placed for rearing, but without much success. The flower stems of *Pedicularis amata* held some of these larvæ (rearing 71); and dipterous larvæ and dipterous pupæ were found in moss, and various sawfly larvæ—both the species which make leaf galls and the ones which live in the immature, female catkins—were found on willows. Attempts were made to rear both kinds, but they progressed only as far as the pupal stage. The larvæ inside the galls made their cocoons on October, 1915, and pupated the following June (Rearing 71). The others (Rearing 85) enter the carpels by eating a hole at their base, and their presence is soon shown by yellow-brown excrement. The infested carpels do not ripen, but dry up, because the larva inside feeds on the wall and seeds, and probably later attacks one or more carpels. In due time the larvæ spin cocoons outside the carpels and pupate inside them.

The overflow from the ponds contains oligochæte worms (*Lumbriculus* sp.), larvæ of dytiscids, and minute mosquitoes (midges). (Pl. IX, fig. 2). Trout caught in a large creek near the harbour had in their stomachs large dipterous larvæ, as well as smaller larvæ (*Chironomus* (?)) and larvæ and nymphs of perlids. In the mud of the brackish pond many green algæ, attached to which were numerous fasciæ of "winter-eggs" of *Daphnia pulex* were present and the water teemed with the young cladocera emerged from these. In the water were also many metanauplii, about 1 cm. long, of the common phyllopod (*Branchinecta paludosa*), a favourite food for the larvæ and beetles of dytiscids; minute, red collembola, a great number of midges in all stages of development, and copepods were also observed. The curious puparia of the interesting fly, *Mydaeina obscura*, were found on the 19th in this pond. The larvæ burrow in the mud of ponds or lakes, and during the postlarva-pre-pupa stages, remain there looking like brown

willow twigs or large plant seeds, and thus evade the notice of water birds. The pupa now develops in and partly fills the case, which shows three divisions first, large, swollen, cylindrical front-end with a lid, by the aid of which the fly later emerged; second, a constricted "neck," and finally the "caudal" part, also cylindrical but smaller than the "cephalic" part, and containing air by which the puparium rises to the surface and floats with the air chamber uppermost. Just before the emerging of the imago the puparium becomes U-shaped, the neck curving so that the part of the puparium containing the pupa also touches the water-surface, and the imago can emerge by the opening of the "lid." This process was observed with one of these pupæ collected July 19, 1915, and the imago emerged four days later; from a pupa collected July 3, 1916, the imago emerged the following day (Rearing 78). The fly itself is also aquatic. As soon as the imago has emerged the puparium stretches out again but remains floating.

On the margin of a large lake inland from Bernard harbour, a great number of freshly emerged midges of both sexes were in copula on the 15th. In the marginal water were many *Chironomus* (pupæ and adults), besides perlid and trichopterous larvæ. *Branchinecta paludosa*, amphipods (*Gammarus limnaeus*), and other freshwater invertebrates were found in many of the nearby lakes.

July 21–31, 1915

Insect life is now very similar to that in the middle of July. Mosquitoes (*Aëdes* sp.) are very numerous and annoying on warm, clear days, most of the larvæ and pupæ in the ponds having transformed (Pl. I, fig. 2). Various flies and crane-flies (*Limnophila* sp., *Stygeropis* sp., *Nephrotoma* sp., *Tipula* sp., etc.), sawflies, and parasitic wasps are common, but neuropteroid imagines are comparatively few. Bumble bees (*Bombus neoboreus, B. sylvicola*, etc.), especially the queens and workers, are busily visiting the many flowers now out. Two of the willow species (*Salix anglorum, S. pulchra*) have now dropped most of their male catkins, but those of *S. reticulata* are in full bloom. Many butterflies (*Erebia* sp., *Brenthis* sp., *Colias* sp., *Oeneis* sp., etc.) and moths are seen on clear, calm days; of the former a female specimen of *Pieris occidentalis* was secured. The advent of this butterfly appears to synchronize with the first blooming of the cruciferæ (*Sisymbrium* sp., etc.) on which, probably, the larvæ feed and which the imago seems to prefer. Muscid maggots were noticed in rotten seal-meat, but could not be reared.

August 1–10, 1915

The following flying insects were noticed:

Bumble bees (*Bombus* sp.)
Sawflies
Wasps (parasitic (*Ichneumon* sp., *Diptera* sp.)
Butterflies (*Colias* sp., *Oeneis* sp., *Brenthis* sp., *Lycaena aquilo*)
Moths (*Homoginea, Tiliaia* sp., Microlepidotera, etc.)
Crane-flies (*Eriopteria* sp., *Tipula* sp., etc.)
Flies
Mosquitoes (*Aëdes* sp.)
Neuropteroid imagines

The *Colias* and *Brenthis* prefer low, grassy land or gravel supporting flowers; the moths are found on clayey or gravelly bluffs or slopes. The mosquitoes are less troublesome than in July.

Sawfly larvæ may be seen boring in the female catkins or making galls upon the leaves of willows. A larger sawfly larva fed on the leaves of bushy willow (*Salix pulchra*) from which, owing to its colour and quiescence, it is with difficulty distinguished. Efforts to rear it progressed no farther than the pupating stage, October, 1915. The common hemiptera (*Chiloxanthes stellatus*) and smaller bugs (*Lobopidea* sp., etc.) and the common collembola, mites, spiders, beetles, caterpillars, etc., are met with.

On the margin of the brackish pond, now much smaller, imagines of *Mydacina obscura* were captured. Empty, flo[illegible] pa cases of the same species floated on the surface, showing that [illegible] had but lately emerged. Dytiscid beetles, midge larvæ, copepo[illegible] *dex* (female now with two winter eggs), and almost full-grown [illegible] *paludosa* (female with eggs) were found in the pond. The bottom of a larger pond inland, consisted of a thick layer of brown detritus mud between the scattered stones and *Carex* vegetation. In or on the bottom were many larvæ and pupæ of midges (*Tanypus* sp., etc.), beetle larvæ, and the common red watermite (*Curvipes reinhardi*). In the big creek at the harbour on August 6, snails (*Aplexa hypnorum*), perlid and ephemeroid-nymphs, turbellaria and *Hydra* sp. were collected.

August 11–20, 1915

The flying insects observed were:—

Bumblebees (*Bombus sulvicola, B. neoborcus, B. arcticus*)
Butterflies (*Colias* sp., *Brenthis* sp., *Oeneis* sp., *Erebia* sp., *Lycaena* sp., *Chrysophanus* sp.)
Moths (*Anarta* sp., etc.)
Wasps, parasitic (*Exolytus insularis, Dioctes modestus*, etc.)
Sawflies
Crane-flies (*Tipula* sp., etc.)
Flies (*Melanostoma* sp., etc.)
Flies, black (*Simulium* sp.)
Midges (*Oecothea aristata*)
Mosquitoes (*Aedes* sp.)

An ephemeroid imago was captured on the 16th, just emerging from its nymphal skin.

On the ground, or upon plants are various spiders: the female of the big *Lycosa* species now carry their newborn young in the egg cocoons. Mites (*Rhagidia gelida*) and collembola are frequent. In plant pillows are found various fly pupæ and lepidopterous chrysalides or cocoons; if the latter be a *Gynaephora* it may contain instead of the lepidopterous pupæ the dried-out caterpillar and about a dozen tachinid (*Euphorocera* sp.) puparia. Beneath the surface are larvæ of the common tipulids, and under stones, an occasional brown slug, *Agriolimax hyperboreus*. Leaves of the various willows are often infected by gall-mites (*Eriophyes* sp.), forming small prickly swellings. The sawfly larvæ are most conspicuous upon the willows, the larger species with its post-larval, red colour, and the smaller boring in the female catkins; these latter pupated the following June, but got no further.

On the margins of the two ponds on the ridge about 100 feet high, southwest of the harbour, brown detritus-mud is exposed. The ponds contain a number of invertebrates, including a few males of *Lepidurus arcticus*; most of the females of this crustacean have now deposited their eggs.

The large creek at the harbour is now nearly dry. Here were found turbellaria (now with "winter eggs" inside), perlid, and ephemeroid nymphs and colonies of *Simulium* pupæ, attached in running water to stones, moss, and grass-stems, the stones being more popular on account of the similarity in colour. In fact it is most difficult to detect these pupæ unless they congregate in large colonies, when the two white, free gill-plumes on the head of each individual show up in the water in undulating streaks. The pupa-cases (August 16) were mostly empty, but some of them contained the pupæ which were infested with one or more minute, bright-red nymphs (three leg pairs) of a watermite, crawling over the dead pupa. They represent probably the larval stage of one of the common hydrachnids. The comparative scarcity of black flies at Bernard harbour may be due to the small amount of streaming freshwater, an element necessary for the complete development of the insect. Conditions may differ farther to the east, judging from the great annoyance travellers have reported from black flies there.

August 21-31, 1915.

Insect life is decreasing. Flowers are less plentiful and certain plants have completed their bloom. A number of insects are, however, on the wing including flies (*Sciara* sp., *Prosimulium borealis*, etc.) crane-flies (*Tipula* sp.), but fewer midges and mosquitoes. An ephemeroid sub-imago was found upon a stone in the creek bed; the imagines of this suborder first emerge apparently about the middle of August. Of hymenoptera, bumblebees (*Bombus* sp., *crotchii*?) are numerous, and small wasps on willow plants. Of butterflies, the common *Colias* sp. are frequent, and in a lesser degree the *Brenthis* sp. The lycaenids (*Lycaena* sp., *Chrysophanus* sp.) are fewer, and the *Oeneis* sp. and *Erebia* sp. have almost disappeared. Moths (*Autographa* sp., *Lygris* sp., etc.) are seen on slopes; when scared the flight of *Lygris* sp. is short and fluttering, though direct from place to place.

Of ground insects the small tineoid imagines, typical of sandy slopes, and the common, black hemipter (*Chiloxanthes stellatus*) are seen, and on dry tundra swamp some curious smaller flies (*Scellus spinimanus*), their abdomen and eyes having a metallic glitter; though having wings they only crawled or jumped. One of them had its pupa skin still attached to its legs. Two (male and female) small crab-spiders (*Xysticus bimaculatus*) were collected besides the common spiders, collembola and mites (*Bdella arctica*), weevils, carabids, caterpillars, etc. The fresh water still contains a teeming life of entomostraca and dytiscid larvae, etc.

August 30-31, 1914.

During this period and the first half of September observations on insect life were possible only in 1914. Autumn was heralded by the scarcity of flying insects and by the behaviour of those upon the ground. A big ichneumonid wasp among *Elymus* plants, and the common, small, jumping flies (black spotted wings) under stones were easily captured. The common hymenopterous cocoons, spiders, mites, and collembola, were found and the common glistening carabid beetles (*Amara glacialis*) which were crawling around or had already excavated small grooves in the sand for hibernation. Some of the willow leaves were infested by the gall mites (*Eriophyes* sp.) or had galls produced by sawfly larvae. The galls were placed for rearing (Rearing 37) and in October the larvae made their pupating-cocoons outside them. The imagines which emerged in the middle of August, 1915, proved to be parasitic wasps (*Dioctes modestus*) and not sawflies, thus proving that hymenoptera as well as diptera, lepidopetera, and coleoptera are kept in check by these insects.

September 1-10, 1914.

Owing to the mild weather, insect life, during this period, was very similar to that during the latter end of August. Even moths and butterflies (*Colias nastes*, *Chrysophanus hypophlaeus feildeni*) were seen early in the month, bumblebees were seen up to the 5th and parasitic wasps (*Ophion bilineatum*, etc.), until the 7th. A few trichopter imagines and some mosquitoes (*Aedes nearcticus*) were seen, but no crane-flies. Other flies observed were *Hydrophoria* sp., *Rhamphomyia* sp., *Peleteria* sp., *Scatophaga* sp., *Limnophora* sp., and a smaller species (*Scellus spinimanus*).

Among the ground insects noticed were *Chiloxanthes stellatus*, spiders (*Tmeticus alatus*, *Micronecta maritima*, *Lycosa* sp.) and mites (*Scutovortex lineatus*). The spiders, *Paradosa glacialis* and *Erigone arctica*, were also seen, as were the common collembola and carabid beetles (*Amara* sp., *Pterostichus mandibularis*, etc.) small black staphylinid beetles, a few smaller dysticids, tipulid larvae, and caterpillars.

September 11-20, 1914 and 1915

The few insects collected were mostly caterpillars, beetles, spiders, and tipulid larvæ. No flying insects were seen.

September 21-30, 1914

No flying insects were seen. Under loose stones various beetles and caterpillars were found. The small staphylinids were more lively than the carabids (*Amara brunnipennis*, etc.). The weevils lay motionless until touched, when they moved, but slowly. Small spiders, mites, and collembola showed few signs of hibernating Larger spiders had made globular webs between the sand and gravel; the size of the web in proportion to its builder, but never larger than a walnut.

September 21-30, 1915

The brackish pond was frozen over. The depth below the ice was about 3 feet, and the mud from the bottom gave a strong odour of sulphuretted hydrogen. In the water were many dead midge larvæ, "winter eggs" of *Daphnia pulex*, and rose-purple copepods (*Eurytemora canadensis*) often carrying their eggs.

The large lake southwest of the harbour was covered with ice over which hundreds of imagines of a big caddis-fly (*Chilostigma præterita*) were crawling. They must have just emerged or perhaps been tempted from their hibernating places by the mild weather. The occurrence of these rather frail imagines in such numbers is surprising; they probably belong to the same species as the large larvæ found in this and other nearby lakes. A male spider, also, was seen crawling over the ice; the same two kinds of arthropods were noticed, a week later, crawling over freshwater ice at Cockburn point, a few miles away, and, the next day, upon lake ice at the harbour.

The big lake of the harbour was found to have a maximum depth of 20 feet; it was frozen over by the 28th. Two days later a sample of sand from the bottom showed a crust of green algæ and detritus and contained red-brown midge larvæ in their sand-covered tubes, besides worms (*Lumbriculus variegatus*), etc.

WEST SIDE OF CORONATION GULF (INCLUDING THE LOWER COPPERMINE RIVER)

East of Bernard harbour the coast shows little change, consisting of gravel or sand, with boulders and outcrops of limestone beds. Liston, Sutton, Lambert, and Douglas island in Dolphin and Union strait have the same composition, though the limesto ɔ (dolomite) is mora prevalent than on the mainland.

The east side of the mouth of Coppermine river is a sandpit projecting from a low, gravelly tundra-plain lying at the foot of the clay hills and the west side is formed by an extension of the gravelly clay banks about 100 feet high which, farther inland, form both sides of the river.

The east side of the Bloody fall gorge is formed by very steep and high cliffs, practically without vegetation; on the west side, the vegetation (scrub-willows, etc.) is best developed upon the lower cliffs.

Above Bloody fall the river widens and both sides have high, gravelly, and sandy cliffs, generally steep and barren but sometimes supporting good vegetation including scrub-willows up to 6 feet high. Inland from Escape rapids the hills attain their highest point. Along the river the slopes support the tundra plants, and "niggerheads" are common.

South of Escape rapids the northern limit of trees is represented by a few diminutive white spruce which from this point increase in number and size, especially in small creek valleys joining the river, where some of the trees are about 12 feet high. They gradually decrease in size and number as the valley is ascended, until they disappear altogether.

Groves of white spruce (*Picea canadensis*) become frequent farther up the river. The largest trees were 30 feet high and about 5 feet in circumference near the ground. Even stunted trees were seen from their rings to be about fifty years old, and the largest must have been nearly five hundred years. Samples were secured of the rich growth of lichens found on the dead trees and on the dead branches of the living trees. Many of the trees were attacked by insects and very few young trees were seen, the growth as a whole indicating longevity. Dr. Richardson ascribes the appearance of the forest—in particular the dead trees and stumps—to a deterioration of the climate, fires and exposure to cold north winds. Insects, however, undoubtedly contribute to the destruction and many dead trees have been killed or injured solely by bark beetles and cerambycid larvæ, which were as numerous in some trees as in trees farther south.[1]

Owing to their scattered distribution and consequent liability to exposure, the percentage of trees, above a certain size, attacked by insects is larger in this region than farther south. Living as they do under the bark, the insects are not greatly influenced by the cold.[2]

Three species of bark beetles, *Polygraphus rufipennis*, *Pityophthorus nitidus*, and *Dendroctonus johanseni*, were found in the dead trees, either under or in the bark,[3] but the third species was found in only one tree, under the bark at its base. All the beetles were dead, and no immature stages were observed.[4]

Tunnels of Cerambycid larvæ were common upon the dead trees. Dead larvæ, cast skins, or their hymenopterous parasites were found in these burrows, occasional "foreign" insects which had crawled into them later, and a few cerambycid imagines, which possibly belonged to the tunnels.

The living trees contained the *Polygraphus* and *Pityophthorus* mentioned above and *Carphoborus andersoni*, but bark beetles were not nearly so numerous as upon the dead trees.

Depredation to the living trees by boring insects is extensive. The bark-boring—the more destructive—are represented by *Merium proteus* and the wood-boring by *Neoclytus muricatulus* and *Xyle[illegible]s undulatus*. Most of the larvæ were heavily parasitized by immature st[illegible] hymenopterous insects, but all efforts to rear were unsuccessful.

Of harmless insects a few sawfly larvæ in cocoons were found in the cerambycid galleries; they were of two kinds, the smaller a light brown, with dark, dorsal streaks; the large, light green. This green larva was reared (No. 46) and emerged July 13, 1915, when it proved to be a new species, *Pontania quadrifasciata* MacGillivray.

Under spruce bark, or in the cerambycid tunnels, spider webs, fragments of flies and beetles, etc., and a winged ant were observed. This ant and a similar specimen found November, 1913, in an old bird's-nest about 30 miles up Sadlerochit river, represent the only ant material secured by the expedition, and the two localities indicate the probable northern li[illegible]or ants in North America.[5]

No other insects were seen along the lower Coppermine river, except a few bot fly-grubs (*Oedemagena tarandi*) from caribou above Bloody falls. Franklin (1st Expedition) states that sandflies were numerous and troublesome in the August evenings, the temperature then being 53 degrees F. at about 67° 12′ North; and Richardson (Arctic Searching Expedition) was annoyed by these insects in the same region as late as September 8, in the evening.

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[1] Johansen, F., Can. For. Jour., XV, 7, July, 1919, pp. 303-5.
[2] See Rept. of Can. Arct. Exped., 1913-18, vol. III, Part E, Coleoptera, by J. M. Swaine.
[3] A section of a trunk was preserved.
[4] The observations were made in February, 1915.
[5] *Formica hereculeana* recorded from Back's Overland Expedition (Great Fish river) by Children.

Apart from the forest insects, the insect life along the west side of Coronation gulf and the lower Coppermine is probably very similar to that at Bernard harbour, though the mosquitoes, etc., become more troublesome farther south.

SOUTH SIDE OF CORONATION GULF (INCLUDING BATHURST INLET, NORTH OF LATITUTE 67½ DEGREES NORTH)

Owing to the milder climate, vegetation and insect life between Coppermine river and Bathurst inlet are at least a week earlier than at Bernard harbour and cessation of plant life is, probably, later (Pl. II, fig. 2). Very few insects were secured by previous expeditions. Hanbury collected butterflies, the earliest ones, apparently at cape Barrow, June 26, while flies, spiders, etc., were noticed on June 10 (Kent peninsula), and the first mosquitoes at Lewes islands on June 27.[1] Insects captured by the Canadian Arctic Expedition were mostly picked up casually, but from them and from the narratives of Hanbury it may be assumed that the insect life is practically the same as at Bernard harbour. The paucity of vegetation on many of the rocky islands causes a scarcity of insect life (Pl. X, fig. 1).

Below is a list of insects secured by Hanbury and by members of the southern party of the Canadian Arctic Expedition; the latter ones are from Tree river and Gray bay, in July, and from cape Barrow (Pl. X, fig. 2), and Bathurst inlet in August and September.

Arachnoidea	Spider (*Lycosa* sp.?)
	" (smaller)
Coleoptera	*Trichalophus stefanssoni*
	Silpha lapponica
	Carabus chamissonis
	Cocinella nugatoria
	Dystiscid
Hymenoptera	*Bombus sylvicola*
	Enura arctica
Diptera	*Tipula arctica*
	Simulium similis
Lepidoptera (moths)	*Anarta richardsonii*
	Hypsoides zetterstedtii[1]
	Hyphoraxis festiva
	Aspilatus arciferaria[1]
	Cidaria sp.[1]
Lepidoptera (butterflies)	*Lycaena orbitulus*[1]
	Brenthis chariclea
	" *frigga improba*
	" *polaris*
	" *pales*[1]
	Colias boothii
	" *hecla*[1]
	" *pelidne*[1]
	" *nastes*[1]
	Erebia disa
	" *fasciata*[1]
	" *rossi*[1]
	Oeneis bore[1]
	" *semidea*[1]

[1] Secured by Hanbury.

The saw-flies were reared from larvæ collected in galls on leaves of *Salix reticulata* at cape Barrow, August 14, 1915. They pupated the following June, and the adults emerged a few days later (Rearing 90).

" In summer the mosquitoes seem to be much more numerous and troublesome along the south side of Coronation gulf than they are along Dolphin and Union strait, probably because the land near the coast is less barren, and more sheltered from summer winds off the ice. In the vicinity of Hood river and the neighbouring parts of Arctic sound and Bathurst inlet the black flies (*Simulidæ*) were numerous enough to be troublesome in late August and early September, a rare thing in other parts of the Arctic coast with which I am familiar." (R. M. Anderson.)

[1] Hanbury, David T., Sport and Travel in the Northland of Canada, 1905, p.

ARCTIC ARCHIPELAGO

On Banks island a collection of insects, etc., was made by Mr. G. H. Wilkins at cape Kellett, 1914–15, but, with the exception of a couple of spiders in poor condition, identified by J. H. Emerton as young *Pardosa glacialis*, none of these insects have been determined, and little can be said of insect life on this island (Pl. VI, fig. 1). On Melville island a few insects (*Bombus arcticus*, with *Parasitus bomborum*, and lepidoptera (*Brenthis polaris*, cocoons of *Gynaephora rossi*) were collected, 1916, by the northern party of the Canadian Arctic Expedition. Spiders, identified by J. H. Emerton as *Erigone psychrophila*, and flies were collected on King Christian land (Findlay island) by the same party. A list of all insects collected by both parties of the expedition from the western half of Victoria island, from 1915 to 1917, appears below.

The coast of this western part is very similar to that of the mainland Generally speaking, the northern part of the coast is higher and rocky, but from Simpson bay eastward the coast and land behind it are very low (except in the neighbourhood of Richardson island) and consist mainly of gravel or sandy tundra and boulders. The vegetation is the typically arctic; only in some of the river-beds do willows (*Salix Richardsonii*) attain as much as 8 feet in height.

Aranecida	
Acari	2 Spiders
Collembola	None
Trichoptera	None } But both orders are found.
	Phryganeoid.
Coleoptera	*Agabus nigripalpis* (Dytiscid)
	Carabidæ: *Amara brunnipennis*, etc.
Hymenoptera	Parasitic wasp—cocoons (from caterpillar).
	Sawfly-larva (middle of June, 1915), and galls on willow leaves.
	Bombus sp. (seen; no specimens collected).
Diptera	*Prosimulium borealis*
	Oedamagena lavandi (only larvæ, in caribou).
	Tanytarsus sp.
	Diamesia arctica
	Mydaeina obscura
	Scatophaga furcata
Siphonaptera	*Tipulid* larva
	Fleas from Arctic hare
Butterflies	*Argynnis chariclea*
	" *polaris*
	" *frigga alaskensis*
	Colias hecla glacialis
	" *nastes*
	Erebia fasciata
	Lycaena aquilo
Moths	*Psychophora sabini*
	Napaea orciferaria
	Titania sp.
	Anarta leucocycla
	Lygris destinata
	Gynaephora rossi (only cocoon)
	Anarta subfumosa
	" *richardsoni*

Summer on Victoria island is generally from a week to a month later than along the south side of Dolphin and Union strait and of Coronation gulf.

According to D. Jenness: all blow flies were seen for the first time May 23, 1915, almost a week later than at Bernard harbour, and bumblebees on June 30; about two weeks later. The butterflies and moths were noticed, as early as at Bernard harbour. Mr. Jenness writes that the first *Saxifraga oppositifolia* blossoms appeared on June 7 and were very common July 5; that flies settled in swarms on drying meat, July 2; that the first mosquitoes were seen July 8, became numerous and annoying July 13, and disappeared in a snowstorm August 22; and that plant and insect life were killed by frost on the night of August 24-25 (Pl. VI, fig. 2).

GENERAL (ARCTIC INSECTS)

A comparison of the insects found in the American Arctic and of those found in Greenland, is interesting. Dr. I. C. Nielsen has compared the insect fauna of the west coast of Greenland with that of the east coast.[1]

Owing to the severity of the climate on the east coast of Greenland as compared with that on the west coast, insect life is less plentiful, including less than half the number of lepidoptera, one-third that of coleoptera and hymenoptera, one-fourth of hemiptera, one-sixth of diptera, and one-tenth of neuropteroids. Orthoptera and thysanoptera are only found on the west coast and are represented by single species (*Atropos and Troctes, Forficula, Blatta*, and *Physopus*) all probably introduced. No beetles (except perhaps staphylinids) are known on the east coast north of about 75 degrees north.

With the exception of Strepsiptera, most orders of insects are represented in Greenland, but far from all families. Ninety per cent of the hymenoptera are ichneumonids, the remainder, sawflies and bumblebees; the beetles are mainly those feeding upon plants, decayed matter, minute arthropods, or waterbeetles. The hymenoptera, lepidoptera, and hemiptera depend on land vegetation but most of the neuropteroids[2] and many of the diptera pass the early and longer part of their life in fresh water. Many of the diptera also belong to blood-sucking species feeding upon Eskimos and other mammals or upon decayed matter. Recent Danish authors give the following list of the different orders of insects found in Greenland:

Diptera	about 170 species		Hemiptera	about 12 species	
Hymenoptera	" 55 "		Neuropteroids	" 10 "	
Mallophaga	" 40 "		Suctoria	" 6 "	
Lepidoptera	" 40 "		Siphunculata	" 6 "	
Coleoptera	" 25 "		Physopoda	only 1-2 "	
Collembola	" 13 "		Orthoptera	" 1-2 "	
Mites	" 65 "		Spiders	about 45 "	

The insects of Greenland are very similar to those so far found in the American Arctic, though the eastern part of the American Arctic has a far more severe climate than the corresponding degrees of latitude in the western part. The limit of spruce, or of isotherms is, therefore, a better southern boundary on which to base conclusions than any parallel of latitude. Owing to the intimate connexion between plants and insects the tree limit is preferable, especially as the data available are insufficient to warrant the use of isotherms as a base.

The country not forested is known as the "barren grounds" and reaches as close to the pole as explorers have attained. Forest insects cannot, of course, invade these grounds. The next insects to stop are the grasshoppers and probably also the other families of orthoptera.[3] No orthoptera have been found in the Canadian Arctic archipelago. From the Arctic mainland the only grasshoppers we secured were a specimen of Acrididæ, said to have been caught near the divide of the Alaskan Arctic mountains, within, or near, the limit of trees, and the specimen of *Melanoplus frigidus* secured by Mr. V. Stefansson in the summer of 1911 in the vicinity of Langton bay. The absence of grasshoppers in the Arctic is very noticeable and not easily accounted for. It cannot be the absence of suitable food, for grasshoppers eat almost any vegetable, and vegetation is

[1] "The Insects of the Dannark Expedition." Meddelelser om Groenland, vol. 43, p. 55. "The insects of East Greenland," Meddelelser om Groenland, vol. 29, pp. 366-369. See also W. Lundbeck: "Entomolog Undersög. i West Groenland, 1889-90," Meddel. om Groenland, vol. VII, pp. 139-11; and W. Lundbeck and K. Henricksen in "Conspectus fauna groenlandica, Land anthropods," Meddel om Groenland, vol 22, p. 797, 1918; and W. Lundbeck: "Notitser om Grönlands entomolog. Fauna," pp. 27-34.

T. C. Schiödte "Grönlands Land—, Ferskvands og Strandbreds Arthropoder," in Rink "Naturhist Tillaeg til en geographist og Statistisk Beskrivelse af Grönland," 1857, pp. 59-71.

[2] Trichoptera are the only neuropteroids known from the east coast.

[3] The *Forficula* collected on Parry's and Ross' voyages was probably introduced.

abundant. The absence of green leaves for nine months in the year may be a contributing cause, but the permanently frozen ground is probably the main factor. Grasshoppers lay their eggs in the ground, and as the surface, except in bare, sandy places, thaws for only a few inches, it may be impossible for grasshoppers to develop. Mr. Norman Criddle, of Treesbank, Man., states that the grasshoppers known to go farthest north in Canada hibernate as nymphs, and that the eggs are laid about a month after the beginning of spring. In the Arctic this would be about July 1, and the two remaining summer months are perhaps not sufficient for the nymphs to grow large enough to withstand the winter, even if the eggs were laid in the ground and hatched out.[1]

The absence of true bees in the Arctic is perhaps due to the scarcity of flowers from which pollen and honey can be secured, and to the absence of suitable trees, etc., for nest-building. Sawflies (*Nematus*) were collected at latitude 72 degrees north, longitude 94 degrees east ("*Fox*" Expedition), and on Ellesmere island (2nd *Fram* Expedition). "*Formica rubra*" from Parry's and Ross's voyage was probably introduced, if the identification is correct.

As to the beetles found beyond the tree limit in the American Arctic, it is probable that those dependent on decaying matter, and those directly (chrysomelidæ, rhynchopora, elateridæ) or indirectly (plant-lice-feeders, coccinellidæ) dependent upon green leaves do not go as far north as the predacious families (carabidæ, staphylinidæ) and the water beetles (dytiscidæ).[2] None of the four first-named families have, it is believed, been found in the Canadian Arctic archipelago. Of the three families of predacious beetles, it may be assumed that those (Carabidæ, Dytiscidæ) depending upon larger prey do not go so far north as the family (staphylinidæ) feeding upon more minute organisms.

Micralymma was collected at cape Sabine; *Lethridius* in Alexandra fjord; *Cryptophagus* in Foulkes fjord (2nd Fram Expedition). The diminishing periods in which fresh water is ice-free as the high north is approached may be related to the eventual disappearance of the dytiscids and other aquatic insects. Dytiscids were collected on Parry's and Ross's voyages.

Of the hemiptera (hemiptera were collected on Parry's and Ross's voyages) the families (aphidæ, etc.), depending upon juicy, green leaves probably do not go as far north as the more agile or occult living families (saldidæ, etc.). Aquatic hemiptera seem to find the arctic ponds unsuited for their development, though some of them (*Corixa*) go as far north as Port Clarence, Alaska.

Of neuropteroids, dragon-flies hardly approach the limit of trees, perhaps owing to the same reason as the aquatic hemiptera; and ephemerids and perlids are not known in the Canadian Arctic archipelago. The trichoptera is probably the family of neuropteroids which reaches farthest north (trichopter collected on Parry's and Ross's voyages), though only in certain species (*Apatania*, etc.); probably because their larvæ seem to be little influenced by their surroundings, and are found in both still and running water of high or low temperature.

Spiders (*Opilio* known from Ponds inlet), mites, and collembola, and insects parasitic upon mammals and birds have been found as far north as there is land; and the same seems to be the case with at least some of the lepidotera (both butterflies and moths) preferring certain plants. It may be assumed that at the highest latitudes (say beyond latitude 80 degrees north) on both sides of Kennedy-Robeson channels these latter orders comprise the bulk of the insect fauna together with sawflies, bumblebees, and parasitic wasps, diptera, and minute hemiptera and beetles.[3]

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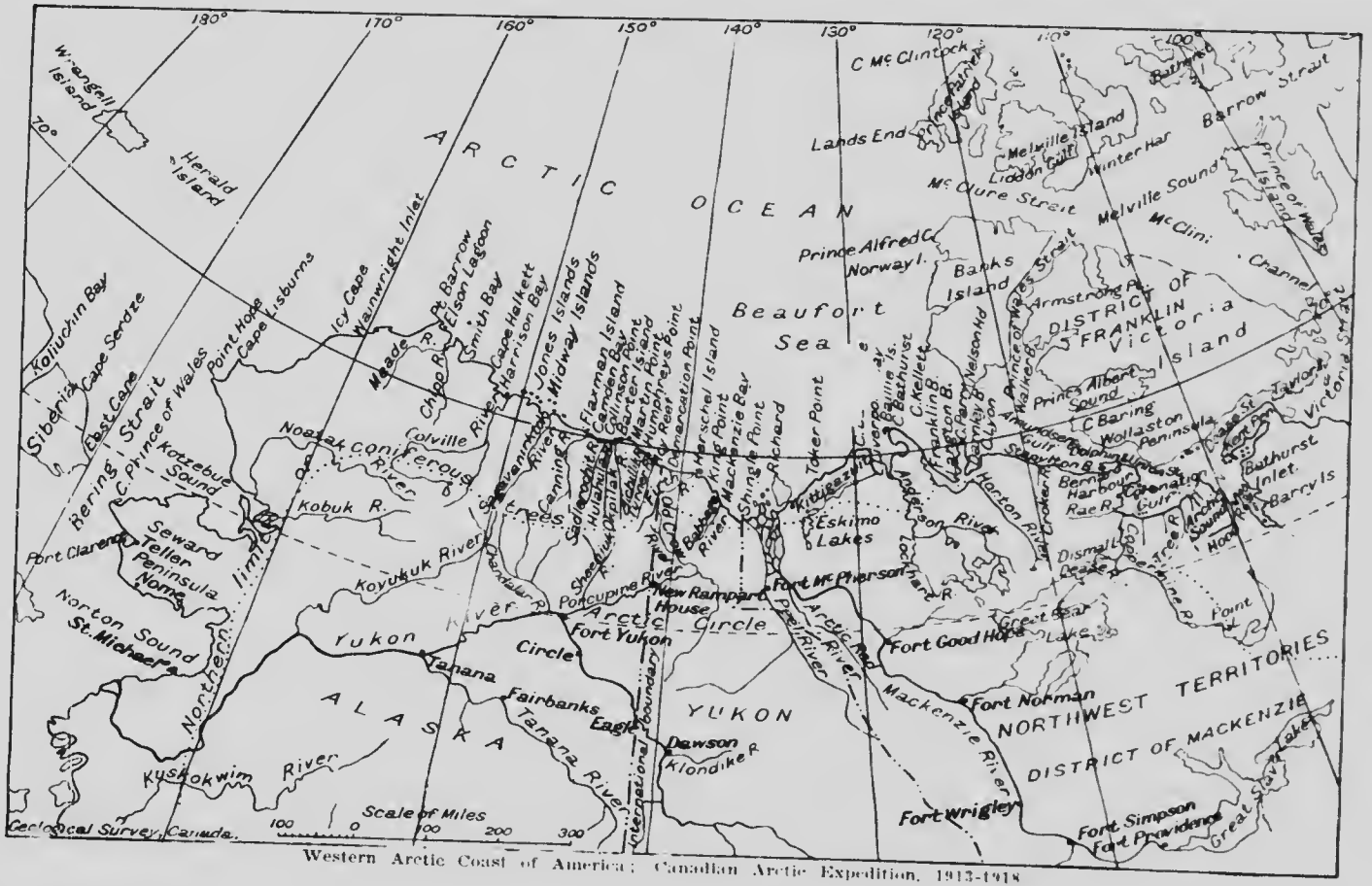
[1] Professor E. M. Walker, of Toronto, claims that all the *Melanoplus* species pass the winter in the egg-stage. The northward distribution of grasshoppers on this continent is treated in his Canadian Arctic Expedition report, vol. III, Part J.

[2] Beetle (*Platyderus*) known from lat. 72° N., long 94° W. ("Fox").

[3] See the insects secured by the *Polaris* expedition, and identified by A. S. Packard, Jr., in "The American Naturalist," Vol. XI, 1877, pp. 51-53.



Western Arctic Coast of America; Canadian Arctic Expedition, 1913-1918

FIG. 1. Fly on *Dryas* flowers. Bernard harbour, Northwest Territories. July 1915. (Photo by G. H. Wilkins.)

FIG. 2. Mosquitoes attacking dog. Bernard harbour. July 6, 1915. (Photo by G. H. Wilkins.)

FIG. 1. Arctic willow shrubbery. East branch of Mackenzie river delta at Nennariak, near south end of Richard island. June, 1914. (Photo by J. J. O'Neill.)

FIG. 2. Arctic willow shrubbery. Mouth of Tree river, Port Epworth, Coronation Gulf. October, 1915. (Photo by J. J. O'Neill.)

PLATE III.

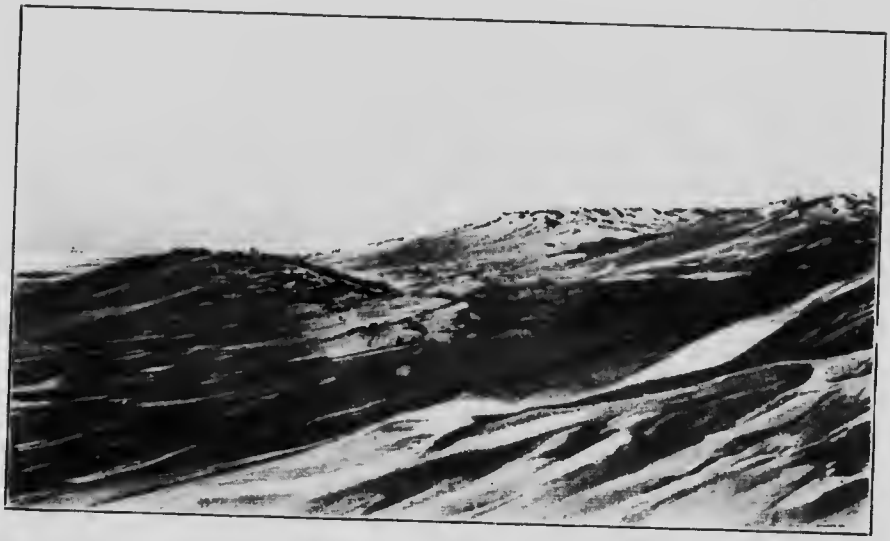


FIG. 1. Winter conditions.. Wind-swept tundra bluffs at Collinson point, Alaska. February 24, 1914. (Photo by F. Johansen.)

FIG. 2. Early spring. Snow melting on tundra at Demarcation point, Alaska, May 13, 1914. (Photo by F. Johansen.)

PLATE IV

FIG. 1. Beginning of summer. Melting tundra pond at Collinson point, Alaska, June 3, 1914. (Photo by F. Johansen.)

FIG. 2. Beginning of summer. Tundra nearly free of snow. Collinson point, Alaska, June 3, 1914. (Photo by F. Johansen.)

PLATE V.

FIG. 1. Tundra ditch at Teller (Port Clarence), Alaska. Reindeer gre August, 1913. (Photo by J. J. O'Neill.)

FIG. 2. Coastal tundra strewn with old driftwood, at Collinson point, Alaska. July 17, 1914. (Photo by F. Johansen.)

Arctic Insect Life

PLATE VI

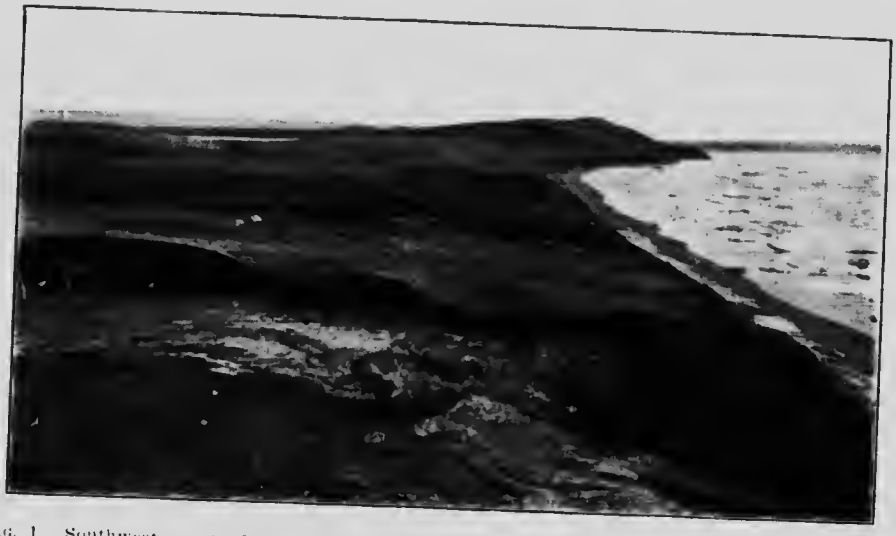


FIG. 1. Southwest coast of Banks Island, looking southeast from Cape Kellett, Earth-Slides, August, 1914. (Photo by G. H. Wilkins.)

FIG. 2. Victoria island. Dolomite beds crossing plain, between southwest coast and the Colville hills, about 8 miles inland. Autumn, 1915. (Photo by D. Jenness.)

Arctic Insect Life

PLATE VII.

FIG. 1. Arctic coast at King point, Yukon. Earth-slides. August, 1914. (Photo by John R. Cox.)

FIG. 2. Inland gully on Herschel Island, Arctic coast of Yukon Territory. July 29, 1916. (Photo by F. Johansen.)

FIG. 1. Arctic coast near cape Parry, Northwest Territories, Dolomite cliffs. July 21, 1916. (Photo by G. H. Wilkins.)

FIG. 2. Dolomite outcrops a short distance inland from Bernard harbour, Northwest Territories. June 21, 1916. (Photo by F. Johansen.)

FIG. 1 Snow melting at Bernard harbour, Northwest Territories May 24, 1915. Note pools. (Photo by F. Johansen.)

FIG. 2. Brook fed by melting snowbank Bernard harbour, Northwest Territories. July 12, 1915. (Photo by F. Johansen.)

Arctic Insect Life

PLATE X.

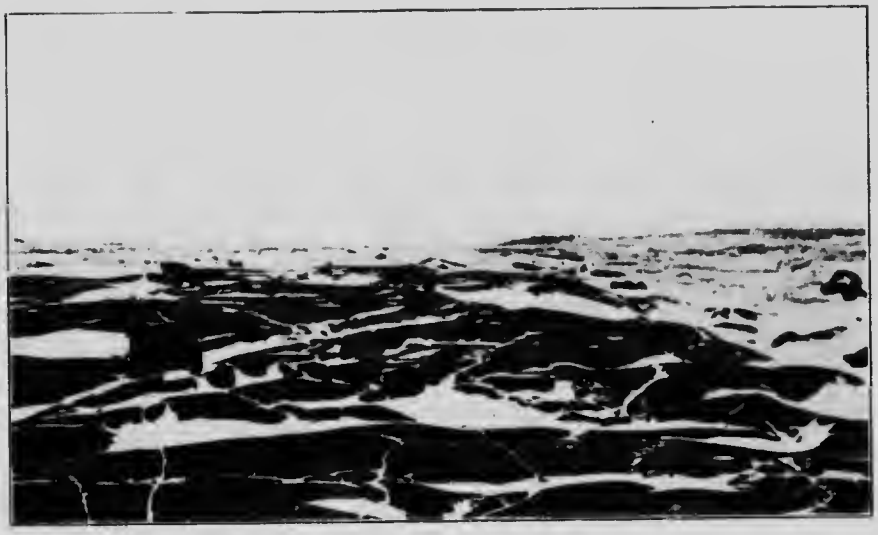


FIG. 1. Surface of diabase island in Coronation gulf, Northwest Territories, March 12, 1916. (Photo by E. Johansen.)

FIG. 2. Cape Barrow harbour, Coronation gulf. Typical granite formation of eastern part of Coronation gulf and Bathurst inlet. August 12, 1915. (Photo by G. H. Wilkins.)

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[illegible] ETC.

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